



# PyTango Documentation

*Release 9.2.5*

**PyTango team**

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<b>1</b>	<b>Getting started</b>	<b>1</b>
1.1	Installing . . . . .	1
1.2	Compiling . . . . .	2
1.3	Testing . . . . .	2
<b>2</b>	<b>Quick tour</b>	<b>3</b>
2.1	Fundamental TANGO concepts . . . . .	3
2.2	Minimum setup . . . . .	4
2.3	Client . . . . .	4
2.4	Server . . . . .	5
<b>3</b>	<b>ITango</b>	<b>11</b>
<b>4</b>	<b>Green mode</b>	<b>13</b>
4.1	Client green modes . . . . .	13
4.2	Server green modes . . . . .	19
<b>5</b>	<b>PyTango API</b>	<b>21</b>
5.1	Data types . . . . .	21
5.2	Client API . . . . .	29
5.3	Server API . . . . .	96
5.4	Database API . . . . .	162
5.5	Encoded API . . . . .	185
5.6	The Utilities API . . . . .	191
5.7	Exception API . . . . .	195
<b>6</b>	<b>How to</b>	<b>201</b>
6.1	How to contribute . . . . .	201
6.2	Check the default TANGO host . . . . .	201
6.3	Check TANGO version . . . . .	201
6.4	Report a bug . . . . .	202
6.5	Test the connection to the Device and get it's current state . . . . .	202
6.6	Read and write attributes . . . . .	202
6.7	Execute commands . . . . .	203
6.8	Execute commands with more complex types . . . . .	204
6.9	Work with Groups . . . . .	204
6.10	Handle errors . . . . .	204
6.11	Registering devices . . . . .	204
6.12	Write a server . . . . .	206
6.13	Server logging . . . . .	207
6.14	Multiple device classes (Python and C++) in a server . . . . .	209

6.15	Create attributes dynamically . . . . .	210
6.16	Create/Delete devices dynamically . . . . .	211
6.17	Write a server (original API) . . . . .	213
<b>7</b>	<b>How to Contribute</b>	<b>221</b>
7.1	Workflow . . . . .	221
7.2	reStructuredText and Sphinx . . . . .	221
7.3	Source code standard . . . . .	221
7.4	Releasing a new version . . . . .	222
<b>8</b>	<b>FAQ</b>	<b>225</b>
<b>9</b>	<b>PyTango Enhancement Proposals</b>	<b>227</b>
9.1	TEP 1 - Device Server High Level API . . . . .	227
9.2	TEP 2 - Tango database serverless . . . . .	237
<b>10</b>	<b>History of changes</b>	<b>243</b>
10.1	Document revisions . . . . .	243
10.2	Version history . . . . .	244
<b>11</b>	<b>Indexes</b>	<b>263</b>
	<b>Python Module Index</b>	<b>265</b>

## 1.1 Installing

### 1.1.1 Linux

PyTango is available on linux as an official debian/ubuntu package:

```
$ sudo apt-get install python-pytango
```

RPM packages are also available for RHEL & CentOS:

- CentOS 6 32bits
- CentOS 6 64bits
- CentOS 7 64bits
- Fedora 23 32bits
- Fedora 23 64bits

### 1.1.2 PyPi

You can also install the latest version from PyPi.

First, make sure you have the following packages already installed (all of them are available from the major official distribution repositories):

- `boost-python` (including `boost-python-dev`)
- `numpy`

Then install PyTango either from pip:

```
$ pip install PyTango
```

or `easy_install`:

```
$ easy_install -U PyTango
```

### 1.1.3 Windows

First, make sure [Python](#) and [numpy](#) are installed.

PyTango team provides a limited set of binary PyTango distributables for Windows XP/Vista/7/8. The complete list of binaries can be downloaded from [PyPI](#).

Select the proper windows package, download it and finally execute the installation wizard.

## 1.2 Compiling

### 1.2.1 Linux

Since PyTango 9 the build system used to compile PyTango is the standard python `setuptools`.

Besides the binaries for the three dependencies mentioned above, you also need the development files for the respective libraries.

You can get the latest `.tar.gz` from [PyPI](#) or directly the latest SVN checkout:

```
$ git clone https://github.com/tango-cs/pytango.git
$ cd pytango
$ python setup.py build
$ sudo python setup.py install
```

This will install PyTango in the system python installation directory. (Since PyTango9, *ITango* has been removed to a separate project and it will not be installed with PyTango.) If you wish to install in a different directory, replace the last line with:

```
$ # private installation to your user (usually ~/.local/lib/python<X>.<Y>/site-
↪packages)
$ python setup.py install --user

$ # or specific installation directory
$ python setup.py install --prefix=/home/homer/local
```

### 1.2.2 Windows

On windows, PyTango must be built using MS VC++. Since it is rarely needed and the instructions are so complicated, I have chosen to place the how-to in a separate text file. You can find it in the source package under `doc/windows_notes.txt`.

## 1.3 Testing

To test the installation, import `tango` and check `tango.Release.version`:

```
$ python -c "import tango; print(tango.Release.version)"
9.2.5
```

Next steps: Check out the [Quick tour](#).

This quick tour will guide you through the first steps on using PyTango.

### 2.1 Fundamental TANGO concepts

Before you begin there are some fundamental TANGO concepts you should be aware of.

Tango consists basically of a set of *devices* running somewhere on the network.

A device is identified by a unique case insensitive name in the format `<domain>/<family>/<member>`.  
Examples: `LAB-01/PowerSupply/01`, `ID21/OpticsHutch/energy`.

Each device has a series of *attributes*, *pipes*, *properties* and *commands*.

An attribute is identified by a name in a device. It has a value that can be read. Some attributes can also be changed (read-write attributes). Each attribute has a well known, fixed data type.

A pipe is a kind of attribute. Unlike attributes, the pipe data type is structured (in the sense of C struct) and it is dynamic.

A property is identified by a name in a device. Usually, devices properties are used to provide a way to configure a device.

A command is also identified by a name. A command may or not receive a parameter and may or not return a value when it is executed.

Any device has **at least** a *State* and *Status* attributes and *State*, *Status* and *Init* commands. Reading the *State* or *Status* attributes has the same effect as executing the *State* or *Status* commands.

Each device has an associated *TANGO Class*. Most of the times the TANGO class has the same name as the object oriented programming class which implements it but that is not mandatory.

TANGO devices *live* inside a operating system process called *TANGO Device Server*. This server acts as a container of devices. A device server can host multiple devices of multiple TANGO classes. Devices are, therefore, only accessible when the corresponding TANGO Device Server is running.

A special TANGO device server called the *TANGO Database Server* will act as a naming service between TANGO servers and clients. This server has a known address where it can be reached. The machines that run TANGO Device Servers and/or TANGO clients, should export an environment variable called `TANGO_HOST` that points to the TANGO Database server address. Example: `TANGO_HOST=homer.lab.eu:10000`

## 2.2 Minimum setup

This chapter assumes you have already installed PyTango.

To explore PyTango you should have a running Tango system. If you are working in a facility/institute that uses Tango, this has probably already been prepared for you. You need to ask your facility/institute tango contact for the TANGO\_HOST variable where Tango system is running.

If you are working in an isolate machine you first need to make sure the Tango system is installed and running (see [tango how to](#)).

Most examples here connect to a device called `sys/tg_test/1` that runs in a TANGO server called `TangoTest` with the instance name `test`. This server comes with the TANGO installation. The TANGO installation also registers the `test` instance. All you have to do is start the `TangoTest` server on a console:

```
$ TangoTest test
Ready to accept request
```

---

**Note:** if you receive a message saying that the server is already running, it just means that somebody has already started the test server so you don't need to do anything.

---

## 2.3 Client

Finally you can get your hands dirty. The first thing to do is start a python console and import the `tango` module. The following example shows how to create a proxy to an existing TANGO device, how to read and write attributes and execute commands from a python console:

```
>>> import tango

>>> # create a device object
>>> test_device = tango.DeviceProxy("sys/tg_test/1")

>>> # every device has a state and status which can be checked with:
>>> print(test_device.state())
RUNNING

>>> print(test_device.status())
The device is in RUNNING state.

>>> # this device has an attribute called "long_scalar". Let's see which value it
↳has...
>>> data = test_device.read_attribute("long_scalar")

>>> # ...PyTango provides a shortcut to do the same:
>>> data = test_device["long_scalar"]

>>> # the result of reading an attribute is a DeviceAttribute python object.
>>> # It has a member called "value" which contains the value of the attribute
>>> data.value
136

>>> # Check the complete DeviceAttribute members:
>>> print(data)
DeviceAttribute[
data_format = SCALAR
    dim_x = 1
    dim_y = 0
```

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```

has_failed = False
  is_empty = False
    name = 'long_scalar'
  nb_read = 1
nb_written = 1
  quality = ATTR_VALID
r_dimension = AttributeDimension(dim_x = 1, dim_y = 0)
  time = TimeVal(tv_nsec = 0, tv_sec = 1399450183, tv_usec = 323990)
  type = DevLong
  value = 136
  w_dim_x = 1
  w_dim_y = 0
w_dimension = AttributeDimension(dim_x = 1, dim_y = 0)
  w_value = 0]

>>> # PyTango provides a handy pythonic shortcut to read the attribute value:
>>> test_device.long_scalar
136

>>> # Setting an attribute value is equally easy:
>>> test_device.write_attribute("long_scalar", 8776)

>>> # ... and a handy shortcut to do the same exists as well:
>>> test_device.long_scalar = 8776

>>> # TangoTest has a command called "DevDouble" which receives a number
>>> # as parameter and returns the same number as a result. Let's
>>> # execute this command:
>>> test_device.command_inout("DevDouble", 45.67)
45.67

>>> # PyTango provides a handy shortcut: it exports commands as device methods:
>>> test_device.DevDouble(45.67)
45.67

>>> # Introspection: check the list of attributes:
>>> test_device.get_attribute_list()
['ampli', 'boolean_scalar', 'double_scalar', '...', 'State', 'Status']

>>>

```

This is just the tip of the iceberg. Check the *DeviceProxy* for the complete API.

PyTango used to come with an integrated IPython based console called *ITango*, now moved to a separate project. It provides helpers to simplify console usage. You can use this console instead of the traditional python console. Be aware, though, that many of the *tricks* you can do in an *ITango* console cannot be done in a python program.

## 2.4 Server

Since PyTango 8.1 it has become much easier to program a Tango device server. PyTango provides some helpers that allow developers to simplify the programming of a Tango device server.

Before creating a server you need to decide:

1. The Tango Class name of your device (example: *PowerSupply*). In our example we will use the same name as the python class name.
2. The list of attributes of the device, their data type, access (read-only vs read-write), data\_format (scalar, 1D, 2D)

### 3. The list of commands, their parameters and their result

In our example we will write a fake power supply device server. There will be a class called *PowerSupply* which will have attributes:

- *voltage* (scalar, read-only, numeric)
- *current* (scalar, read\_write, numeric, expert mode)
- *noise* (2D, read-only, numeric)

pipes:

- *info* (read-only)

commands:

- *TurnOn* (argument: None, result: None)
- *TurnOff* (argument: None, result: None)
- *Ramp* (param: scalar, numeric; result: bool)

properties:

- *host* (string representing the host name of the actual power supply)
- *port* (port number in the host with default value = 9788)

Here is the code for the `power_supply.py`

```
1  #!/usr/bin/env python
2  # -*- coding: utf-8 -*-
3
4  """Demo power supply tango device server"""
5
6  import time
7  import numpy
8
9  from tango import AttrQuality, AttrWriteType, DispLevel, DevState, DebugIt
10 from tango.server import Device, attribute, command, pipe, device_property
11
12
13 class PowerSupply(Device):
14
15     voltage = attribute(label="Voltage", dtype=float,
16                        display_level=DispLevel.OPERATOR,
17                        access=AttrWriteType.READ,
18                        unit="V", format="8.4f",
19                        doc="the power supply voltage")
20
21     current = attribute(label="Current", dtype=float,
22                        display_level=DispLevel.EXPERT,
23                        access=AttrWriteType.READ_WRITE,
24                        unit="A", format="8.4f",
25                        min_value=0.0, max_value=8.5,
26                        min_alarm=0.1, max_alarm=8.4,
27                        min_warning=0.5, max_warning=8.0,
28                        fget="get_current",
29                        fset="set_current",
30                        doc="the power supply current")
31
32     noise = attribute(label="Noise",
33                      dtype=((int,)),
34                      max_dim_x=1024, max_dim_y=1024)
35
36     info = pipe(label='Info')
```

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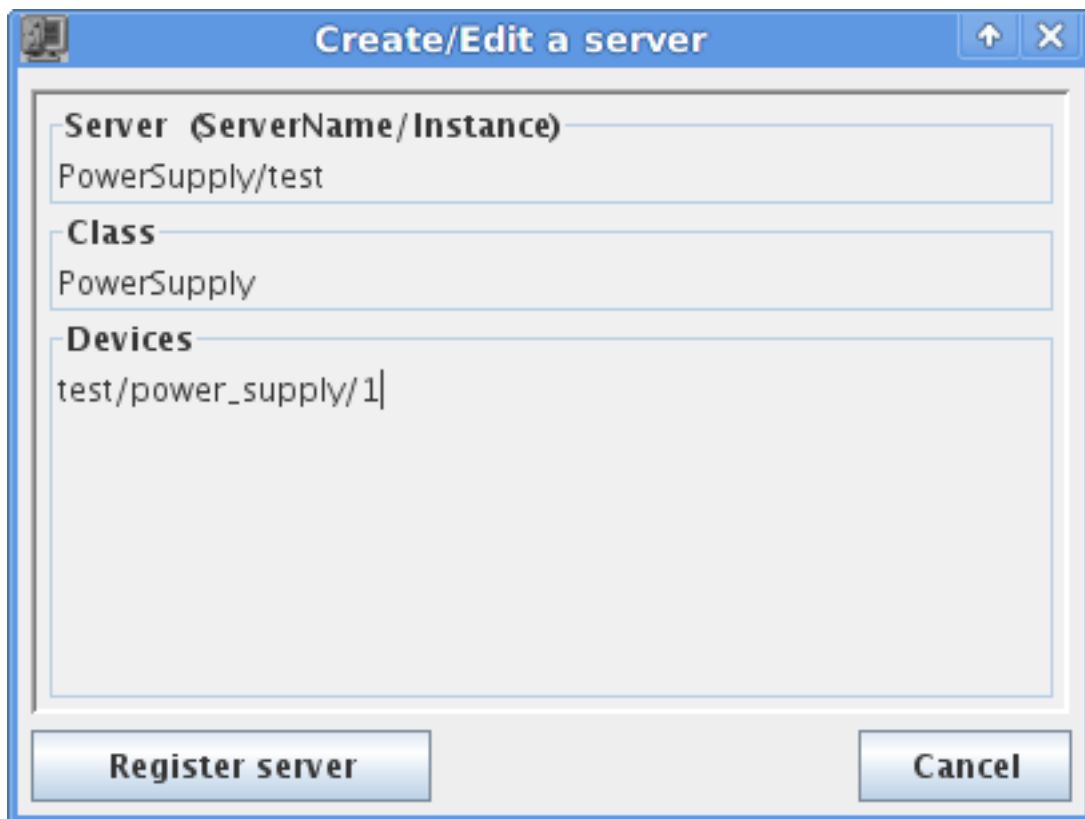
```

37
38     host = device_property(dtype=str)
39     port = device_property(dtype=int, default_value=9788)
40
41     def init_device(self):
42         Device.init_device(self)
43         self.__current = 0.0
44         self.set_state(DevState.STANDBY)
45
46     def read_voltage(self):
47         self.info_stream("read_voltage(%s, %d)", self.host, self.port)
48         return 9.99, time.time(), AttrQuality.ATTR_WARNING
49
50     def get_current(self):
51         return self.__current
52
53     def set_current(self, current):
54         # should set the power supply current
55         self.__current = current
56
57     def read_info(self):
58         return 'Information', dict(manufacturer='Tango',
59                                   model='PS2000',
60                                   version_number=123)
61
62     @DebugIt()
63     def read_noise(self):
64         return numpy.random.random_integers(1000, size=(100, 100))
65
66     @command
67     def TurnOn(self):
68         # turn on the actual power supply here
69         self.set_state(DevState.ON)
70
71     @command
72     def TurnOff(self):
73         # turn off the actual power supply here
74         self.set_state(DevState.OFF)
75
76     @command(dtype_in=float, doc_in="Ramp target current",
77             dtype_out=bool, doc_out="True if ramping went well, "
78             "False otherwise")
79     def Ramp(self, target_current):
80         # should do the ramping
81         return True
82
83
84 if __name__ == "__main__":
85     PowerSupply.run_server()

```

Check the *high level server API* for the complete reference API. The *write a server how to* can help as well.

Before running this brand new server we need to register it in the Tango system. You can do it with Jive (*Jive->Edit->Create server*):



... or in a python script:

```
>>> import tango

>>> dev_info = tango.DbDevInfo()
>>> dev_info.server = "PowerSupply/test"
>>> dev_info._class = "PowerSupply"
>>> dev_info.name = "test/power_supply/1"

>>> db = tango.Database()
>>> db.add_device(dev_info)
```

After, you can run the server on a console with:

```
$ python power_supply.py test
Ready to accept request
```

Now you can access it from a python console:

```
>>> import tango

>>> power_supply = tango.DeviceProxy("test/power_supply/1")
>>> power_supply.state()
STANDBY

>>> power_supply.current = 2.3

>>> power_supply.current
2.3

>>> power_supply.PowerOn()
>>> power_supply.Ramp(2.1)
True
```

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```
>>> power_supply.state()
ON
```

---

**Note:** In this example, the name of the server and the name of the tango class are the same: *PowerSupply*. This pattern is enforced by the `run_server()` method. However, it is possible to run several tango classes in the same server. In this case, the server name would typically be the name of server file. See the `run()` function for further information.

---



ITango is a PyTango CLI based on IPython. It is designed to be used as an IPython profile.



```
tcoutinho@pc151:~$ itango
ITango 8.0.0 -- An interactive Tango client.

Running on top of Python 2.7.1, IPython 0.14.dev and PyTango 8.0.0

help      -> ITango's help system.
object?   -> Details about 'object'. ?object also works, ?? prints more.

IPython profile: tango

hint: Try typing: mydev = Device("<tab>

ITango [1]:
```

ITango is available since PyTango 7.1.2 and has been moved to a separate project since PyTango 9.2.0:

- [package and instructions on PyPI](#)
- [sources on GitHub](#)
- [documentation on pythonhosted](#)





PyTango supports cooperative green Tango objects. Since version 8.1 two *green* modes have been added: Futures and Gevent. In version 9.2.0 another one has been added: Asyncio.

The Futures uses the standard python module `concurrent.futures`. The Gevent mode uses the well known `gevent` library. The newest, Asyncio mode, uses `asyncio` - a Python library for asynchronous programming (it's featured as a part of a standard Python distribution since version 3.5 of Python; it's available on PyPI for older ones).

You can set the PyTango green mode at a global level. Set the environment variable `PYTANGO_GREEN_MODE` to either *futures*, *gevent* or *asyncio* (case insensitive). If this environment variable is not defined the PyTango global green mode defaults to *Synchronous*.

## 4.1 Client green modes

You can also change the active global green mode at any time in your program:

```
>>> from tango import DeviceProxy, GreenMode
>>> from tango import set_green_mode, get_green_mode

>>> get_green_mode()
tango.GreenMode.Synchronous

>>> dev = DeviceProxy("sys/tg_test/1")
>>> dev.get_green_mode()
tango.GreenMode.Synchronous

>>> set_green_mode(GreenMode.Futures)
>>> get_green_mode()
tango.GreenMode.Futures

>>> dev.get_green_mode()
tango.GreenMode.Futures
```

As you can see by the example, the global green mode will affect any previously created *DeviceProxy* using the default *DeviceProxy* constructor parameters.

You can specify green mode on a *DeviceProxy* at creation time. You can also change the green mode at any time:

```
>>> from tango.futures import DeviceProxy

>>> dev = DeviceProxy("sys/tg_test/1")
>>> dev.get_green_mode()
tango.GreenMode.Futures

>>> dev.set_green_mode(GreenMode.Synchronous)
>>> dev.get_green_mode()
tango.GreenMode.Synchronous
```

### 4.1.1 futures mode

Using `concurrent.futures` cooperative mode in PyTango is relatively easy:

```
>>> from tango.futures import DeviceProxy

>>> dev = DeviceProxy("sys/tg_test/1")
>>> dev.get_green_mode()
tango.GreenMode.Futures

>>> print(dev.state())
RUNNING
```

The `tango.futures.DeviceProxy()` API is exactly the same as the standard `DeviceProxy`. The difference is in the semantics of the methods that involve synchronous network calls (constructor included) which may block the execution for a relatively big amount of time. The list of methods that have been modified to accept *futures* semantics are, on the `tango.futures.DeviceProxy()`:

- Constructor
- `state()`
- `status()`
- `read_attribute()`
- `write_attribute()`
- `write_read_attribute()`
- `read_attributes()`
- `write_attributes()`
- `ping()`

So how does this work in fact? I see no difference from using the *standard* `DeviceProxy`. Well, this is, in fact, one of the goals: be able to use a *futures* cooperation without changing the API. Behind the scenes the methods mentioned before have been modified to be able to work cooperatively.

All of the above methods have been boosted with two extra keyword arguments *wait* and *timeout* which allow to fine tune the behaviour. The *wait* parameter is by default set to *True* meaning wait for the request to finish (the default semantics when not using green mode). If *wait* is set to *True*, the *timeout* determines the maximum time to wait for the method to execute. The default is *None* which means wait forever. If *wait* is set to *False*, the *timeout* is ignored.

If *wait* is set to *True*, the result is the same as executing the *standard* method on a `DeviceProxy`. If *wait* is set to *False*, the result will be a `concurrent.futures.Future`. In this case, to get the actual value you will need to do something like:

```
>>> from tango.futures import DeviceProxy

>>> dev = DeviceProxy("sys/tg_test/1")
```

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```
>>> result = dev.state(wait=False)
>>> result
<Future at 0x16cb310 state=pending>

>>> # this will be the blocking code
>>> state = result.result()
>>> print(state)
RUNNING
```

Here is another example using `read_attribute()`:

```
>>> from tango.futures import DeviceProxy

>>> dev = DeviceProxy("sys/tg_test/1")
>>> result = dev.read_attribute('wave', wait=False)
>>> result
<Future at 0x16cbe50 state=pending>

>>> dev_attr = result.result()
>>> print(dev_attr)
DeviceAttribute[
data_format = tango.AttrDataFormat.SPECTRUM
    dim_x = 256
    dim_y = 0
has_failed = False
is_empty = False
    name = 'wave'
    nb_read = 256
nb_written = 0
    quality = tango.AttrQuality.ATTR_VALID
r_dimension = AttributeDimension(dim_x = 256, dim_y = 0)
    time = TimeVal(tv_nsec = 0, tv_sec = 1383923329, tv_usec = 451821)
    type = tango.CmdArgType.DevDouble
    value = array([-9.61260664e-01, -9.65924853e-01, -9.70294813e-01,
-9.74369212e-01, -9.78146810e-01, -9.81626455e-01,
-9.84807087e-01, -9.87687739e-01, -9.90267531e-01,
...
5.15044507e-1])
    w_dim_x = 0
    w_dim_y = 0
w_dimension = AttributeDimension(dim_x = 0, dim_y = 0)
    w_value = None]
```

### 4.1.2 gevent mode

**Warning:** Before using gevent mode please note that at the time of writing this documentation, `tango.gevent` requires the latest version 1.0 of gevent (which has been released the day before :-P).

Using `gevent` cooperative mode in PyTango is relatively easy:

```
>>> from tango.gevent import DeviceProxy

>>> dev = DeviceProxy("sys/tg_test/1")
>>> dev.get_green_mode()
tango.GreenMode.Gevent
```

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```
>>> print (dev.state())
RUNNING
```

The `tango.gevent.DeviceProxy()` API is exactly the same as the standard `DeviceProxy`. The difference is in the semantics of the methods that involve synchronous network calls (constructor included) which may block the execution for a relatively big amount of time. The list of methods that have been modified to accept `gevent` semantics are, on the `tango.gevent.DeviceProxy()`:

- Constructor
- `state()`
- `status()`
- `read_attribute()`
- `write_attribute()`
- `write_read_attribute()`
- `read_attributes()`
- `write_attributes()`
- `ping()`

So how does this work in fact? I see no difference from using the *standard* `DeviceProxy`. Well, this is, in fact, one of the goals: be able to use a `gevent` cooperation without changing the API. Behind the scenes the methods mentioned before have been modified to be able to work cooperatively with other greenlets.

All of the above methods have been boosted with two extra keyword arguments `wait` and `timeout` which allow to fine tune the behaviour. The `wait` parameter is by default set to `True` meaning wait for the request to finish (the default semantics when not using green mode). If `wait` is set to `True`, the `timeout` determines the maximum time to wait for the method to execute. The default `timeout` is `None` which means wait forever. If `wait` is set to `False`, the `timeout` is ignored.

If `wait` is set to `True`, the result is the same as executing the *standard* method on a `DeviceProxy`. If `wait` is set to `False`, the result will be a `gevent.event.AsyncResult`. In this case, to get the actual value you will need to do something like:

```
>>> from tango.gevent import DeviceProxy

>>> dev = DeviceProxy("sys/tg_test/1")
>>> result = dev.state(wait=False)
>>> result
<gevent.event.AsyncResult at 0x1a74050>

>>> # this will be the blocking code
>>> state = result.get()
>>> print (state)
RUNNING
```

Here is another example using `read_attribute()`:

```
>>> from tango.gevent import DeviceProxy

>>> dev = DeviceProxy("sys/tg_test/1")
>>> result = dev.read_attribute('wave', wait=False)
>>> result
<gevent.event.AsyncResult at 0x1aff54e>

>>> dev_attr = result.get()
>>> print (dev_attr)
```

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```

DeviceAttribute[
data_format = tango.AttrDataFormat.SPECTRUM
    dim_x = 256
    dim_y = 0
has_failed = False
is_empty = False
    name = 'wave'
    nb_read = 256
    nb_written = 0
    quality = tango.AttrQuality.ATTR_VALID
r_dimension = AttributeDimension(dim_x = 256, dim_y = 0)
    time = TimeVal(tv_nsec = 0, tv_sec = 1383923292, tv_usec = 886720)
    type = tango.CmdArgType.DevDouble
    value = array([-9.61260664e-01, -9.65924853e-01, -9.70294813e-01,
-9.74369212e-01, -9.78146810e-01, -9.81626455e-01,
-9.84807087e-01, -9.87687739e-01, -9.90267531e-01,
...
5.15044507e-1])
    w_dim_x = 0
    w_dim_y = 0
w_dimension = AttributeDimension(dim_x = 0, dim_y = 0)
    w_value = None]

```

**Note:** due to the internal workings of `gevent`, setting the `wait` flag to `True` (default) doesn't prevent other greenlets from running in *parallel*. This is, in fact, one of the major bonus of working with `gevent` when compared with `concurrent.futures`

### 4.1.3 asyncio mode

Asyncio mode is similar to `gevent` but it uses explicit coroutines. You can compare `gevent` and `asyncio` examples.

```

1 import asyncio
2 from tango.asyncio import DeviceProxy
3
4 async def asyncio_example():
5     dev = await DeviceProxy("sys/tg_test/1")
6     print(dev.get_green_mode())
7
8     print(await dev.state())
9
10 loop = asyncio.get_event_loop()
11 loop.run_until_complete(asyncio_example())
12 loop.close()

```

Below you can find a TCP server example, which runs in an asynchronous mode and waits for a device's attribute name from a TCP client, then asks the device for a value and replies to the TCP client.

```

1 """A simple TCP server for Tango attributes.
2
3 It runs on all interfaces on port 8888:
4
5     $ python tango_tcp_server.py
6     Serving on 0.0.0.0 port 8888
7
8 It can be accessed using netcat:
9

```

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```

10  $ ncat localhost 8888
11  >>> sys/tg_test/1/ampli
12  0.0
13  >>> sys/tg_test/1/state
14  RUNNING
15  >>> sys/tg_test/1/nope
16  DevFailed[
17  DevError[
18      desc = Attribute nope is not supported by device sys/tg_test/1
19      origin = AttributeProxy::real_constructor()
20      reason = API_UnsupportedAttribute
21      severity = ERR]
22  ]
23  >>> ...
24  """
25
26  import asyncio
27  from tango.asyncio import AttributeProxy
28
29
30  async def handle_echo(reader, writer):
31      # Write the cursor
32      writer.write(b'>>> ')
33      # Loop over client request
34      async for line in reader:
35          request = line.decode().strip()
36          # Get attribute value using asyncio green mode
37          try:
38              proxy = await AttributeProxy(request)
39              attr_value = await proxy.read()
40              reply = str(attr_value.value)
41              # Catch exception if something goes wrong
42              except Exception as exc:
43                  reply = str(exc)
44              # Reply to client
45              writer.write(reply.encode() + b'\n' + b'>>> ')
46          # Close communication
47          writer.close()
48
49
50  async def start_serving():
51      server = await asyncio.start_server(handle_echo, '0.0.0.0', 8888)
52      print('Serving on {} port {}'.format(*server.sockets[0].getsockname()))
53      return server
54
55
56  async def stop_serving(server):
57      server.close()
58      await server.wait_closed()
59
60
61  def main():
62      # Start the server
63      loop = asyncio.get_event_loop()
64      server = loop.run_until_complete(start_serving())
65      # Serve requests until Ctrl+C is pressed
66      try:
67          loop.run_forever()
68      except KeyboardInterrupt:
69          pass
70      # Close the server

```

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```

71     loop.run_until_complete(stop_serving(server))
72     loop.close()
73
74
75 if __name__ == '__main__':
76     main()

```

## 4.2 Server green modes

**Warning:** Green modes for the server side are still very much experimental. If you encounter any issues, please report them on the GitHub [issues](#) page.

PyTango server API from version 9.2.0 supports two green modes: `Gevent` and `Asyncio`. Both can be used in writing new device servers in an asynchronous way.

### 4.2.1 gevent mode

This mode lets you convert your existing devices to asynchronous devices easily. You just add `green_mode = tango.GreenMode.Gevent` line to your device class. Consider this example:

```

class GeventDevice(Device):
    green_mode = tango.GreenMode.Gevent

```

Every method in your device class will be treated as a coroutine implicitly. This can be beneficial, but also potentially dangerous as it is a lot harder to debug. You should use this green mode with care. `Gevent` green mode is useful when you don't want to change too much in your existing code (or you don't feel comfortable with writing syntax of asynchronous calls).

Another thing to have in mind is that the Tango monitor lock is present - you can't have two read operations happening concurrently. Any subsequent ones will always have to wait for the first one to finish.

Greenlets (a task in a background, but handled within the event loop) can be used.

### 4.2.2 asyncio mode

The way `asyncio` green mode on the server side works is it redirects all user code to an event loop. This means that all user methods become coroutines, so in Python > 3.5 you should define them with `async` keyword. In Python < 3.5, you should use a `@coroutine` decorator. This also means that in order to convert existing code of your devices to `Asyncio` green mode you will have to introduce at least those changes. But, of course, to truly benefit from this green mode (and asynchronous approach in general), you should introduce more far-fetched changes!

The main benefit of asynchronous programming approach is that it lets you control precisely when code is run sequentially without interruptions and when control can be given back to the event loop. It's especially useful if you want to perform some long operations and don't want to prevent clients from accessing other parts of your device (attributes, in particular). This means that in `Asyncio` green mode there is no monitor lock!

The example below shows how `asyncio` can be used to write an asynchronous Tango device:

```
1  """Demo Tango Device Server using asyncio green mode"""
2
3  import asyncio
4  from tango import DevState, GreenMode
5  from tango.server import Device, command, attribute
6
7
8  class AsyncioDevice(Device):
9      green_mode = GreenMode.Asyncio
10
11     async def init_device(self):
12         await super().init_device()
13         self.set_state(DevState.ON)
14
15     @command
16     async def long_running_command(self):
17         loop = asyncio.get_event_loop()
18         future = loop.create_task(self.coroutine_target())
19
20     async def coroutine_target(self):
21         self.set_state(DevState.INSERT)
22         await asyncio.sleep(15)
23         self.set_state(DevState.EXTRACT)
24
25     @attribute
26     async def test_attribute(self):
27         await asyncio.sleep(2)
28         return 42
29
30
31 if __name__ == '__main__':
32     AsyncioDevice.run_server()
```



This module implements the Python Tango Device API mapping.

### 5.1 Data types

This chapter describes the mapping of data types between Python and Tango.

Tango has more data types than Python which is more dynamic. The input and output values of the commands are translated according to the array below. Note that if PyTango is compiled with `numpy` support the `numpy` type will be the used for the input arguments. Also, it is recommended to use `numpy` arrays of the appropriate type for output arguments as well, as they tend to be much more efficient.

**For scalar types (SCALAR)**

Tango data type	Python 2.x type	Python 3.x type ( <i>New in PyTango 8.0</i> )
DEV_VOID	No data	No data
DEV_BOOLEAN	<code>bool</code>	<code>bool</code>
DEV_SHORT	<code>int</code>	<code>int</code>
DEV_LONG	<code>int</code>	<code>int</code>
DEV_LONG64	<ul style="list-style-type: none"> <li><code>long</code> (on a 32 bits computer)</li> <li><code>int</code> (on a 64 bits computer)</li> </ul>	<code>int</code>
DEV_FLOAT	<code>float</code>	<code>float</code>
DEV_DOUBLE	<code>float</code>	<code>float</code>
DEV_USHORT	<code>int</code>	<code>int</code>
DEV_ULONG	<code>int</code>	<code>int</code>
DEV_ULONG64	<ul style="list-style-type: none"> <li><code>long</code> (on a 32 bits computer)</li> <li><code>int</code> (on a 64 bits computer)</li> </ul>	<code>int</code>
DEV_STRING	<code>str</code>	<code>str</code> (decoded with <i>latin-1</i> , aka <i>ISO-8859-1</i> )
DEV_ENCODED ( <i>New in PyTango 8.0</i> )	sequence of two elements: <ol style="list-style-type: none"> <li><code>str</code></li> <li><code>bytes</code> (for any value of <i>extract_as</i>)</li> </ol>	sequence of two elements: <ol style="list-style-type: none"> <li><code>str</code> (decoded with <i>latin-1</i>, aka <i>ISO-8859-1</i>)</li> <li><code>bytes</code> (for any value of <i>extract_as</i>, except <code>String</code>. In this case it is <code>str</code> (decoded with default python encoding <i>utf-8</i>))</li> </ol>
DEV_ENUM ( <i>New in PyTango 9.0</i> )	<ul style="list-style-type: none"> <li><code>int</code> (for value)</li> <li><code>list &lt;str&gt;</code> (for <code>enum_labels</code>)</li> </ul> <p><b>Note:</b> direct attribute access via type <code>enum.IntEnum</code>. This type uses the package <code>enum34</code>.</p>	<ul style="list-style-type: none"> <li><code>int</code> (for value)</li> <li><code>list &lt;str&gt;</code> (for <code>enum_labels</code>)</li> </ul> <p><b>Note:</b> direct attribute access via type <code>enum.IntEnum</code>. Python &lt; 3.4, uses the package <code>enum34</code>. Python &gt;= 3.4, uses standard package <code>enum</code>.</p>

**For array types (SPECTRUM/IMAGE)**

Tango data type	ExtractAs	Data type (Python 2.x)	Data type (Python 3.x) ( <i>New in PyTango 8.0</i> )
DEVVAR_CHARARRAY	Numpy	<code>numpy.ndarray</code> ( <code>dtype= numpy.uint8</code> )	<code>numpy.ndarray</code> ( <code>dtype= numpy.uint8</code> )
	Bytes	<code>bytes</code> (which is in fact equal to <code>str</code> )	<code>bytes</code>
	ByteArray	<code>bytearray</code>	<code>bytearray</code>

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Table 1 – continued from previous page

Tango data type	ExtractAs	Data type (Python 2.x)	Data type (Python 3.x) (New in PyTango 8.0)
	String	<code>str</code>	String <code>str</code> (decoded with default python encoding <i>utf-8!!!</i> )
	List	<code>list &lt;int&gt;</code>	<code>list &lt;int&gt;</code>
	Tuple	<code>tuple &lt;int&gt;</code>	<code>tuple &lt;int&gt;</code>
DEVVAR_SHORTARRAY or (DEV_SHORT + SPECTRUM) or (DEV_SHORT + IMAGE)	Numpy	<code>numpy.ndarray (dtype= numpy. uint16)</code>	<code>numpy.ndarray (dtype= numpy. uint16)</code>
	Bytes	<code>bytes (which is in fact equal to str)</code>	<code>bytes</code>
	ByteArray	<code>bytearray</code>	<code>bytearray</code>
	String	<code>str</code>	String <code>str</code> (decoded with default python encoding <i>utf-8!!!</i> )
	List	<code>list &lt;int&gt;</code>	<code>list &lt;int&gt;</code>
	Tuple	<code>tuple &lt;int&gt;</code>	<code>tuple &lt;int&gt;</code>
DEVVAR_LONGARRAY or (DEV_LONG + SPECTRUM) or (DEV_LONG + IMAGE)	Numpy	<code>numpy.ndarray (dtype= numpy. uint32)</code>	<code>numpy.ndarray (dtype= numpy. uint32)</code>
	Bytes	<code>bytes (which is in fact equal to str)</code>	<code>bytes</code>
	ByteArray	<code>bytearray</code>	<code>bytearray</code>
	String	<code>str</code>	String <code>str</code> (decoded with default python encoding <i>utf-8!!!</i> )
	List	<code>list &lt;int&gt;</code>	<code>list &lt;int&gt;</code>
	Tuple	<code>tuple &lt;int&gt;</code>	<code>tuple &lt;int&gt;</code>
DEVVAR_LONG64ARRAY or (DEV_LONG64 + SPECTRUM) or (DEV_LONG64 + IMAGE)	Numpy	<code>numpy.ndarray (dtype= numpy. uint64)</code>	<code>numpy.ndarray (dtype= numpy. uint64)</code>
	Bytes	<code>bytes (which is in fact equal to str)</code>	<code>bytes</code>
	ByteArray	<code>bytearray</code>	<code>bytearray</code>
	String	<code>str</code>	String <code>str</code> (decoded with default python encoding <i>utf-8!!!</i> )
	List	<code>list &lt;int (64 bits) / long (32 bits)&gt;</code>	<code>list &lt;int&gt;</code>
	Tuple	<code>tuple &lt;int (64 bits) / long (32 bits)&gt;</code>	<code>tuple &lt;int&gt;</code>
DEVVAR_FLOATARRAY or (DEV_FLOAT + SPECTRUM) or (DEV_FLOAT + IMAGE)	Numpy	<code>numpy.ndarray (dtype= numpy. float32)</code>	<code>numpy.ndarray (dtype= numpy. float32)</code>
	Bytes	<code>bytes (which is in fact equal to str)</code>	<code>bytes</code>
	ByteArray	<code>bytearray</code>	<code>bytearray</code>
	String	<code>str</code>	String <code>str</code> (decoded with default python encoding <i>utf-8!!!</i> )
	List	<code>list &lt;float&gt;</code>	<code>list &lt;float&gt;</code>
	Tuple	<code>tuple &lt;float&gt;</code>	<code>tuple &lt;float&gt;</code>
DEVVAR_DOUBLEARRAY or (DEV_DOUBLE + SPECTRUM) or (DEV_DOUBLE + IMAGE)	Numpy	<code>numpy.ndarray (dtype= numpy. float64)</code>	<code>numpy.ndarray (dtype= numpy. float64)</code>

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Table 1 – continued from previous page

Tango data type	ExtractAs	Data type (Python 2.x)	Data type (Python 3.x) ( <i>New in PyTango 8.0</i> )
	Bytes	<code>bytes</code> (which is in fact equal to <code>str</code> )	<code>bytes</code>
	ByteArray	<code>bytearray</code>	<code>bytearray</code>
	String	<code>str</code>	String <code>str</code> (decoded with default python encoding <i>utf-8!!!</i> )
	List	<code>list &lt;float&gt;</code>	<code>list &lt;float&gt;</code>
	Tuple	<code>tuple &lt;float&gt;</code>	<code>tuple &lt;float&gt;</code>
DEVVAR_USHORTARRAY or (DEV_USHORT + SPECTRUM) or (DEV_USHORT + IMAGE)	Numpy	<code>numpy.ndarray</code> ( <code>dtype= numpy. uint16</code> )	<code>numpy.ndarray</code> ( <code>dtype= numpy. uint16</code> )
	Bytes	<code>bytes</code> (which is in fact equal to <code>str</code> )	<code>bytes</code>
	ByteArray	<code>bytearray</code>	<code>bytearray</code>
	String	<code>str</code>	String <code>str</code> (decoded with default python encoding <i>utf-8!!!</i> )
	List	<code>list &lt;int&gt;</code>	<code>list &lt;int&gt;</code>
	Tuple	<code>tuple &lt;int&gt;</code>	<code>tuple &lt;int&gt;</code>
DEVVAR_ULONGARRAY or (DEV_ULONG + SPECTRUM) or (DEV_ULONG + IMAGE)	Numpy	<code>numpy.ndarray</code> ( <code>dtype= numpy. uint32</code> )	<code>numpy.ndarray</code> ( <code>dtype= numpy. uint32</code> )
	Bytes	<code>bytes</code> (which is in fact equal to <code>str</code> )	<code>bytes</code>
	ByteArray	<code>bytearray</code>	<code>bytearray</code>
	String	<code>str</code>	String <code>str</code> (decoded with default python encoding <i>utf-8!!!</i> )
	List	<code>list &lt;int&gt;</code>	<code>list &lt;int&gt;</code>
	Tuple	<code>tuple &lt;int&gt;</code>	<code>tuple &lt;int&gt;</code>
DEVVAR_ULONG64ARRAY or (DEV_ULONG64 + SPECTRUM) or (DEV_ULONG64 + IMAGE)	Numpy	<code>numpy.ndarray</code> ( <code>dtype= numpy. uint64</code> )	<code>numpy.ndarray</code> ( <code>dtype= numpy. uint64</code> )
	Bytes	<code>bytes</code> (which is in fact equal to <code>str</code> )	<code>bytes</code>
	ByteArray	<code>bytearray</code>	<code>bytearray</code>
	String	<code>str</code>	String <code>str</code> (decoded with default python encoding <i>utf-8!!!</i> )
	List	<code>list &lt;int (64 bits) / long (32 bits)&gt;</code>	<code>list &lt;int&gt;</code>
	Tuple	<code>tuple &lt;int (64 bits) / long (32 bits)&gt;</code>	<code>tuple &lt;int&gt;</code>
DEVVAR_STRINGARRAY or (DEV_STRING + SPECTRUM) or (DEV_STRING + IMAGE)		<code>sequence&lt;str&gt;</code>	<code>sequence&lt;str&gt;</code> (decoded with <i>latin-1</i> , aka <i>ISO-8859-1</i> )

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Table 1 – continued from previous page

Tango data type	ExtractAs	Data type (Python 2.x)	Data type (Python 3.x) (New in PyTango 8.0)
DEV_LONGSTRINGARRAY		sequence of two elements: 0. <code>numpy.ndarray</code> ( <code>dtype= numpy.int32</code> ) or <code>sequence&lt;int&gt;</code> 1. <code>sequence&lt;str&gt;</code>	sequence of two elements: 0. <code>numpy.ndarray</code> ( <code>dtype= numpy.int32</code> ) or <code>sequence&lt;int&gt;</code> 1. <code>sequence&lt;str&gt;</code> (decoded with <i>latin-1</i> , aka <i>ISO-8859-1</i> )
DEV_DOUBLESTRINGARRAY		sequence of two elements: 0. <code>numpy.ndarray</code> ( <code>dtype= numpy.float64</code> ) or <code>sequence&lt;int&gt;</code> 1. <code>sequence&lt;str&gt;</code>	sequence of two elements: 0. <code>numpy.ndarray</code> ( <code>dtype= numpy.float64</code> ) or <code>sequence&lt;int&gt;</code> 1. <code>sequence&lt;str&gt;</code> (decoded with <i>latin-1</i> , aka <i>ISO-8859-1</i> )

For SPECTRUM and IMAGES the actual sequence object used depends on the context where the tango data is used, and the availability of `numpy`.

1. for properties the sequence is always a `list`. Example:

```
>>> import tango
>>> db = tango.Database()
>>> s = db.get_property(["TangoSynchrotrons"])
>>> print type(s)
<type 'list'>
```

2. for attribute/command values

- `numpy.ndarray` if PyTango was compiled with `numpy` support (default) and `numpy` is installed.
- `list` otherwise

### 5.1.1 Pipe data types

Pipes require different data types. You can think of them as a structured type.

A pipe transports data which is called a *blob*. A *blob* consists of name and a list of fields. Each field is called *data element*. Each *data element* consists of a name and a value. *Data element* names must be unique in the same blob.

The value can be of any of the SCALAR or SPECTRUM tango data types (except `DevEnum`).

Additionally, the value can be a *blob* itself.

In PyTango, a *blob* is represented by a sequence of two elements:

- blob name (str)

- data is either:
  - sequence (`list`, `tuple`, or other) of data elements where each element is a `dict` with the following keys:
    - \* `name` (mandatory): (`str`) data element name
    - \* `value` (mandatory): data (compatible with any of the SCALAR or SPECTRUM data types except `DevEnum`). If value is to be a sub-*blob* then it should be sequence of [*blob name*, sequence of data elements] (see above)
    - \* `dtype` (optional, mandatory if a `DevEncoded` is required): see *Data type equivalence*. If `dtype` key is not given, PyTango will try to find the proper tango type by inspecting the value.
  - a `dict` where key is the data element name and value is the data element value (compact version)

When using the compact dictionary version note that the order of the data elements is lost. If the order is important for you, consider using `collections.OrderedDict` instead (if you have python  $\geq 2.7$ ). If not you can use `orderdict` backport module available on pypi). Also, in compact mode it is not possible to enforce a specific type. As a consequence, `DevEncoded` is not supported in compact mode.

The description sounds more complicated that it actually is. Here are some practical examples of what you can return in a server as a read request from a pipe:

```
import numpy as np

# plain (one level) blob showing different tango data types
# (explicitly and implicit):

PIPE0 = \
('BlobCase0',
 ({'name': 'DE1', 'value': 123,}, # converts to_
 ↪DevLong64
 {'name': 'DE2', 'value': np.int32(456),}, # converts to_
 ↪DevLong
 {'name': 'DE3', 'value': 789, 'dtype': 'int32'}, # converts to_
 ↪DevLong
 {'name': 'DE4', 'value': np.uint32(123)}, # converts to_
 ↪DevULong
 {'name': 'DE5', 'value': range(5), 'dtype': ('uint16',)}, # converts to_
 ↪DevVarUShortArray
 {'name': 'DE6', 'value': [1.11, 2.22], 'dtype': ('float64',)}, # converts to_
 ↪DevVarDoubleArray
 {'name': 'DE7', 'value': numpy.zeros((100,))}, # converts to_
 ↪DevVarDoubleArray
 {'name': 'DE8', 'value': True}, # converts to_
 ↪DevBoolean
 )
)

# similar as above but in compact version (implicit data type conversion):

PIPE1 = \
('BlobCase1', dict(DE1=123, DE2=np.int32(456), DE3=np.int32(789),
                   DE4=np.uint32(123), DE5=np.arange(5, dtype='uint16'),
                   DE6=[1.11, 2.22], DE7=numpy.zeros((100,)),
                   DE8=True)
)

# similar as above but order matters so we use an ordered dict:
```

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```

import collections

data = collections.OrderedDict()
data['DE1'] = 123
data['DE2'] = np.int32(456)
data['DE3'] = np.int32(789)
data['DE4'] = np.uint32(123)
data['DE5'] = np.arange(5, dtype='uint16')
data['DE6'] = [1.11, 2.22]
data['DE7'] = numpy.zeros((100,))
data['DE8'] = True

PIPE2 = 'BlobCase2', data

# another plain blob showing string, string array and encoded data types:

PIPE3 = \
('BlobCase3',
 ({'name': 'stringDE', 'value': 'Hello'},
  {'name': 'VectorStringDE', 'value': ('bonjour', 'le', 'monde')},
  {'name': 'DevEncodedDE', 'value': ('json', '"isn\'t it?")', 'dtype': 'bytes'},
 )
)

# blob with sub-blob which in turn has a sub-blob

PIPE4 = \
('BlobCase4',
 ({'name': '1DE', 'value': ('Inner', ({'name': '1_1DE', 'value': 'Grenoble'},
                                     {'name': '1_2DE', 'value': ('InnerInner',
                                                                     {'name': '1_1_
→1DE', 'value': np.int32(111)},
                                                                     {'name': '1_1_
→2DE', 'value': [3.33]}))
                                     })
  },
  {'name': '2DE', 'value': (3,4,5,6), 'dtype': ('int32',) },
 )
)

```

### 5.1.2 DevEnum pythonic usage

When using regular tango DeviceProxy and AttributeProxy DevEnum is treated just like in cpp tango (see [enumerated attributes](#) for more info). However, since PyTango >= 9.2.5 there is a more pythonic way of using DevEnum data types if you use the *high level API*, both in server and client side.

In server side you can use python `enum.IntEnum` class to deal with DevEnum attributes:

```

import time
from enum import IntEnum
from tango import AttrWriteType
from tango.server import Device, attribute, command

class Noon(IntEnum):
    AM = 0 # DevEnum's must start at 0
    PM = 1 # and increment by 1

```

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```

class DisplayType(IntEnum):
    ANALOG = 0 # DevEnum's must start at 0
    DIGITAL = 1 # and increment by 1

class Clock(Device):

    display_type = DisplayType(0)

    @attribute(dtype=float)
    def time(self):
        return time.time()

    gmtime = attribute(dtype=(int,), max_dim_x=9)

    def read_gmtime(self):
        return time.gmtime()

    @attribute(dtype=Noon)
    def noon(self):
        time_struct = time.gmtime(time.time())
        return Noon.AM if time_struct.tm_hour < 12 else Noon.PM

    display = attribute(dtype=DisplayType, access=AttrWriteType.READ_WRITE)

    def read_display(self):
        return self.display_type

    def write_display(self, display_type):
        self.display_type = display_type

    @command(dtype_in=float, dtype_out=str)
    def ctime(self, seconds):
        """
        Convert a time in seconds since the Epoch to a string in local time.
        This is equivalent to asctime(localtime(seconds)). When the time tuple
        is not present, current time as returned by localtime() is used.
        """
        return time.ctime(seconds)

    @command(dtype_in=(int,), dtype_out=float)
    def mktime(self, tupl):
        return time.mktime(tupl)

if __name__ == "__main__":
    Clock.run_server()

```

On the client side you can also use a pythonic approach for using DevEnum attributes:

```

import sys
import PyTango

if len(sys.argv) != 2:
    print("must provide one and only one clock device name")
    sys.exit(1)

clock = PyTango.DeviceProxy(sys.argv[1])
t = clock.time
gmt = clock.gmtime
noon = clock.noon

```

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```

display = clock.display
print(t)
print(gmt)
print(noon, noon.name, noon.value)
if noon == noon.AM:
    print('Good morning!')
print(clock.ctime(t))
print(clock.mktime(gmt))
print(display, display.name, display.value)
clock.display = display.ANALOG
clock.display = 'DIGITAL' # you can use a valid string to set the value
print(clock.display, clock.display.name, clock.display.value)
display_type = type(display) # or even create your own IntEnum type
analog = display_type(0)
clock.display = analog
print(clock.display, clock.display.name, clock.display.value)
clock.display = clock.display.DIGITAL
print(clock.display, clock.display.name, clock.display.value)

```

## 5.2 Client API

### 5.2.1 DeviceProxy

```
class tango.DeviceProxy(*args, **kwargs)
```

Bases: `_tango.Connection`

DeviceProxy is the high level Tango object which provides the client with an easy-to-use interface to TANGO devices. DeviceProxy provides interfaces to all TANGO Device interfaces. The DeviceProxy manages timeouts, stateless connections and reconnection if the device server is restarted. To create a DeviceProxy, a Tango Device name must be set in the object constructor.

**Example:** `dev = tango.DeviceProxy("sys/tg_test/1")`

```
DeviceProxy(dev_name, green_mode=None, wait=True, timeout=True) -> DeviceProxy
DeviceProxy(self, dev_name, need_check_acc, green_mode=None, wait=True, timeout=True) -> DeviceProxy
```

Creates a new *DeviceProxy*.

#### Parameters

- **dev\_name** (*str*) – the device name or alias
- **need\_check\_acc** (*bool*) – in first version of the function it defaults to True. Determines if at creation time of DeviceProxy it should check for channel access (rarely used)
- **green\_mode** (*GreenMode*) – determines the mode of execution of the device (including the way it is created). Defaults to the current global green\_mode (check `get_green_mode()` and `set_green_mode()`)
- **wait** (*bool*) – whether or not to wait for result. If green\_mode Ignored when green\_mode is Synchronous (always waits).
- **timeout** (*float*) – The number of seconds to wait for the result. If None, then there is no limit on the wait time. Ignored when green\_mode is Synchronous or wait is False.

#### Returns

if **green\_mode** is Synchronous or **wait** is True: *DeviceProxy*

**elif green\_mode is Futures:** `concurrent.futures.Future`

**elif green\_mode is Gevent:** `gevent.event.AsyncResult`

#### Throws

- : class:*~tango.DevFailed* if green\_mode is Synchronous or wait is True and there is an error creating the device.
- : class:*concurrent.futures.TimeoutError* if green\_mode is Futures, wait is False, timeout is not None and the time to create the device has expired.
- : class:*gevent.timeout.Timeout* if green\_mode is Gevent, wait is False, timeout is not None and the time to create the device has expired.

New in version 8.1.0: *green\_mode* parameter. *wait* parameter. *timeout* parameter.

**add\_logging\_target** (*self*, *target\_type\_target\_name*) → None

Adds a new logging target to the device.

The *target\_type\_target\_name* input parameter must follow the format: *target\_type::target\_name*. Supported target types are: console, file and device. For a device target, the *target\_name* part of the *target\_type\_target\_name* parameter must contain the name of a log consumer device (as defined in A.8). For a file target, *target\_name* is the full path to the file to log to. If omitted, the device's name is used to build the file name (which is something like *domain\_family\_member.log*). Finally, the *target\_name* part of the *target\_type\_target\_name* input parameter is ignored in case of a console target and can be omitted.

#### Parameters

**target\_type\_target\_name** (*str*) logging target

**Return** None

**Throws** *DevFailed* from device

*New in PyTango 7.0.0*

**adm\_name** (*self*) → *str*

Return the name of the corresponding administrator device. This is useful if you need to send an administration command to the device server, e.g restart it

*New in PyTango 3.0.4*

**alias** (*self*) → *str*

Return the device alias if one is defined. Otherwise, throws exception.

**Return** (*str*) device alias

**attribute\_history** (*self*, *attr\_name*, *depth*, *extract\_as=ExtractAs.Numpy*) → *sequence*<DeviceAttributeHistory>

Retrieve attribute history from the attribute polling buffer. See chapter on Advanced Feature for all details regarding polling

#### Parameters

**attr\_name** (*str*) Attribute name.

**depth** (*int*) The wanted history depth.

**extract\_as** (*ExtractAs*)

**Return** This method returns a vector of DeviceAttributeHistory types.

**Throws** *NonSupportedFeature*, *ConnectionFailed*,  
*CommunicationFailed*, *DevFailed* from device

**attribute\_list\_query** (*self*) → sequence<AttributeInfo>

Query the device for info on all attributes. This method returns a sequence of `tango.AttributeInfo`.

**Parameters** None

**Return** (sequence<*AttributeInfo*>) containing the attributes configuration

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**attribute\_list\_query\_ex** (*self*) → sequence<AttributeInfoEx>

Query the device for info on all attributes. This method returns a sequence of `tango.AttributeInfoEx`.

**Parameters** None

**Return** (sequence<*AttributeInfoEx*>) containing the attributes configuration

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**attribute\_query** (*self*, *attr\_name*) → AttributeInfoEx

Query the device for information about a single attribute.

**Parameters**

**attr\_name** (*str*) the attribute name

**Return** (*AttributeInfoEx*) containing the attribute configuration

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**black\_box** (*self*, *n*) → sequence<str>

Get the last commands executed on the device server

**Parameters**

**n** *n* number of commands to get

**Return** (sequence<*str*>) sequence of strings containing the date, time, command and from which client computer the command was executed

**Example**

```
print(black_box(4))
```

**cancel\_all\_polling\_asynch\_request** (*self*) → None

Cancel all running asynchronous request

This is a client side call. Obviously, the calls cannot be aborted while it is running in the device.

**Parameters** None

**Return** None

*New in PyTango 7.0.0*

**cancel\_asynch\_request** (*self*, *id*) → None

Cancel a running asynchronous request

This is a client side call. Obviously, the call cannot be aborted while it is running in the device.

#### Parameters

**id** The asynchronous call identifier

**Return** None

*New in PyTango 7.0.0*

**command\_history** (*self*, *cmd\_name*, *depth*) → sequence<DeviceDataHistory>

Retrieve command history from the command polling buffer. See chapter on Advanced Feature for all details regarding polling

#### Parameters

**cmd\_name** (*str*) Command name.

**depth** (*int*) The wanted history depth.

**Return** This method returns a vector of DeviceDataHistory types.

**Throws** *NonSupportedFeature*, *ConnectionFailed*,  
*CommunicationFailed*, *DevFailed* from device

**command\_inout** (*self*, *cmd\_name*, *cmd\_param*=None, *green\_mode*=None, *wait*=True, *timeout*=None) → any

Execute a command on a device.

#### Parameters

**cmd\_name** (*str*) Command name.

**cmd\_param** (*any*) It should be a value of the type expected by the command or a DeviceData object with this value inserted. It can be omitted if the command should not get any argument.

**green\_mode** (*GreenMode*) Defaults to the current DeviceProxy GreenMode. (see *get\_green\_mode()* and *set\_green\_mode()*).

**wait** (*bool*) whether or not to wait for result. If *green\_mode* is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when *green\_mode* is *Synchronous* (always waits).

**timeout** (*float*) The number of seconds to wait for the result. If None, then there is no limit on the wait time. Ignored when *green\_mode* is *Synchronous* or *wait* is False.

**Return** The result of the command. The type depends on the command. It may be None.

**Throws** *ConnectionFailed*, *CommunicationFailed*,  
*DeviceUnlocked*, *DevFailed* from device *TimeoutError* (*green\_mode* == *Futures*) If the future didn't finish executing before the given timeout. *Timeout* (*green\_mode* == *Gevent*) If the async result didn't finish executing before the given timeout.

New in version 8.1.0: *green\_mode* parameter. *wait* parameter. *timeout* parameter.

`command_inout_async(self, cmd_name) → id`

`command_inout_async(self, cmd_name, cmd_param) → id`

`command_inout_async(self, cmd_name, cmd_param, forget) → id`

Execute asynchronously (polling model) a command on a device

#### Parameters

**cmd\_name** (`str`) Command name.

**cmd\_param** (`any`) It should be a value of the type expected by the command or a `DeviceData` object with this value inserted. It can be omitted if the command should not get any argument. If the command should get no argument and you want to set the 'forget' param, use `None` for `cmd_param`.

**forget** (`bool`) If this flag is set to true, this means that the client does not care at all about the server answer and will even not try to get it. Default value is `False`. Please, note that device re-connection will not take place (in case it is needed) if the fire and forget mode is used. Therefore, an application using only fire and forget requests is not able to automatically re-connect to device.

**Return** (`int`) This call returns an asynchronous call identifier which is needed to get the command result (see `command_inout_reply`)

**Throws** `ConnectionFailed`, `TypeError`, anything thrown by `command_query`

`command_inout_async(self, cmd_name, callback) → None`

`command_inout_async(self, cmd_name, cmd_param, callback) → None`

Execute asynchronously (callback model) a command on a device.

#### Parameters

**cmd\_name** (`str`) Command name.

**cmd\_param** (`any`) It should be a value of the type expected by the command or a `DeviceData` object with this value inserted. It can be omitted if the command should not get any argument.

**callback** Any callable object (function, lambda...) or any object with a method named "cmd\_ended".

**Return** `None`

**Throws** `ConnectionFailed`, `TypeError`, anything thrown by `command_query`

---

**Important:** by default, TANGO is initialized with the **polling** model. If you want to use the **push** model (the one with the `callback` parameter), you need to change the global TANGO model to `PUSH_CALLBACK`. You can do this with the `tango.ApiUtil().set_async_cb_sub_model'`

---

`command_inout_raw(self, cmd_name, cmd_param=None) → DeviceData`

Execute a command on a device.

#### Parameters

**cmd\_name** (`str`) Command name.

**cmd\_param** (any) It should be a value of the type expected by the command or a DeviceData object with this value inserted. It can be omitted if the command should not get any argument.

**Return** A DeviceData object.

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DeviceUnlocked*, *DevFailed* from device

**command\_inout\_reply** (*self*, *id*) → DeviceData

Check if the answer of an asynchronous `command_inout` is arrived (polling model). If the reply is arrived and if it is a valid reply, it is returned to the caller in a DeviceData object. If the reply is an exception, it is re-thrown by this call. An exception is also thrown in case of the reply is not yet arrived.

#### Parameters

**id** (int) Asynchronous call identifier.

**Return** (*DeviceData*)

**Throws** *AsyncCall*, *AsyncReplyNotArrived*, *CommunicationFailed*, *DevFailed* from device

**command\_inout\_reply**(*self*, *id*, *timeout*) -> *DeviceData*

Check if the answer of an asynchronous `command_inout` is arrived (polling model). `id` is the asynchronous call identifier. If the reply is arrived and if it is a valid reply, it is returned to the caller in a *DeviceData* object. If the reply is an exception, it is re-thrown by this call. If the reply is not yet arrived, the call will wait (blocking the process) for the time specified in `timeout`. If after `timeout` milliseconds, the reply is still not there, an exception is thrown. If `timeout` is set to 0, the call waits until the reply arrived.

#### Parameters

**id** (int) Asynchronous call identifier.

**timeout** (int)

**Return** (*DeviceData*)

**Throws** *AsyncCall*, *AsyncReplyNotArrived*, *CommunicationFailed*, *DevFailed* from device

**command\_inout\_reply\_raw** (*self*, *id*, *timeout*) → DeviceData

Check if the answer of an asynchronous `command_inout` is arrived (polling model). `id` is the asynchronous call identifier. If the reply is arrived and if it is a valid reply, it is returned to the caller in a DeviceData object. If the reply is an exception, it is re-thrown by this call. If the reply is not yet arrived, the call will wait (blocking the process) for the time specified in `timeout`. If after `timeout` milliseconds, the reply is still not there, an exception is thrown. If `timeout` is set to 0, the call waits until the reply arrived.

#### Parameters

**id** (int) Asynchronous call identifier.

**timeout** (int)

**Return** (*DeviceData*)

**Throws** *AsynCall*, *AsynReplyNotArrived*, *CommunicationFailed*, *DevFailed* from device

**command\_list\_query** (*self*) → sequence<CommandInfo>

Query the device for information on all commands.

**Parameters** None

**Return** (*CommandInfoList*) Sequence of *CommandInfo* objects

**command\_query** (*self*, *command*) → *CommandInfo*

Query the device for information about a single command.

**Parameters**

**command** (*str*) command name

**Return** (*CommandInfo*) object

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**Example**

```
com_info = dev.command_query("DevString")
print(com_info.cmd_name)
print(com_info.cmd_tag)
print(com_info.in_type)
print(com_info.out_type)
print(com_info.in_type_desc)
print(com_info.out_type_desc)
print(com_info.disp_level)
```

See *CommandInfo* documentation string form more detail

**connect** (*self*, *corba\_name*) → None

Creates a connection to a TANGO device using it's stringified CORBA reference i.e. IOR or corbaloc.

**Parameters**

**corba\_name** (*str*) Name of the CORBA object

**Return** None

*New in PyTango 7.0.0*

**delete\_property** (*self*, *value*)

Delete a the given of properties for this device. This method accepts the following types as value parameter:

1. string [in] - single property to be deleted
2. tango.DbDatum [in] - single property data to be deleted
3. tango.DbData [in] - several property data to be deleted
4. sequence<string> [in]- several property data to be deleted
5. sequence<DbDatum> [in] - several property data to be deleted
6. dict<str, obj> [in] - keys are property names to be deleted (values are ignored)

7. dict<str, DbDatum> [in] - several DbDatum.name are property names to be deleted (keys are ignored)

**Parameters**

**value** can be one of the following:

1. string [in] - single property data to be deleted
2. tango.DbDatum [in] - single property data to be deleted
3. tango.DbData [in] - several property data to be deleted
4. sequence<string> [in]- several property data to be deleted
5. sequence<DbDatum> [in] - several property data to be deleted
6. dict<str, obj> [in] - keys are property names to be deleted (values are ignored)
7. dict<str, DbDatum> [in] - several DbDatum.name are property names to be deleted (keys are ignored)

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed* *DevFailed* from device (*DB\_SQLError*)

**description** (*self*) → str

Get device description.

**Parameters** None

**Return** (str) describing the device

**dev\_name** (*self*) → str

Return the device name as it is stored locally

**Parameters** None

**Return** (str)

**event\_queue\_size** (*self*, *event\_id*) → int

Returns the number of stored events in the event reception buffer. After every call to DeviceProxy.get\_events(), the event queue size is 0. During event subscription the client must have chosen the 'pull model' for this event. event\_id is the event identifier returned by the DeviceProxy.subscribe\_event() method.

**Parameters**

**event\_id** (int) event identifier

**Return** an integer with the queue size

**Throws** *EventSystemFailed*

*New in PyTango 7.0.0*

**get\_access\_control** (*self*) → AccessControlType

Returns the current access control type

**Parameters** None

**Return** (*AccessControlType*) The current access control type



*New in PyTango 7.0.0*

**get\_access\_right** (*self*) → *AccessControlType*

Returns the current access control type

**Parameters** None

**Return** (*AccessControlType*) The current access control type

*New in PyTango 8.0.0*

**get\_async\_replies** (*self*, *call\_timeout*) → None

Try to obtain data returned by a command asynchronously requested. This method blocks for the specified timeout if the reply is not yet arrived. This method fires callback when the reply arrived. If the timeout is set to 0, the call waits indefinitely for the reply

**Parameters**

**call\_timeout** (*int*) timeout in miliseconds

**Return** None

*New in PyTango 7.0.0*

**get\_attribute\_config** (*self*, *name*) → *AttributeInfoEx*

Return the attribute configuration for a single attribute.

**Parameters**

**name** (*str*) attribute name

**Return** (*AttributeInfoEx*) Object containing the attribute information

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

Deprecated: use `get_attribute_config_ex` instead

**get\_attribute\_config** (*self*, *names*) → *AttributeInfoList*

Return the attribute configuration for the list of specified attributes. To get all the attributes pass a sequence containing the constant `tango::class::constants.AllAttr`

**Parameters**

**names** (sequence<*str*>) attribute names

**Return** (*AttributeInfoList*) Object containing the attributes information

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

Deprecated: use `get_attribute_config_ex` instead

**get\_attribute\_config\_ex** (*self*, *name*) → *AttributeInfoListEx* :

Return the extended attribute configuration for a single attribute.

**Parameters**

**name** (*str*) attribute name

**Return** (*AttributeInfoEx*) Object containing the attribute information

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

`get_attribute_config( self, names) -> AttributeInfoListEx :`

Return the extended attribute configuration for the list of specified attributes. To get all the attributes pass a sequence containing the constant `tango::class::constants.AllAttr`

**Parameters**

**names** (sequence<str>) attribute names

**Return** (*AttributeInfoList*) Object containing the attributes information

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

`get_attribute_list( self) -> sequence<str>`

Return the names of all attributes implemented for this device.

**Parameters** None

**Return** sequence<str>

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

`get_attribute_poll_period( self, attr_name) -> int`

Return the attribute polling period.

**Parameters**

**attr\_name** (str) attribute name

**Return** polling period in milliseconds

`get_command_config( self) -> CommandInfoList`

Return the command configuration for all commands.

**Return** (*CommandInfoList*) Object containing the commands information

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

`get_command_config( self, name) -> CommandInfo`

Return the command configuration for a single command.

**Parameters**

**name** (str) command name

**Return** (*CommandInfo*) Object containing the command information

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

`get_command_config( self, names) -> CommandInfoList`

Return the command configuration for the list of specified commands.

**Parameters**

**names** (sequence<str>) command names

**Return** (CommandInfoList) Object containing the commands information

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**get\_command\_list** (*self*) → sequence<str>

Return the names of all commands implemented for this device.

**Parameters** None

**Return** sequence<str>

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**get\_command\_poll\_period** (*self*, *cmd\_name*) → int

Return the command polling period.

**Parameters**

**cmd\_name** (str) command name

**Return** polling period in milliseconds

**get\_db\_host** (*self*) → str

Returns a string with the database host.

**Parameters** None

**Return** (str)

*New in PyTango 7.0.0*

**get\_db\_port** (*self*) → str

Returns a string with the database port.

**Parameters** None

**Return** (str)

*New in PyTango 7.0.0*

**get\_db\_port\_num** (*self*) → int

Returns an integer with the database port.

**Parameters** None

**Return** (int)

*New in PyTango 7.0.0*

**get\_dev\_host** (*self*) → str

Returns the current host

**Parameters** None

**Return** (`str`) the current host

*New in PyTango 7.2.0*

**get\_dev\_port** (`self`) → `str`

Returns the current port

**Parameters** None

**Return** (`str`) the current port

*New in PyTango 7.2.0*

**get\_device\_db** (`self`) → Database

Returns the internal database reference

**Parameters** None

**Return** (`Database`) object

*New in PyTango 7.0.0*

**get\_events** (`event_id`, `callback=None`, `extract_as=Numpy`) → None

The method extracts all waiting events from the event reception buffer.

If `callback` is not None, it is executed for every event. During event subscription the client must have chosen the pull model for this event. The callback will receive a parameter of type `EventData`, `AttrConfEventData` or `DataReadyEventData` depending on the type of the event (`event_type` parameter of `subscribe_event`).

If `callback` is None, the method extracts all waiting events from the event reception buffer. The returned `event_list` is a vector of `EventData`, `AttrConfEventData` or `DataReadyEventData` pointers, just the same data the callback would have received.

**Parameters**

**event\_id** (`int`) is the event identifier returned by the `DeviceProxy.subscribe_event()` method.

**callback** (`callable`) Any callable object or any object with a "push\_event" method.

**extract\_as** (`ExtractAs`)

**Return** None

**Throws** `EventSystemFailed`

**See Also** `subscribe_event`

*New in PyTango 7.0.0*

**get\_fqdn** (`self`) → `str`

Returns the fully qualified domain name

**Parameters** None

**Return** (`str`) the fully qualified domain name

*New in PyTango 7.2.0*

**get\_from\_env\_var** (`self`) → `bool`

Returns True if determined by environment variable or False otherwise

**Parameters** None

**Return** (`bool`)

*New in PyTango 7.0.0*

**get\_green\_mode** ()

Returns the green mode in use by this DeviceProxy.

**Returns** the green mode in use by this DeviceProxy.

**Return type** *GreenMode*

**See also:**

*tango.get\_green\_mode()* *tango.set\_green\_mode()*

*New in PyTango 8.1.0*

**get\_idl\_version** (*self*) → `int`

Get the version of the Tango Device interface implemented by the device

**Parameters** None

**Return** (`int`)

**get\_last\_event\_date** (*self*, *event\_id*) → `TimeVal`

Returns the arrival time of the last event stored in the event reception buffer. After every call to `DeviceProxy.get_events()`, the event reception buffer is empty. In this case an exception will be returned. During event subscription the client must have chosen the 'pull model' for this event. *event\_id* is the event identifier returned by the `DeviceProxy.subscribe_event()` method.

**Parameters**

**event\_id** (`int`) event identifier

**Return** (*tango.TimeVal*) representing the arrival time

**Throws** *EventSystemFailed*

*New in PyTango 7.0.0*

**get\_locker** (*self*, *lockinfo*) → `bool`

If the device is locked, this method returns True and sets some locker process information in the structure passed as argument. If the device is not locked, the method returns False.

**Parameters**

**lockinfo [out]** (`tango.LockInfo`) object that will be filled with lock information

**Return** (`bool`) True if the device is locked by us. Otherwise, False

*New in PyTango 7.0.0*

**get\_logging\_level** (*self*) → `int`

Returns the current device's logging level, where:

- 0=OFF
- 1=FATAL
- 2=ERROR
- 3=WARNING

- 4=INFO
- 5=DEBUG

:Parameters:None :Return: (`int`) representing the current logging level

*New in PyTango 7.0.0*

**get\_logging\_target** (*self*) → sequence<str>

Returns a sequence of string containing the current device's logging targets. Each vector element has the following format: `target_type::target_name`. An empty sequence is returned if the device has no logging targets.

**Parameters** None

**Return** a sequence<str> with the logging targets

*New in PyTango 7.0.0*

**get\_pipe\_config** (*self*) → PipeInfoList

Return the pipe configuration for all pipes.

**Return** (`PipeInfoList`) Object containing the pipes information

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device

`get_pipe_config(self, name) -> PipeInfo`

Return the pipe configuration for a single pipe.

**Parameters**

**name** (`str`) pipe name

**Return** (`PipeInfo`) Object containing the pipe information

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device

`get_pipe_config(self, names) -> PipeInfoList`

Return the pipe configuration for the list of specified pipes. To get all the pipes pass a sequence containing the constant `tango::class::constants.AllPipe`

**Parameters**

**names** (sequence<str>) pipe names

**Return** (`PipeInfoList`) Object containing the pipes information

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device

*New in PyTango 9.2.0*

**get\_property** (*propname*, *value=None*) → tango.DbData

Get a (list) property(ies) for a device.

This method accepts the following types as `propname` parameter: 1. `string` [`in`] - single property data to be fetched 2. `sequence<string>` [`in`] - several property data to be fetched 3. `tango.DbDatum` [`in`] - single property data to be fetched 4. `tango.DbData` [`in,out`] - several property data to be fetched. 5. `sequence<DbDatum>` - several property data to be fetched

Note: for cases 3, 4 and 5 the 'value' parameter if given, is IGNORED.

If value is given it must be a tango.DbData that will be filled with the property values

#### Parameters

**propname** (any) property(ies) name(s)

**value** (DbData) (optional, default is None meaning that the method will create internally a tango.DbData and return it filled with the property values

**Return** (DbData) object containing the property(ies) value(s). If a tango.DbData is given as parameter, it returns the same object otherwise a new tango.DbData is returned

**Throws** *NonDbDevice*, *ConnectionFailed* (with database), *CommunicationFailed* (with database), *DevFailed* from database device

**get\_property\_list** (*self*, *filter*, *array=None*) → obj

Get the list of property names for the device. The parameter filter allows the user to filter the returned name list. The wildcard character is '\*'. Only one wildcard character is allowed in the filter parameter.

#### Parameters

**filter[in]** (*str*) the filter wildcard

**array[out]** (sequence obj or None) (optional, default is None) an array to be filled with the property names. If None a new list will be created internally with the values.

**Return** the given array filled with the property names (or a new list if array is None)

**Throws** *NonDbDevice*, *WrongNameSyntax*, *ConnectionFailed* (with database), *CommunicationFailed* (with database) *DevFailed* from database device

*New in PyTango 7.0.0*

**get\_source** (*self*) → DevSource

Get the data source(device, polling buffer, polling buffer then device) used by command\_inout or read\_attribute methods

**Parameters** None

**Return** (*DevSource*)

#### Example

```
source = dev.get_source()
if source == DevSource.CACHE_DEV : ...
```

**get\_tango\_lib\_version** (*self*) → int

Returns the Tango lib version number used by the remote device Otherwise, throws exception.

**Return** (*int*) The device Tango lib version as a 3 or 4 digits number. Possible return value are: 100,200,500,520,700,800,810,...

*New in PyTango 8.1.0*

**get\_timeout\_millis** (*self*) → int

Get the client side timeout in milliseconds

**Parameters** None

**Return** (int)

**get\_transparency\_reconnection** (*self*) → bool

Returns the device transparency reconnection flag.

**Parameters** None

**Return** (bool) True if transparency reconnection is set or False otherwise

**import\_info** (*self*) → DbDevImportInfo

Query the device for import info from the database.

**Parameters** None

**Return** (*DbDevImportInfo*)

**Example**

```
dev_import = dev.import_info()
print(dev_import.name)
print(dev_import.exported)
print(dev_ior.ior)
print(dev_version.version)
```

All DbDevImportInfo fields are strings except for exported which is an integer”

**info** (*self*) → DeviceInfo

A method which returns information on the device

**Parameters** None

**Return** (*DeviceInfo*) object

**Example**

```
dev_info = dev.info()
print(dev_info.dev_class)
print(dev_info.server_id)
print(dev_info.server_host)
print(dev_info.server_version)
print(dev_info.doc_url)
print(dev_info.dev_type)
```

All DeviceInfo fields are strings **except for** the server\_version which **is** an integer”

**is\_attribute\_polled** (*self*, *attr\_name*) → bool

True if the attribute is polled.

**Parameters**

**attr\_name** (*str*) attribute name

**Return** boolean value



**is\_command\_polled** (*self*, *cmd\_name*) → bool

True if the command is polled.

**Parameters**

**cmd\_name** (*str*) command name

**Return** boolean value

**is\_dbase\_used** (*self*) → bool

Returns if the database is being used

**Parameters** None

**Return** (*bool*) True if the database is being used

*New in PyTango 7.2.0*

**is\_event\_queue\_empty** (*self*, *event\_id*) → bool

Returns true when the event reception buffer is empty. During event subscription the client must have chosen the 'pull model' for this event. *event\_id* is the event identifier returned by the `DeviceProxy.subscribe_event()` method.

**Parameters**

**event\_id** (*int*) event identifier

**Return** (*bool*) True if queue is empty or False otherwise

**Throws** *EventSystemFailed*

*New in PyTango 7.0.0*

**is\_locked** (*self*) → bool

Returns True if the device is locked. Otherwise, returns False.

**Parameters** None

**Return** (*bool*) True if the device is locked. Otherwise, False

*New in PyTango 7.0.0*

**is\_locked\_by\_me** (*self*) → bool

Returns True if the device is locked by the caller. Otherwise, returns False (device not locked or locked by someone else)

**Parameters** None

**Return** (*bool*) True if the device is locked by us. Otherwise, False

*New in PyTango 7.0.0*

**lock** (*self*, (*int*)*lock\_validity*) → None

Lock a device. The *lock\_validity* is the time (in seconds) the lock is kept valid after the previous lock call. A default value of 10 seconds is provided and should be fine in most cases. In case it is necessary to change the lock validity, it's not possible to ask for a validity less than a minimum value set to 2 seconds. The library provided an automatic system to periodically re lock the device until an unlock call. No code is needed to start/stop this automatic re-locking system. The locking system is re-entrant. It is then allowed to call this method on a device already locked by the same process. The locking system has the following features:

- It is impossible to lock the database device or any device server process admin device
- Destroying a locked DeviceProxy unlocks the device
- Restarting a locked device keeps the lock
- It is impossible to restart a device locked by someone else
- Restarting a server breaks the lock

A locked device is protected against the following calls when executed by another client:

- `command_inout` call except for device state and status requested via `command` and for the set of commands defined as allowed following the definition of allowed command in the Tango control access schema.
- `write_attribute` call
- `write_read_attribute` call
- `set_attribute_config` call

#### Parameters

**lock\_validity** (`int`) lock validity time in seconds (optional, default value is `tango.constants.DEFAULT_LOCK_VALIDITY`)

**Return** None

*New in PyTango 7.0.0*

**locking\_status** (`self`) → `str`

This method returns a plain string describing the device locking status. This string can be:

- 'Device <device name> is not locked' in case the device is not locked
- 'Device <device name> is locked by CPP or Python client with PID <pid> from host <host name>' in case the device is locked by a CPP client
- 'Device <device name> is locked by JAVA client class <main class> from host <host name>' in case the device is locked by a JAVA client

**Parameters** None

**Return** a string representing the current locking status

*New in PyTango 7.0.0*

**name** (`self`) → `str`

Return the device name from the device itself.

**pending\_asynch\_call** (`self`) → `int`

Return number of device asynchronous pending requests"

*New in PyTango 7.0.0*

**ping** (`self`) → `int`

A method which sends a ping to the device

**Parameters** None

**Return** (`int`) time elapsed in microseconds

**Throws** `exception` if device is not alive

**poll\_attribute** (*self*, *attr\_name*, *period*) → None

Add an attribute to the list of polled attributes.

**Parameters**

**attr\_name** (*str*) attribute name

**period** (*int*) polling period in milliseconds

**Return** None

**poll\_command** (*self*, *cmd\_name*, *period*) → None

Add a command to the list of polled commands.

**Parameters**

**cmd\_name** (*str*) command name

**period** (*int*) polling period in milliseconds

**Return** None

**polling\_status** (*self*) → sequence<str>

Return the device polling status.

**Parameters** None

**Return** (sequence<str>) One string for each polled command/attribute. Each string is multi-line string with:

- attribute/command name
- attribute/command polling period in milliseconds
- attribute/command polling ring buffer
- time needed for last attribute/command execution in milliseconds
- time since data in the ring buffer has not been updated
- delta time between the last records in the ring buffer
- exception parameters in case of the last execution failed

**put\_property** (*self*, *value*) → None

Insert or update a list of properties for this device. This method accepts the following types as value parameter: 1. `tango.DbDatum` - single property data to be inserted 2. `tango.DbData` - several property data to be inserted 3. `sequence<DbDatum>` - several property data to be inserted 4. `dict<str, DbDatum>` - keys are property names and value has data to be inserted 5. `dict<str, seq<str>>` - keys are property names and value has data to be inserted 6. `dict<str, obj>` - keys are property names and `str(obj)` is property value

**Parameters**

**value** can be one of the following: 1. `tango.DbDatum` - single property data to be inserted 2. `tango.DbData` - several property data to be inserted 3. `sequence<DbDatum>` - several property data to be inserted 4. `dict<str, DbDatum>` - keys are property names and value has data to be inserted 5. `dict<str, seq<str>>` - keys are property names and value has data to be inserted 6. `dict<str, obj>` - keys are property names and `str(obj)` is property value

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed* *DevFailed* from device (*DB\_SQLError*)

**read\_attribute** (*self*, *attr\_name*, *extract\_as=ExtractAs.Numpy*, *green\_mode=None*, *wait=True*, *timeout=None*) → *DeviceAttribute*

Read a single attribute.

#### Parameters

**attr\_name** (*str*) The name of the attribute to read.

**extract\_as** (*ExtractAs*) Defaults to *numpy*.

**green\_mode** (*GreenMode*) Defaults to the current *DeviceProxy GreenMode*. (see *get\_green\_mode()* and *set\_green\_mode()*).

**wait** (*bool*) whether or not to wait for result. If *green\_mode* is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when *green\_mode* is *Synchronous* (always waits).

**timeout** (*float*) The number of seconds to wait for the result. If *None*, then there is no limit on the wait time. Ignored when *green\_mode* is *Synchronous* or *wait* is *False*.

**Return** (*DeviceAttribute*)

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device *TimeoutError* (*green\_mode == Futures*) If the future didn't finish executing before the given timeout. *Timeout* (*green\_mode == Gevent*) If the async result didn't finish executing before the given timeout.

Changed in version 7.1.4: For *DevEncoded* attributes, before it was returning a *DeviceAttribute.value* as a tuple (**format<str>**, **data<str>**) no matter what was the *extract\_as* value was. Since 7.1.4, it returns a (**format<str>**, **data<buffer>**) unless *extract\_as* is *String*, in which case it returns (**format<str>**, **data<str>**).

Changed in version 8.0.0: For *DevEncoded* attributes, now returns a *DeviceAttribute.value* as a tuple (**format<str>**, **data<bytes>**) unless *extract\_as* is *String*, in which case it returns (**format<str>**, **data<str>**). Carefull, if using python >= 3 **data<str>** is decoded using default python *utf-8* encoding. This means that PyTango assumes tango DS was written encapsulating string into *utf-8* which is the default python encoding.

New in version 8.1.0: *green\_mode* parameter. *wait* parameter. *timeout* parameter.

**read\_attribute\_async** (*self*, *attr\_name*) → *int*

**read\_attribute\_async** (*self*, *attr\_name*, *callback*) → *None*

Shortcut to *self.read\_attributes\_async([attr\_name], cb)*

*New in PyTango 7.0.0*

**read\_attribute\_reply** (*self*, *id*, *extract\_as*) → *int*

**read\_attribute\_reply** (*self*, *id*, *timeout*, *extract\_as*) → *None*

Shortcut to *self.read\_attributes\_reply()[0]*

*New in PyTango 7.0.0*

**read\_attributes** (*self*, *attr\_names*, *extract\_as=ExtractAs.Numpy*, *green\_mode=None*, *wait=True*, *timeout=None*) → *sequence<DeviceAttribute>*

Read the list of specified attributes.

**Parameters**

**attr\_names** (sequence<str>) A list of attributes to read.

**extract\_as** (ExtractAs) Defaults to numpy.

**green\_mode** (*GreenMode*) Defaults to the current DeviceProxy *GreenMode*. (see *get\_green\_mode()* and *set\_green\_mode()*).

**wait** (bool) whether or not to wait for result. If *green\_mode* is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when *green\_mode* is *Synchronous* (always waits).

**timeout** (float) The number of seconds to wait for the result. If None, then there is no limit on the wait time. Ignored when *green\_mode* is *Synchronous* or *wait* is False.

**Return** (sequence<*DeviceAttribute*>)

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device *TimeoutError* (*green\_mode* == *Futures*) If the future didn't finish executing before the given timeout. *Timeout* (*green\_mode* == *Gevent*) If the async result didn't finish executing before the given timeout.

New in version 8.1.0: *green\_mode* parameter. *wait* parameter. *timeout* parameter.

**read\_attributes\_async** (*self*, *attr\_names*) → int

Read asynchronously (polling model) the list of specified attributes.

**Parameters**

**attr\_names** (sequence<str>) A list of attributes to read. It should be a *StdStringVector* or a sequence of str.

**Return** an asynchronous call identifier which is needed to get attributes value.

**Throws** *ConnectionFailed*

*New in PyTango 7.0.0*

**read\_attributes\_async** (*self*, *attr\_names*, *callback*, *extract\_as=Numpy*) -> None

Read asynchronously (push model) an attribute list.

**Parameters**

**attr\_names** (sequence<str>) A list of attributes to read. See *read\_attributes*.

**callback** (callable) This callback object should be an instance of a user class with an *attr\_read()* method. It can also be any callable object.

**extract\_as** (ExtractAs) Defaults to numpy.

**Return** None

**Throws** *ConnectionFailed*

*New in PyTango 7.0.0*

---

**Important:** by default, TANGO is initialized with the **polling** model. If you want to use the **push** model (the one with the callback parameter), you need to change the global TANGO model to PUSH\_CALLBACK. You can do this with the `tango.ApiUtil.set_asynch_cb_sub_model()`

---

**read\_attributes\_reply** (*self*, *id*, *extract\_as=ExtractAs.Numpy*) → DeviceAttribute

Check if the answer of an asynchronous read\_attribute is arrived (polling model).

**Parameters**

**id** (*int*) is the asynchronous call identifier.

**extract\_as** (*ExtractAs*)

**Return** If the reply is arrived and if it is a valid reply, it is returned to the caller in a list of DeviceAttribute. If the reply is an exception, it is re-thrown by this call. An exception is also thrown in case of the reply is not yet arrived.

**Throws** *AsynCall*, *AsynReplyNotArrived*, *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

*New in PyTango 7.0.0*

**read\_attributes\_reply** (*self*, *id*, *timeout*, *extract\_as=ExtractAs.Numpy*) → DeviceAttribute

Check if the answer of an asynchronous read\_attributes is arrived (polling model).

**Parameters**

**id** (*int*) is the asynchronous call identifier.

**timeout** (*int*)

**extract\_as** (*ExtractAs*)

**Return** If the reply is arrived and if it is a valid reply, it is returned to the caller in a list of DeviceAttribute. If the reply is an exception, it is re-thrown by this call. If the reply is not yet arrived, the call will wait (blocking the process) for the time specified in timeout. If after timeout milliseconds, the reply is still not there, an exception is thrown. If timeout is set to 0, the call waits until the reply arrived.

**Throws** *AsynCall*, *AsynReplyNotArrived*, *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

*New in PyTango 7.0.0*

**read\_pipe** (*self*, *pipe\_name*, *extract\_as=ExtractAs.Numpy*, *green\_mode=None*, *wait=True*, *timeout=None*) → tuple

Read a single pipe. The result is a *blob*: a tuple with two elements: blob name (string) and blob data (sequence). The blob data consists of a sequence where each element is a dictionary with the following keys:

- name: blob element name
- dtype: tango data type
- value: blob element data (str for DevString, etc)

In case dtype is DevPipeBlob, value is again a *blob*.

**Parameters**

**pipe\_name** (*str*) The name of the pipe to read.

**extract\_as** (*ExtractAs*) Defaults to numpy.

**green\_mode** (*GreenMode*) Defaults to the current DeviceProxy GreenMode. (see *get\_green\_mode()* and *set\_green\_mode()*).

**wait** (*bool*) whether or not to wait for result. If *green\_mode* is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when *green\_mode* is *Synchronous* (always waits).

**timeout** (*float*) The number of seconds to wait for the result. If None, then there is no limit on the wait time. Ignored when *green\_mode* is *Synchronous* or *wait* is False.

**Return** tuple<str, sequence>

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device *TimeoutError* (*green\_mode* == *Futures*) If the future didn't finish executing before the given timeout. *Timeout* (*green\_mode* == *Gevent*) If the async result didn't finish executing before the given timeout.

*New in PyTango 9.2.0*

**reconnect** (*self*, *db\_used*) → None

Reconnect to a CORBA object.

**Parameters**

**db\_used** (*bool*) Use thatabase

**Return** None

*New in PyTango 7.0.0*

**remove\_logging\_target** (*self*, *target\_type\_target\_name*) → None

Removes a logging target from the device's target list.

The *target\_type\_target\_name* input parameter must follow the format: *target\_type::target\_name*. Supported target types are: *console*, *file* and *device*. For a device target, the *target\_name* part of the *target\_type\_target\_name* parameter must contain the name of a log consumer device (as defined in ). For a file target, *target\_name* is the full path to the file to remove. If omitted, the default log file is removed. Finally, the *target\_name* part of the *target\_type\_target\_name* input parameter is ignored in case of a console target and can be omitted. If *target\_name* is set to *\**, all targets of the specified *target\_type* are removed.

**Parameters**

**target\_type\_target\_name** (*str*) logging target

**Return** None

*New in PyTango 7.0.0*

**set\_access\_control** (*self*, *acc*) → None

Sets the current access control type

**Parameters**

**acc** (*AccessControlType*) the type of access control to set

**Return** None

*New in PyTango 7.0.0*

**set\_attribute\_config** (*self*, *attr\_info*) → None

Change the attribute configuration for the specified attribute

**Parameters**

**attr\_info** (*AttributeInfo*) attribute information

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**set\_attribute\_config**( *self*, *attr\_info\_ex* ) -> None

Change the extended attribute configuration for the specified attribute

**Parameters**

**attr\_info\_ex** (*AttributeInfoEx*) extended attribute information

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**set\_attribute\_config**( *self*, *attr\_info* ) -> None

Change the attributes configuration for the specified attributes

**Parameters**

**attr\_info** (sequence<*AttributeInfo*>) attributes information

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**set\_attribute\_config**( *self*, *attr\_info\_ex* ) -> None

Change the extended attributes configuration for the specified attributes

**Parameters**

**attr\_info\_ex** (sequence<*AttributeInfoListEx*>) extended attributes information

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**set\_green\_mode** (*green\_mode=**None*)

Sets the green mode to be used by this DeviceProxy Setting it to None means use the global PyTango green mode (see *tango.get\_green\_mode()*).

**Parameters** **green\_mode** (*GreenMode*) – the new green mode

*New in PyTango 8.1.0*

**set\_logging\_level** (*self*, (*int*)*level*) → None

Changes the device's logging level, where:

- 0=OFF



- 1=FATAL
- 2=ERROR
- 3=WARNING
- 4=INFO
- 5=DEBUG

**Parameters**

**level** (`int`) logging level

**Return** None

*New in PyTango 7.0.0*

**set\_pipe\_config** (*self*, *pipe\_info*) → None

Change the pipe configuration for the specified pipe

**Parameters**

**pipe\_info** (`PipeInfo`) pipe information

**Return** None

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device

set\_pipe\_config( self, pipe\_info) -> None

Change the pipes configuration for the specified pipes

**Parameters**

**pipe\_info** (sequence<`PipeInfo`>) pipes information

**Return** None

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device

**set\_source** (*self*, *source*) → None

Set the data source(device, polling buffer, polling buffer then device) for `command_inout` and `read_attribute` methods.

**Parameters**

**source** (`DevSource`) constant.

**Return** None

**Example**

```
dev.set_source(DevSource.CACHE_DEV)
```

**set\_timeout\_millis** (*self*, *timeout*) → None

Set client side timeout for device in milliseconds. Any method which takes longer than this time to execute will throw an exception

**Parameters**

**timeout** integer value of timeout in milliseconds

**Return** None

**Example**

```
dev.set_timeout_millis(1000)
```

**set\_transparency\_reconnection** (*self*, *yesno*) → None

Set the device transparency reconnection flag

**Parameters** " - val : (bool) True to set transparency reconnection " or False otherwise**Return** None**state** (*self*) → DevState

A method which returns the state of the device.

**Parameters** None**Return** (*DevState*) constant**Example**

```
dev_st = dev.state()
if dev_st == DevState.ON : ...
```

**status** (*self*) → str

A method which returns the status of the device as a string.

**Parameters** None**Return** (*str*) describing the device status**stop\_poll\_attribute** (*self*, *attr\_name*) → None

Remove an attribute from the list of polled attributes.

**Parameters****attr\_name** (*str*) attribute name**Return** None**stop\_poll\_command** (*self*, *cmd\_name*) → None

Remove a command from the list of polled commands.

**Parameters****cmd\_name** (*str*) command name**Return** None**subscribe\_event** (*event\_type*, *cb*, *stateless=False*, *green\_mode=None*) → int

The client call to subscribe for event reception in the push model. The client implements a callback method which is triggered when the event is received. This method is currently used device interface change events only.

**Parameters**

**event\_type** (*EventType*) Is the event reason and must be on the enumerated values: \* EventType.INTERFACE\_CHANGE\_EVENT

**callback** (*callable*) Is any callable object or an object with a callable "push\_event" method.

**stateless** (*bool*) When the this flag is set to false, an exception will be thrown when the event subscription encounters a problem. With the stateless flag set to true, the event subscription will always succeed, even if the corresponding device server is not running. The keep alive thread will try every 10 seconds to subscribe for the specified event. At every subscription retry, a callback is executed which contains the corresponding exception

**green\_mode** the corresponding green mode (default is GreenMode.Synchronous)

**Return** An event id which has to be specified when unsubscribing from this event.

**Throws** *EventSystemFailed*

```
subscribe_event(self, attr_name, event, callback, filters=[], stateless=False, extract_as=Numpy, green_mode=None) -> int
```

The client call to subscribe for event reception in the push model. The client implements a `callback` method which is triggered when the event is received. Filtering is done based on the reason specified and the event type. For example when reading the state and the reason specified is "change" the event will be fired only when the state changes. Events consist of an attribute name and the event reason. A standard set of reasons are implemented by the system, additional device specific reasons can be implemented by device servers programmers.

### Parameters

**attr\_name** (*str*) The device attribute name which will be sent as an event e.g. "current".

**event\_type** (*EventType*) Is the event reason and must be on the enumerated values: \* EventType.CHANGE\_EVENT \* EventType.PERIODIC\_EVENT \* EventType.ARCHIVE\_EVENT \* EventType.ATTR\_CONF\_EVENT \* EventType.DATA\_READY\_EVENT \* EventType.USER\_EVENT

**callback** (*callable*) Is any callable object or an object with a callable "push\_event" method.

**filters** (*sequence<str>*) A variable list of name,value pairs which define additional filters for events.

**stateless** (*bool*) When the this flag is set to false, an exception will be thrown when the event subscription encounters a problem. With the stateless flag set to true, the event subscription will always succeed, even if the corresponding device server is not running. The keep alive thread will try every 10 seconds to subscribe for the specified event. At every subscription retry, a callback is executed which contains the corresponding exception

**extract\_as** (*ExtractAs*)

**green\_mode** the corresponding green mode (default is Green-Mode.Synchronous)

**Return** An event id which has to be specified when unsubscribing from this event.

**Throws** *EventSystemFailed*

`subscribe_event(self, attr_name, event, queuesize, filters=[], stateless=False, green_mode=None) -> int`

The client call to subscribe for event reception in the pull model. Instead of a `callback` method the client has to specify the size of the event reception buffer.

The event reception buffer is implemented as a round robin buffer. This way the client can set-up different ways to receive events:

- Event reception buffer size = 1 : The client is interested only in the value of the last event received. All other events that have been received since the last reading are discarded.
- Event reception buffer size > 1 : The client has chosen to keep an event history of a given size. When more events arrive since the last reading, older events will be discarded.
- Event reception buffer size = ALL\_EVENTS : The client buffers all received events. The buffer size is unlimited and only restricted by the available memory for the client.

All other parameters are similar to the descriptions given in the other `subscribe_event()` version.

**unlock** (*self, (bool)force*) → None

Unlock a device. If used, the method argument provides a back door on the locking system. If this argument is set to true, the device will be unlocked even if the caller is not the locker. This feature is provided for administration purpose and should be used very carefully. If this feature is used, the locker will receive a `DeviceUnlocked` during the next call which is normally protected by the locking Tango system.

#### Parameters

**force** (`bool`) force unlocking even if we are not the locker (optional, default value is False)

**Return** None

*New in PyTango 7.0.0*

**unsubscribe\_event** (*self, event\_id*) → None

Unsubscribes a client from receiving the event specified by `event_id`.

#### Parameters

**event\_id** (`int`) is the event identifier returned by the `DeviceProxy::subscribe_event()`. Unlike in TangoC++ we check that the `event_id` has been subscribed in this `DeviceProxy`.

**Return** None

**Throws** *EventSystemFailed*

**write\_attribute** (*self, attr\_name, value, green\_mode=None, wait=True, timeout=None*) →

None  
**write\_attribute** (*self, attr\_info, value, green\_mode=None, wait=True, timeout=None*) -> None

Write a single attribute.

#### Parameters

**attr\_name** (*str*) The name of the attribute to write.

**attr\_info** (*AttributeInfo*)

**value** The value. For non SCALAR attributes it may be any sequence of sequences.

**green\_mode** (*GreenMode*) Defaults to the current DeviceProxy GreenMode. (see *get\_green\_mode()* and *set\_green\_mode()*).

**wait** (*bool*) whether or not to wait for result. If *green\_mode* is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when *green\_mode* is *Synchronous* (always waits).

**timeout** (*float*) The number of seconds to wait for the result. If *None*, then there is no limit on the wait time. Ignored when *green\_mode* is *Synchronous* or *wait* is *False*.

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DeviceUnlocked*, *DevFailed* from device *TimeoutError* (*green\_mode == Futures*) If the future didn't finish executing before the given timeout. *Timeout* (*green\_mode == Gevent*) If the async result didn't finish executing before the given timeout.

New in version 8.1.0: *green\_mode* parameter. *wait* parameter. *timeout* parameter.

**write\_attribute\_async** (*attr\_name, value, cb=None*)  
 write\_attributes\_async( self, values) -> int write\_attributes\_async( self, values, callback)  
 -> None

Shortcut to self.write\_attributes\_async([attr\_name, value], cb)

*New in PyTango 7.0.0*

**write\_attribute\_reply** (*self, id*) → None

Check if the answer of an asynchronous write\_attribute is arrived (polling model). If the reply is arrived and if it is a valid reply, the call returned. If the reply is an exception, it is re-thrown by this call. An exception is also thrown in case of the reply is not yet arrived.

#### Parameters

**id** (*int*) the asynchronous call identifier.

**Return** None

**Throws** *AsyncCall*, *AsyncReplyNotArrived*, *CommunicationFailed*, *DevFailed* from device.

*New in PyTango 7.0.0*

**write\_attribute\_reply** (*self, id, timeout*) -> None

Check if the answer of an asynchronous write\_attribute is arrived (polling model). *id* is the asynchronous call identifier. If the reply is arrived and if it is a valid reply, the call returned. If the reply is an exception, it is re-thrown by this call. If the reply is not yet arrived, the call will wait (blocking the process) for the time specified in *timeout*. If after *timeout* milliseconds, the reply is still not there, an exception is thrown. If *timeout* is set to 0, the call waits until the reply arrived.

**Parameters**

**id** (*int*) the asynchronous call identifier.

**timeout** (*int*) the timeout

**Return** None

**Throws** *AsyncCall*, *AsyncReplyNotArrived*,  
*CommunicationFailed*, *DevFailed* from device.

*New in PyTango 7.0.0*

**write\_attributes** (*self, name\_val, green\_mode=None, wait=True, timeout=None*) → None

Write the specified attributes.

**Parameters**

**name\_val** A list of pairs (attr\_name, value). See write\_attribute

**green\_mode** (*GreenMode*) Defaults to the current DeviceProxy GreenMode. (see *get\_green\_mode()* and *set\_green\_mode()*).

**wait** (*bool*) whether or not to wait for result. If green\_mode is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when green\_mode is *Synchronous* (always waits).

**timeout** (*float*) The number of seconds to wait for the result. If None, then there is no limit on the wait time. Ignored when green\_mode is *Synchronous* or wait is False.

**Throws** *ConnectionFailed*, *CommunicationFailed*,  
*DeviceUnlocked*, *DevFailed* or *NamedDevFailedList* from device  
*TimeoutError* (green\_mode == *Futures*) If the future didn't finish executing before the given timeout. *Timeout* (green\_mode == *Event*) If the async result didn't finish executing before the given timeout.

*New in version 8.1.0: green\_mode parameter. wait parameter. timeout parameter.*

**write\_attributes\_async** (*self, values*) → int

Write asynchronously (polling model) the specified attributes.

**Parameters**

**values** (*any*) See write\_attributes.

**Return** An asynchronous call identifier which is needed to get the server reply

**Throws** *ConnectionFailed*

*New in PyTango 7.0.0*

**write\_attributes\_async** (*self, values, callback*) → None

Write asynchronously (callback model) a single attribute.

**Parameters**

**values** (*any*) See write\_attributes.

**callback** (callable) This callback object should be an instance of a user class with an `attr_written()` method . It can also be any callable object.

**Return** None

**Throws** *ConnectionFailed*

*New in PyTango 7.0.0*

---

**Important:** by default, TANGO is initialized with the **polling** model. If you want to use the **push** model (the one with the callback parameter), you need to change the global TANGO model to PUSH\_CALLBACK. You can do this with the `tango.ApiUtil.set_asynch_cb_sub_model()`

---

**write\_attributes\_reply** (*self, id*) → None

Check if the answer of an asynchronous `write_attributes` is arrived (polling model). If the reply is arrived and if it is a valid reply, the call returned. If the reply is an exception, it is re-thrown by this call. An exception is also thrown in case of the reply is not yet arrived.

**Parameters**

**id** (*int*) the asynchronous call identifier.

**Return** None

**Throws** *AsyncCall*, *AsyncReplyNotArrived*, *CommunicationFailed*, *DevFailed* from device.

*New in PyTango 7.0.0*

**write\_attributes\_reply** (*self, id, timeout*) -> None

Check if the answer of an asynchronous `write_attributes` is arrived (polling model). `id` is the asynchronous call identifier. If the reply is arrived and if it is a valid reply, the call returned. If the reply is an exception, it is re-thrown by this call. If the reply is not yet arrived, the call will wait (blocking the process) for the time specified in `timeout`. If after `timeout` milliseconds, the reply is still not there, an exception is thrown. If `timeout` is set to 0, the call waits until the reply arrived.

**Parameters**

**id** (*int*) the asynchronous call identifier.

**timeout** (*int*) the timeout

**Return** None

**Throws** *AsyncCall*, *AsyncReplyNotArrived*, *CommunicationFailed*, *DevFailed* from device.

*New in PyTango 7.0.0*

**write\_pipe** (*self, blob, green\_mode=None, wait=True, timeout=None*)

Write a *blob* to a single pipe. The *blob* comprises: a tuple with two elements: blob name (string) and blob data (sequence). The blob data consists of a sequence where each element is a dictionary with the following keys:

- name: blob element name
- dtype: tango data type

- value: blob element data (str for DevString, etc)

In case dtype is DevPipeBlob, value is also a *blob*.

#### Parameters

**blob** a tuple with two elements: blob name (string) and blob data (sequence).

**green\_mode** (*GreenMode*) Defaults to the current DeviceProxy GreenMode. (see *get\_green\_mode()* and *set\_green\_mode()*).

**wait** (*bool*) whether or not to wait for result. If green\_mode is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when green\_mode is *Synchronous* (always waits).

**timeout** (*float*) The number of seconds to wait for the result. If None, then there is no limit on the wait time. Ignored when green\_mode is *Synchronous* or wait is False.

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device *TimeoutError* (green\_mode == *Futures*) If the future didn't finish executing before the given timeout. *Timeout* (green\_mode == *Gevent*) If the async result didn't finish executing before the given timeout.

*New in PyTango 9.2.1*

**write\_read\_attribute** (*self*, *attr\_name*, *value*, *extract\_as=ExtractAs.Numpy*, *green\_mode=None*, *wait=True*, *timeout=None*) → *DeviceAttribute*

Write then read a single attribute in a single network call. By default (serialisation by device), the execution of this call in the server can't be interrupted by other clients.

**Parameters** see *write\_attribute(attr\_name, value)*

**Return** A *tango.DeviceAttribute* object.

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DeviceUnlocked*, *DevFailed* from device, *WrongData TimeoutError* (green\_mode == *Futures*) If the future didn't finish executing before the given timeout. *Timeout* (green\_mode == *Gevent*) If the async result didn't finish executing before the given timeout.

*New in PyTango 7.0.0*

New in version 8.1.0: *green\_mode* parameter. *wait* parameter. *timeout* parameter.

**write\_read\_attributes** (*self*, *name\_val*, *attr\_names*, *extract\_as=ExtractAs.Numpy*, *green\_mode=None*, *wait=True*, *timeout=None*) → *DeviceAttribute*

Write then read attribute(s) in a single network call. By default (serialisation by device), the execution of this call in the server can't be interrupted by other clients. On the server side, attribute(s) are first written and if no exception has been thrown during the write phase, attributes will be read.

#### Parameters

**name\_val** A list of pairs (*attr\_name*, *value*). See *write\_attribute*

**attr\_names** (*sequence<str>*) A list of attributes to read.

**extract\_as** (*ExtractAs*) Defaults to *numpy*.



**green\_mode** (*GreenMode*) Defaults to the current DeviceProxy GreenMode. (see *get\_green\_mode()* and *set\_green\_mode()*).

**wait** (*bool*) whether or not to wait for result. If *green\_mode* is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when *green\_mode* is *Synchronous* (always waits).

**timeout** (*float*) The number of seconds to wait for the result. If *None*, then there is no limit on the wait time. Ignored when *green\_mode* is *Synchronous* or *wait* is *False*.

**Return** (*sequence*<*DeviceAttribute*>)

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DeviceUnlocked*, *DevFailed* from device, *WrongData* *TimeoutError* (*green\_mode* == *Futures*) If the future didn't finish executing before the given timeout. *Timeout* (*green\_mode* == *Gevent*) If the async result didn't finish executing before the given timeout.

*New in PyTango 9.2.0*

## 5.2.2 AttributeProxy

**class** `tango.AttributeProxy` (*\*args, \*\*kwargs*)

AttributeProxy is the high level Tango object which provides the client with an easy-to-use interface to TANGO attributes.

To create an AttributeProxy, a complete attribute name must be set in the object constructor.

**Example:** `att = AttributeProxy("tango/tangotest/1/long_scalar")`

Note: PyTango implementation of AttributeProxy is in part a python reimplementaion of the AttributeProxy found on the C++ API.

**delete\_property** (*self, value*) → *None*

Delete a the given of properties for this attribute. This method accepts the following types as value parameter:

1. *string* [*in*] - single property to be deleted
2. *tango.DbDatum* [*in*] - single property data to be deleted
3. *tango.DbData* [*in*] - several property data to be deleted
4. *sequence*<*string*> [*in*]- several property data to be deleted
5. *sequence*<*DbDatum*> [*in*] - several property data to be deleted
6. *dict*<*str, obj*> [*in*] - keys are property names to be deleted (values are ignored)
7. *dict*<*str, DbDatum*> [*in*] - several *DbDatum.name* are property names to be deleted (keys are ignored)

### Parameters

**value** can be one of the following:

1. *string* [*in*] - single property data to be deleted
2. *tango.DbDatum* [*in*] - single property data to be deleted
3. *tango.DbData* [*in*] - several property data to be deleted
4. *sequence*<*string*> [*in*]- several property data to be deleted
5. *sequence*<*DbDatum*> [*in*] - several property data to be deleted

6. dict<str, obj> [in] - keys are property names to be deleted (values are ignored)
7. dict<str, DbDatum> [in] - several DbDatum.name are property names to be deleted (keys are ignored)

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed* *DevFailed* from device (DB\_SQLError)

**event\_queue\_size** (\*args, \*\*kwds)

**This method is a simple way to do:** self.get\_device\_proxy().event\_queue\_size(...)

For convenience, here is the documentation of DeviceProxy.event\_queue\_size(...):

event\_queue\_size(self, event\_id) -> int

Returns the number of stored events in the event reception buffer. After every call to DeviceProxy.get\_events(), the event queue size is 0. During event subscription the client must have chosen the 'pull model' for this event. event\_id is the event identifier returned by the DeviceProxy.subscribe\_event() method.

#### Parameters

**event\_id** (int) event identifier

**Return** an integer with the queue size

**Throws** *EventSystemFailed*

*New in PyTango 7.0.0*

**get\_config** (\*args, \*\*kwds)

**This method is a simple way to do:** self.get\_device\_proxy().get\_attribute\_config(self.name(), ...)

For convenience, here is the documentation of DeviceProxy.get\_attribute\_config(...):

get\_attribute\_config( self, name) -> AttributeInfoEx

Return the attribute configuration for a single attribute.

#### Parameters

**name** (str) attribute name

**Return** (*AttributeInfoEx*) Object containing the attribute information

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

Deprecated: use get\_attribute\_config\_ex instead

get\_attribute\_config( self, names) -> AttributeInfoList

Return the attribute configuration for the list of specified attributes. To get all the attributes pass a sequence containing the constant tango.class:constants.AllAttr

#### Parameters

**names** (sequence<str>) attribute names

**Return** (`AttributeInfoList`) Object containing the attributes information

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device

Deprecated: use `get_attribute_config_ex` instead

**get\_device\_proxy** (*self*) → `DeviceProxy`

A method which returns the device associated to the attribute

**Parameters** None

**Return** (`DeviceProxy`)

**get\_events** (*\*args, \*\*kwargs*)

**This method is a simple way to do:** `self.get_device_proxy().get_events(...)`

For convenience, here is the documentation of `DeviceProxy.get_events(...)`:

`get_events(event_id, callback=None, extract_as=Numpy) -> None`

The method extracts all waiting events from the event reception buffer.

If callback is not None, it is executed for every event. During event subscription the client must have chosen the pull model for this event. The callback will receive a parameter of type `EventData`, `AttrConfEventData` or `DataReadyEventData` depending on the type of the event (`event_type` parameter of `subscribe_event`).

If callback is None, the method extracts all waiting events from the event reception buffer. The returned `event_list` is a vector of `EventData`, `AttrConfEventData` or `DataReadyEventData` pointers, just the same data the callback would have received.

#### Parameters

**event\_id** (`int`) is the event identifier returned by the `DeviceProxy.subscribe_event()` method.

**callback** (`callable`) Any callable object or any object with a "push\_event" method.

**extract\_as** (`ExtractAs`)

**Return** None

**Throws** `EventSystemFailed`

**See Also** `subscribe_event`

*New in PyTango 7.0.0*

**get\_last\_event\_date** (*\*args, \*\*kwargs*)

**This method is a simple way to do:** `self.get_device_proxy().get_last_event_date(...)`

For convenience, here is the documentation of `DeviceProxy.get_last_event_date(...)`:

`get_last_event_date(self, event_id) -> TimeVal`

Returns the arrival time of the last event stored in the event reception buffer. After every call to `DeviceProxy.get_events()`, the event reception buffer is empty. In this case an exception will be returned. During event subscription the client must have chosen the 'pull model' for this event. `event_id` is the event identifier returned by the `DeviceProxy.subscribe_event()` method.

**Parameters****event\_id** (*int*) event identifier**Return** (*tango.TimeVal*) representing the arrival time**Throws** *EventSystemFailed**New in PyTango 7.0.0***get\_poll\_period** (*\*args, \*\*kws*)**This method is a simple way to do:** `self.get_device_proxy().get_attribute_poll_period(self.name(), ...)`For convenience, here is the documentation of `DeviceProxy.get_attribute_poll_period(...)`:`get_attribute_poll_period(self, attr_name) -> int`

Return the attribute polling period.

**Parameters****attr\_name** (*str*) attribute name**Return** polling period in milliseconds**get\_property** (*self, propname, value*) → *DbData*

Get a (list) property(ies) for an attribute.

This method accepts the following types as `propname` parameter:

1. `string` [*in*] - single property data to be fetched
2. `sequence<string>` [*in*] - several property data to be fetched
3. `tango.DbDatum` [*in*] - single property data to be fetched
4. `tango.DbData` [*in,out*] - several property data to be fetched
5. `sequence<DbDatum>` - several property data to be fetched

Note: for cases 3, 4 and 5 the 'value' parameter if given, is IGNORED.

If value is given it must be a `tango.DbData` that will be filled with the property values**Parameters****propname** (*str*) property(ies) name(s)**value** (`tango.DbData`) (optional, default is `None` meaning that the method will create internally a `tango.DbData` and return it filled with the property values)**Return** (`DbData`) containing the property(ies) value(s). If a `tango.DbData` is given as parameter, it returns the same object otherwise a new `tango.DbData` is returned**Throws** *NonDbDevice*, *ConnectionFailed* (with database), *CommunicationFailed* (with database), *DevFailed* from database device**get\_transparency\_reconnection** (*\*args, \*\*kws*)**This method is a simple way to do:** `self.get_device_proxy().get_transparency_reconnection(...)`For convenience, here is the documentation of `DeviceProxy.get_transparency_reconnection(...)`:`get_transparency_reconnection(self) -> bool`

Returns the device transparency reconnection flag.

**Parameters** None

**Return** (`bool`) True if transparency reconnection is set or False otherwise

**history** (\*args, \*\*kwargs)

**This method is a simple way to do:** `self.get_device_proxy().attribute_history(self.name(), ...)`

For convenience, here is the documentation of `DeviceProxy.attribute_history(...)`:

`attribute_history(self, attr_name, depth, extract_as=ExtractAs.Numpy) -> sequence<DeviceAttributeHistory>`

Retrieve attribute history from the attribute polling buffer. See chapter on Advanced Feature for all details regarding polling

**Parameters**

**attr\_name** (`str`) Attribute name.

**depth** (`int`) The wanted history depth.

**extract\_as** (`ExtractAs`)

**Return** This method returns a vector of `DeviceAttributeHistory` types.

**Throws** `NonSupportedFeature`, `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device

**is\_event\_queue\_empty** (\*args, \*\*kwargs)

**This method is a simple way to do:** `self.get_device_proxy().is_event_queue_empty(...)`

For convenience, here is the documentation of `DeviceProxy.is_event_queue_empty(...)`:

`is_event_queue_empty(self, event_id) -> bool`

Returns true when the event reception buffer is empty. During event subscription the client must have chosen the 'pull model' for this event. `event_id` is the event identifier returned by the `DeviceProxy.subscribe_event()` method.

**Parameters**

**event\_id** (`int`) event identifier

**Return** (`bool`) True if queue is empty or False otherwise

**Throws** `EventSystemFailed`

*New in PyTango 7.0.0*

**is\_polled** (\*args, \*\*kwargs)

**This method is a simple way to do:** `self.get_device_proxy().is_attribute_polled(self.name(), ...)`

For convenience, here is the documentation of `DeviceProxy.is_attribute_polled(...)`:

`is_attribute_polled(self, attr_name) -> bool`

True if the attribute is polled.

**Parameters**

**attr\_name** (`str`) attribute name

**Return** boolean value

**name** (*self*) → str

Returns the attribute name

**Parameters** None

**Return** (str) with the attribute name

**ping** (*\*args*, *\*\*kwargs*)

**This method is a simple way to do:** self.get\_device\_proxy().ping(...)

For convenience, here is the documentation of DeviceProxy.ping(...):

ping(self) -> int

A method which sends a ping to the device

**Parameters** None

**Return** (int) time elapsed in microseconds

**Throws** exception if device is not alive

**poll** (*\*args*, *\*\*kwargs*)

**This method is a simple way to do:** self.get\_device\_proxy().poll\_attribute(self.name(), ...)

For convenience, here is the documentation of DeviceProxy.poll\_attribute(...):

poll\_attribute(self, attr\_name, period) -> None

Add an attribute to the list of polled attributes.

**Parameters**

**attr\_name** (str) attribute name

**period** (int) polling period in milliseconds

**Return** None

**put\_property** (*self*, *value*) → None

Insert or update a list of properties for this attribute. This method accepts the following types as value parameter: 1. tango.DbDatum - single property data to be inserted 2. tango.DbData - several property data to be inserted 3. sequence<DbDatum> - several property data to be inserted 4. dict<str, DbDatum> - keys are property names and value has data to be inserted 5. dict<str, seq<str>> - keys are property names and value has data to be inserted 6. dict<str, obj> - keys are property names and str(obj) is property value

**Parameters**

**value** can be one of the following: 1. tango.DbDatum - single property data to be inserted 2. tango.DbData - several property data to be inserted 3. sequence<DbDatum> - several property data to be inserted 4. dict<str, DbDatum> - keys are property names and value has data to be inserted 5. dict<str, seq<str>> - keys are property names and value has data to be inserted 6. dict<str, obj> - keys are property names and str(obj) is property value

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed* *DevFailed* from device (DB\_SQLError)

**read** (\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().read\_attribute(self.name(), ...)

For convenience, here is the documentation of DeviceProxy.read\_attribute(...):

```
read_attribute(self, attr_name, extract_as=ExtractAs.Numpy,
green_mode=None, wait=True, timeout=None) -> DeviceAttribute
```

Read a single attribute.

#### Parameters

**attr\_name** (*str*) The name of the attribute to read.

**extract\_as** (*ExtractAs*) Defaults to numpy.

**green\_mode** (*GreenMode*) Defaults to the current DeviceProxy GreenMode. (see *get\_green\_mode()* and *set\_green\_mode()*).

**wait** (*bool*) whether or not to wait for result. If green\_mode is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when green\_mode is *Synchronous* (always waits).

**timeout** (*float*) The number of seconds to wait for the result. If None, then there is no limit on the wait time. Ignored when green\_mode is *Synchronous* or wait is False.

**Return** (*DeviceAttribute*)

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device *TimeoutError* (green\_mode == *Futures*) If the future didn't finish executing before the given timeout. *Timeout* (green\_mode == *Gevent*) If the async result didn't finish executing before the given timeout.

Changed in version 7.1.4: For *DevEncoded* attributes, before it was returning a *DeviceAttribute.value* as a tuple (**format<str>**, **data<str>**) no matter what was the *extract\_as* value was. Since 7.1.4, it returns a (**format<str>**, **data<buffer>**) unless *extract\_as* is *String*, in which case it returns (**format<str>**, **data<str>**).

Changed in version 8.0.0: For *DevEncoded* attributes, now returns a *DeviceAttribute.value* as a tuple (**format<str>**, **data<bytes>**) unless *extract\_as* is *String*, in which case it returns (**format<str>**, **data<str>**). Carefull, if using python >= 3 **data<str>** is decoded using default python *utf-8* encoding. This means that PyTango assumes tango DS was written encapsulating string into *utf-8* which is the default python encoding.

New in version 8.1.0: *green\_mode* parameter. *wait* parameter. *timeout* parameter.

**read\_async** (\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().read\_attribute\_async(self.name(), ...)

For convenience, here is the documentation of DeviceProxy.read\_attribute\_async(...):

```
read_attribute_async( self, attr_name) -> int
read_attribute_async( self, attr_name, callback) -> None
```

Shortcut to self.read\_attributes\_async([attr\_name], cb)

*New in PyTango 7.0.0*

**read\_reply** (\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().read\_attribute\_reply(...)

For convenience, here is the documentation of DeviceProxy.read\_attribute\_reply(...):

```
read_attribute_reply( self, id, extract_as) -> int read_attribute_reply( self, id,
timeout, extract_as) -> None
```

Shortcut to self.read\_attributes\_reply()[0]

*New in PyTango 7.0.0*

**set\_config** (\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().set\_attribute\_config(...)

For convenience, here is the documentation of DeviceProxy.set\_attribute\_config(...):

```
set_attribute_config( self, attr_info) -> None
```

Change the attribute configuration for the specified attribute

#### Parameters

**attr\_info** (*AttributeInfo*) attribute information

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*,  
*DevFailed* from device

```
set_attribute_config( self, attr_info_ex) -> None
```

Change the extended attribute configuration for the specified attribute

#### Parameters

**attr\_info\_ex** (*AttributeInfoEx*) extended attribute information

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*,  
*DevFailed* from device

```
set_attribute_config( self, attr_info) -> None
```

Change the attributes configuration for the specified attributes

#### Parameters

**attr\_info** (sequence<*AttributeInfo*>) attributes information

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*,  
*DevFailed* from device

```
set_attribute_config( self, attr_info_ex) -> None
```

Change the extended attributes configuration for the specified attributes

#### Parameters

**attr\_info\_ex** (sequence<*AttributeInfoListEx*>) extended attributes information



**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*,  
*DevFailed* from device

**set\_transparency\_reconnection** (\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().set\_transparency\_reconnection(...)

For convenience, here is the documentation of DeviceProxy.set\_transparency\_reconnection(...):

set\_transparency\_reconnection(self, yesno) -> None

Set the device transparency reconnection flag

**Parameters** " - val : (bool) True to set transparency reconnection " or False otherwise

**Return** None

**state** (\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().state(...)

For convenience, here is the documentation of DeviceProxy.state(...): **state** (self) -> *DevState*

A method which returns the state of the device.

**Parameters** None

**Return** (*DevState*) constant

**Example**

```
dev_st = dev.state()
if dev_st == DevState.ON : ...
```

**status** (\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().status(...)

For convenience, here is the documentation of DeviceProxy.status(...): **status** (self) -> *str*

A method which returns the status of the device as a string.

**Parameters** None

**Return** (*str*) describing the device status

**stop\_poll** (\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().stop\_poll\_attribute(self.name(), ...)

For convenience, here is the documentation of DeviceProxy.stop\_poll\_attribute(...):

stop\_poll\_attribute(self, attr\_name) -> None

Remove an attribute from the list of polled attributes.

**Parameters**

**attr\_name** (*str*) attribute name

**Return** None

**subscribe\_event** (\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().subscribe\_event(self.name(), ...)

For convenience, here is the documentation of DeviceProxy.subscribe\_event(...):

subscribe\_event(event\_type, cb, stateless=False, green\_mode=None) -> int

The client call to subscribe for event reception in the push model. The client implements a callback method which is triggered when the event is received. This method is currently used device interface change events only.

#### Parameters

**event\_type** (*EventType*) Is the event reason and must be on the enumerated values: \* EventType.INTERFACE\_CHANGE\_EVENT

**callback** (*callable*) Is any callable object or an object with a callable "push\_event" method.

**stateless** (*bool*) When the this flag is set to false, an exception will be thrown when the event subscription encounters a problem. With the stateless flag set to true, the event subscription will always succeed, even if the corresponding device server is not running. The keep alive thread will try every 10 seconds to subscribe for the specified event. At every subscription retry, a callback is executed which contains the corresponding exception

**green\_mode** the corresponding green mode (default is GreenMode.Synchronous)

**Return** An event id which has to be specified when unsubscribing from this event.

**Throws** *EventSystemFailed*

subscribe\_event(self, attr\_name, event, callback, filters=[], stateless=False, extract\_as=Numpy, green\_mode=None) -> int

The client call to subscribe for event reception in the push model. The client implements a callback method which is triggered when the event is received. Filtering is done based on the reason specified and the event type. For example when reading the state and the reason specified is "change" the event will be fired only when the state changes. Events consist of an attribute name and the event reason. A standard set of reasons are implemented by the system, additional device specific reasons can be implemented by device servers programmers.

#### Parameters

**attr\_name** (*str*) The device attribute name which will be sent as an event e.g. "current".

**event\_type** (*EventType*) Is the event reason and must be on the enumerated values:  
\* EventType.CHANGE\_EVENT  
\* EventType.PERIODIC\_EVENT \*

```

EventType.ARCHIVE_EVENT      *      Event-
Type.ATTR_CONF_EVENT        *      Event-
Type.DATA_READY_EVENT       *      Event-
Type.USER_EVENT

```

**callback** (*callable*) Is any callable object or an object with a callable “push\_event” method.

**filters** (*sequence<str>*) A variable list of name,value pairs which define additional filters for events.

**stateless** (*bool*) When the this flag is set to false, an exception will be thrown when the event subscription encounters a problem. With the stateless flag set to true, the event subscription will always succeed, even if the corresponding device server is not running. The keep alive thread will try every 10 seconds to subscribe for the specified event. At every subscription retry, a callback is executed which contains the corresponding exception

**extract\_as** (*ExtractAs*)

**green\_mode** the corresponding green mode (default is *GreenMode.Synchronous*)

**Return** An event id which has to be specified when unsubscribing from this event.

**Throws** *EventSystemFailed*

```

subscribe_event(self, attr_name, event, queuesize, filters=[], stateless=False,
green_mode=None) -> int

```

The client call to subscribe for event reception in the pull model. Instead of a `callback` method the client has to specify the size of the event reception buffer.

The event reception buffer is implemented as a round robin buffer. This way the client can set-up different ways to receive events:

- Event reception buffer size = 1 : The client is interested only in the value of the last event received. All other events that have been received since the last reading are discarded.
- Event reception buffer size > 1 : The client has chosen to keep an event history of a given size. When more events arrive since the last reading, older events will be discarded.
- Event reception buffer size = `ALL_EVENTS` : The client buffers all received events. The buffer size is unlimited and only restricted by the available memory for the client.

All other parameters are similar to the descriptions given in the other `subscribe_event()` version.

```

unsubscribe_event (*args, **kws)

```

**This method is a simple way to do:** `self.get_device_proxy().unsubscribe_event(...)`

For convenience, here is the documentation of `DeviceProxy.unsubscribe_event(...)`:

```

unsubscribe_event(self, event_id) -> None

```

Unsubscribes a client from receiving the event specified by `event_id`.

**Parameters**

**event\_id** (*int*) is the event identifier returned by the `DeviceProxy::subscribe_event()`. Unlike in TangoC++ we check that the `event_id` has been subscribed in this `DeviceProxy`.

**Return** `None`

**Throws** `EventSystemFailed`

**write** (*\*args, \*\*kwargs*)

**This method is a simple way to do:** `self.get_device_proxy().write_attribute(self.name(), ...)`

For convenience, here is the documentation of `DeviceProxy.write_attribute(...)`:

`write_attribute(self, attr_name, value, green_mode=None, wait=True, timeout=None) -> None`  
`write_attribute(self, attr_info, value, green_mode=None, wait=True, timeout=None) -> None`

Write a single attribute.

**Parameters**

**attr\_name** (*str*) The name of the attribute to write.

**attr\_info** (*AttributeInfo*)

**value** The value. For non SCALAR attributes it may be any sequence of sequences.

**green\_mode** (*GreenMode*) Defaults to the current `DeviceProxy GreenMode`. (see `get_green_mode()` and `set_green_mode()`).

**wait** (*bool*) whether or not to wait for result. If `green_mode` is *Synchronous*, this parameter is ignored as it always waits for the result. Ignored when `green_mode` is *Synchronous* (always waits).

**timeout** (*float*) The number of seconds to wait for the result. If `None`, then there is no limit on the wait time. Ignored when `green_mode` is *Synchronous* or `wait` is `False`.

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DeviceUnlocked`, `DevFailed` from device `TimeoutError` (`green_mode == Futures`) If the future didn't finish executing before the given timeout. `Timeout` (`green_mode == Gevent`) If the async result didn't finish executing before the given timeout.

New in version 8.1.0: `green_mode` parameter. `wait` parameter. `timeout` parameter.

**write\_async** (*\*args, \*\*kwargs*)

**This method is a simple way to do:** `self.get_device_proxy().write_attribute_async(...)`

For convenience, here is the documentation of `DeviceProxy.write_attribute_async(...)`:

`write_attributes_async(self, values) -> int`  
`write_attributes_async(self, values, callback) -> None`

Shortcut to `self.write_attributes_async([attr_name, value], cb)`

*New in PyTango 7.0.0*

**write\_read**(\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().write\_read\_attribute(self.name(), ...)

For convenience, here is the documentation of DeviceProxy.write\_read\_attribute(...):

write\_read\_attribute(self, attr\_name, value, extract\_as=ExtractAs.Numpy, green\_mode=None, wait=True, timeout=None) -> DeviceAttribute

Write then read a single attribute in a single network call. By default (serialisation by device), the execution of this call in the server can't be interrupted by other clients.

**Parameters** see write\_attribute(attr\_name, value)

**Return** A tango.DeviceAttribute object.

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DeviceUnlocked*, *DevFailed* from device, *WrongData* TimeoutError (green\_mode == Futures) If the future didn't finish executing before the given timeout. Timeout (green\_mode == Gevent) If the async result didn't finish executing before the given timeout.

*New in PyTango 7.0.0*

New in version 8.1.0: *green\_mode* parameter. *wait* parameter. *timeout* parameter.

**write\_reply**(\*args, \*\*kwargs)

**This method is a simple way to do:** self.get\_device\_proxy().write\_attribute\_reply(...)

For convenience, here is the documentation of DeviceProxy.write\_attribute\_reply(...):

write\_attribute\_reply(self, id) -> None

Check if the answer of an asynchronous write\_attribute is arrived (polling model). If the reply is arrived and if it is a valid reply, the call returned. If the reply is an exception, it is re-thrown by this call. An exception is also thrown in case of the reply is not yet arrived.

**Parameters**

**id** (int) the asynchronous call identifier.

**Return** None

**Throws** *AsyncCall*, *AsynReplyNotArrived*, *CommunicationFailed*, *DevFailed* from device.

*New in PyTango 7.0.0*

write\_attribute\_reply(self, id, timeout) -> None

Check if the answer of an asynchronous write\_attribute is arrived (polling model). id is the asynchronous call identifier. If the reply is arrived and if it is a valid reply, the call returned. If the reply is an exception, it is re-thrown by this call. If the reply is not yet arrived, the call will wait (blocking the process) for the time specified in timeout. If after timeout milliseconds, the reply is still not there, an exception is thrown. If timeout is set to 0, the call waits until the reply arrived.

**Parameters**

**id** (*int*) the asynchronous call identifier.

**timeout** (*int*) the timeout

**Return** None

**Throws** *AsyncCall*, *AsyncReplyNotArrived*, *CommunicationFailed*, *DevFailed* from device.

*New in PyTango 7.0.0*

## 5.2.3 Group

### Group class

**class** `tango.Group` (*name*)

Bases: `object`

A Tango Group represents a hierarchy of tango devices. The hierarchy may have more than one level. The main goal is to group devices with same attribute(s)/command(s) to be able to do parallel requests.

**add** (*self*, *subgroup*, *timeout\_ms=-1*) → None

Attaches a (sub)\_RealGroup.

To remove the subgroup use the `remove()` method.

**Parameters**

**subgroup** (*str*)

**timeout\_ms** (*int*) If `timeout_ms` parameter is different from `-1`, the client side timeout associated to each device composing the `_RealGroup` added is set to `timeout_ms` milliseconds. If `timeout_ms` is `-1`, timeouts are not changed.

**Return** None

**Throws** `TypeError`, `ArgumentError`

**command\_inout** (*self*, *cmd\_name*, *forward=True*) → `sequence<GroupCmdReply>`

**command\_inout** (*self*, *cmd\_name*, *param*, *forward=True*) → `sequence<GroupCmdReply>`

**command\_inout** (*self*, *cmd\_name*, *param\_list*, *forward=True*) → `sequence<GroupCmdReply>`

**Just a shortcut to do:** `self.command_inout_reply(self.command_inout_async(...))`

**Parameters**

**cmd\_name** (*str*) Command name

**param** (*any*) parameter value

**param\_list** (`tango.DeviceDataList`) sequence of parameters. When given, it's length must match the group size.

**forward** (*bool*) If it is set to `true` (the default) request is forwarded to subgroups. Otherwise, it is only applied to the local set of devices.

**Return** (`sequence<GroupCmdReply>`)

```
command_inout_async (self, cmd_name, forget=False, forward=True, reserved=-1) → int
command_inout_async (self, cmd_name, param, forget=False, forward=True, reserved=-1) → int
command_inout_async (self, cmd_name, param_list, forget=False, forward=True, reserved=-1) → int
```

Executes a Tango command on each device in the group asynchronously. The method sends the request to all devices and returns immediately. Pass the returned request id to `Group.command_inout_reply()` to obtain the results.

#### Parameters

**cmd\_name** (`str`) Command name

**param** (`any`) parameter value

**param\_list** (`tango.DeviceDataList`) sequence of parameters. When given, it's length must match the group size.

**forget** (`bool`) Fire and forget flag. If set to true, it means that no reply is expected (i.e. the caller does not care about it and will not even try to get it)

**forward** (`bool`) If it is set to true (the default) request is forwarded to subgroups. Otherwise, it is only applied to the local set of devices.

**reserved** (`int`) is reserved for internal purpose and should not be used. This parameter may disappear in a near future.

**Return** (`int`) request id. Pass the returned request id to `Group.command_inout_reply()` to obtain the results.

#### Throws

```
command_inout_reply (self, req_id, timeout_ms=0) → sequence<GroupCmdReply>
```

Returns the results of an asynchronous command.

#### Parameters

**req\_id** (`int`) Is a request identifier previously returned by one of the `command_inout_async` methods

**timeout\_ms** (`int`) For each device in the hierarchy, if the command result is not yet available, `command_inout_reply` wait `timeout_ms` milliseconds before throwing an exception. This exception will be part of the global reply. If `timeout_ms` is set to 0, `command_inout_reply` waits "indefinitely".

**Return** (sequence<`GroupCmdReply`>)

#### Throws

```
contains (self, pattern, forward=True) → bool
```

#### Parameters

**pattern** (`str`) The pattern can be a fully qualified or simple group name, a device name or a device name pattern.

**forward** (*bool*) If *fwd* is set to *true* (the default), the remove request is also forwarded to subgroups. Otherwise, it is only applied to the local set of elements.

**Return** (*bool*) Returns *true* if the hierarchy contains groups and/or devices which name matches the specified pattern. Returns *false* otherwise.

#### Throws

**disable** (*\*args, \*\*kwargs*)

Disables a group or a device element in a group.

**enable** (*\*args, \*\*kwargs*)

Enables a group or a device element in a group.

**get\_device\_list** (*self, forward=True*) → *sequence<str>*

Considering the following hierarchy:

```
g2.add("my/device/04")
g2.add("my/device/05")

g4.add("my/device/08")
g4.add("my/device/09")

g3.add("my/device/06")
g3.add(g4)
g3.add("my/device/07")

g1.add("my/device/01")
g1.add(g2)
g1.add("my/device/03")
g1.add(g3)
g1.add("my/device/02")
```

The returned vector content depends on the value of the *forward* option. If set to *true*, the results will be organized as follows:

```
dl = g1.get_device_list(True)

dl[0] contains "my/device/01" which belongs to g1
dl[1] contains "my/device/04" which belongs to g1.g2
dl[2] contains "my/device/05" which belongs to g1.g2
dl[3] contains "my/device/03" which belongs to g1
dl[4] contains "my/device/06" which belongs to g1.g3
dl[5] contains "my/device/08" which belongs to g1.g3.g4
dl[6] contains "my/device/09" which belongs to g1.g3.g4
dl[7] contains "my/device/07" which belongs to g1.g3
dl[8] contains "my/device/02" which belongs to g1
```

If the *forward* option is set to *false*, the results are:

```
dl = g1.get_device_list(False);

dl[0] contains "my/device/01" which belongs to g1
dl[1] contains "my/device/03" which belongs to g1
dl[2] contains "my/device/02" which belongs to g1
```

#### Parameters

**forward** (*bool*) If it is set to *true* (the default), the request is forwarded to sub-groups. Otherwise, it is only applied to the local set of devices.

**Return** (*sequence<str>*) The list of devices currently in the hierarchy.



**Throws****get\_fully\_qualified\_name** (\*args, \*\*kwargs)

Get the complete (dpt-separated) name of the group. This takes into consideration the name of the group and its parents.

**get\_name** (\*args, \*\*kwargs)

Get the name of the group. Eg: Group('name').get\_name() == 'name'

**get\_size** (self, forward=True) → int**Parameters****forward** (bool) If it is set to true (the default), the request is forwarded to sub-groups.**Return** (int) The number of the devices in the hierarchy**Throws****is\_enabled** (\*args, \*\*kwargs)Check if a group is enabled. *New in PyTango 7.0.0***name\_equals** (\*args, \*\*kwargs)*New in PyTango 7.0.0***name\_matches** (\*args, \*\*kwargs)*New in PyTango 7.0.0***ping** (self, forward=True) → bool

Ping all devices in a group.

**Parameters****forward** (bool) If fwd is set to true (the default), the request is also forwarded to subgroups. Otherwise, it is only applied to the local set of devices.**Return** (bool) This method returns true if all devices in the group are alive, false otherwise.**Throws****read\_attribute** (self, attr\_name, forward=True) → sequence<GroupAttrReply>**Just a shortcut to do:** self.read\_attribute\_reply(self.read\_attribute\_async(...))**read\_attribute\_async** (self, attr\_name, forward=True, reserved=-1) → int

Reads an attribute on each device in the group asynchronously. The method sends the request to all devices and returns immediately.

**Parameters****attr\_name** (str) Name of the attribute to read.**forward** (bool) If it is set to true (the default) request is forwarded to subgroups. Otherwise, it is only applied to the local set of devices.**reserved** (int) is reserved for internal purpose and should not be used. This parameter may disappear in a near future.**Return** (int) request id. Pass the returned request id to Group.read\_attribute\_reply() to obtain the results.**Throws**

**read\_attribute\_reply** (*self*, *req\_id*, *timeout\_ms=0*) → sequence<GroupAttrReply>

Returns the results of an asynchronous attribute reading.

**Parameters**

**req\_id** (*int*) a request identifier previously returned by `read_attribute_async`.

**timeout\_ms** (*int*) For each device in the hierarchy, if the attribute value is not yet available, `read_attribute_reply` wait `timeout_ms` milliseconds before throwing an exception. This exception will be part of the global reply. If `timeout_ms` is set to 0, `read_attribute_reply` waits “indefinitely”.

**Return** (sequence<GroupAttrReply>)

**Throws**

**read\_attributes** (*self*, *attr\_names*, *forward=True*) → sequence<GroupAttrReply>

**Just a shortcut to do:** `self.read_attributes_reply(self.read_attributes_async(...))`

**read\_attributes\_async** (*self*, *attr\_names*, *forward=True*, *reserved=-1*) → int

Reads the attributes on each device in the group asynchronously. The method sends the request to all devices and returns immediately.

**Parameters**

**attr\_names** (sequence<str>) Name of the attributes to read.

**forward** (*bool*) If it is set to true (the default) request is forwarded to subgroups. Otherwise, it is only applied to the local set of devices.

**reserved** (*int*) is reserved for internal purpose and should not be used. This parameter may disappear in a near future.

**Return** (*int*) request id. Pass the returned request id to `Group.read_attributes_reply()` to obtain the results.

**Throws**

**read\_attributes\_reply** (*self*, *req\_id*, *timeout\_ms=0*) → sequence<GroupAttrReply>

Returns the results of an asynchronous attribute reading.

**Parameters**

**req\_id** (*int*) a request identifier previously returned by `read_attribute_async`.

**timeout\_ms** (*int*) For each device in the hierarchy, if the attribute value is not yet available, `read_attribute_reply` wait `timeout_ms` milliseconds before throwing an exception. This exception will be part of the global reply. If `timeout_ms` is set to 0, `read_attributes_reply` waits “indefinitely”.

**Return** (sequence<GroupAttrReply>)

**Throws**

**remove\_all** (*self*) → None

Removes all elements in the `_RealGroup`. After such a call, the `_RealGroup` is empty.

**set\_timeout\_millis** (*self*, *timeout\_ms*) → bool

Set client side timeout for all devices composing the group in milliseconds. Any method which takes longer than this time to execute will throw an exception.

#### Parameters

**timeout\_ms** (*int*)

**Return** None

**Throws** (errors are ignored)

*New in PyTango 7.0.0*

**write\_attribute** (*self, attr\_name, value, forward=True, multi=False*) → *sequence<GroupReply>*

**Just a shortcut to do:** `self.write_attribute_reply(self.write_attribute_async(...))`

**write\_attribute\_async** (*self, attr\_name, value, forward=True, multi=False*) → *int*

Writes an attribute on each device in the group asynchronously. The method sends the request to all devices and returns immediately.

#### Parameters

**attr\_name** (*str*) Name of the attribute to write.

**value** (*any*) Value to write. See `DeviceProxy.write_attribute`

**forward** (*bool*) If it is set to true (the default) request is forwarded to subgroups. Otherwise, it is only applied to the local set of devices.

**multi** (*bool*) If it is set to false (the default), the same value is applied to all devices in the group. Otherwise the value is interpreted as a sequence of values, and each value is applied to the corresponding device in the group. In this case `len(value)` must be equal to `group.get_size()`!

**Return** (*int*) request id. Pass the returned request id to `Group.write_attribute_reply()` to obtain the acknowledgements.

**Throws**

**write\_attribute\_reply** (*self, req\_id, timeout\_ms=0*) → *sequence<GroupReply>*

Returns the acknowledgements of an asynchronous attribute writing.

#### Parameters

**req\_id** (*int*) a request identifier previously returned by `write_attribute_async`.

**timeout\_ms** (*int*) For each device in the hierarchy, if the acknowledgment is not yet available, `write_attribute_reply` wait `timeout_ms` milliseconds before throwing an exception. This exception will be part of the global reply. If `timeout_ms` is set to 0, `write_attribute_reply` waits "indefinitely".

**Return** (*sequence<GroupReply>*)

**Throws**

## GroupReply classes

Group member functions do not return the same as their DeviceProxy counterparts, but objects that contain them. This is:

- *write attribute* family returns `tango.GroupReplyList`
- *read attribute* family returns `tango.GroupAttrReplyList`
- *command inout* family returns `tango.GroupCmdReplyList`

The Group\*ReplyList objects are just list-like objects containing `GroupReply`, `GroupAttrReply` and `GroupCmdReply` elements that will be described now.

Note also that `GroupReply` is the base of `GroupCmdReply` and `GroupAttrReply`.

### **class** `tango.GroupReply`

This is the base class for the result of an operation on a `PyTangoGroup`, being it a write attribute, read attribute, or command inout operation.

It has some trivial common operations:

- `has_failed(self)` -> bool
- `group_element_enabled(self)` ->bool
- `dev_name(self)` -> str
- `obj_name(self)` -> str
- `get_err_stack(self)` -> `DevErrorList`

### **class** `tango.GroupAttrReply`

`get_data` (*self*, *extract\_as*=`ExtractAs.Numpy`) → `DeviceAttribute`

Get the `DeviceAttribute`.

#### **Parameters**

**extract\_as** (`ExtractAs`)

**Return** (`DeviceAttribute`) Whatever is stored there, or None.

### **class** `tango.GroupCmdReply`

`get_data` (*self*) → any

Get the actual value stored in the `GroupCmdRply`, the command output value. It's the same as `self.get_data_raw().extract()`

**Parameters** None

**Return** (any) Whatever is stored there, or None.

`get_data_raw` (*self*) → any

Get the `DeviceData` containing the output parameter of the command.

**Parameters** None

**Return** (`DeviceData`) Whatever is stored there, or None.

## 5.2.4 Green API

Summary:

- `tango.get_green_mode()`
- `tango.set_green_mode()`

- `tango.futures.DeviceProxy()`
- `tango.gevent.DeviceProxy()`

`tango.get_green_mode()`

Returns the current global default PyTango green mode.

**Returns** the current global default PyTango green mode

**Return type** `GreenMode`

`tango.set_green_mode(green_mode=None)`

Sets the global default PyTango green mode.

Advice: Use only in your final application. Don't use this in a python library in order not to interfere with the behavior of other libraries and/or application where your library is being.

**Parameters** `green_mode` (`GreenMode`) – the new global default PyTango green mode

`tango.futures.DeviceProxy(self, dev_name, wait=True, timeout=True) → DeviceProxy`

`DeviceProxy(self, dev_name, need_check_acc, wait=True, timeout=True) -> DeviceProxy`

Creates a *futures* enabled `DeviceProxy`.

The `DeviceProxy` constructor internally makes some network calls which makes it *slow*. By using the *futures green mode* you are allowing other python code to be executed in a cooperative way.

---

**Note:** The timeout parameter has no relation with the tango device client side timeout (gettable by `get_timeout_millis()` and settable through `set_timeout_millis()`)

---

#### Parameters

- **dev\_name** (`str`) – the device name or alias
- **need\_check\_acc** (`bool`) – in first version of the function it defaults to True. Determines if at creation time of `DeviceProxy` it should check for channel access (rarely used)
- **wait** (`bool`) – whether or not to wait for result of creating a `DeviceProxy`.
- **timeout** (`float`) – The number of seconds to wait for the result. If None, then there is no limit on the wait time. Ignored when wait is False.

#### Returns

**if wait is True:** `DeviceProxy`

**else:** `concurrent.futures.Future`

#### Throws

- a `DevFailed` if wait is True and there is an error creating the device.
- a `concurrent.futures.TimeoutError` if wait is False, timeout is not None and the time to create the device has expired.

New in PyTango 8.1.0

`tango.gevent.DeviceProxy(self, dev_name, wait=True, timeout=True) → DeviceProxy`

`DeviceProxy(self, dev_name, need_check_acc, wait=True, timeout=True) -> DeviceProxy`

Creates a *gevent* enabled `DeviceProxy`.

The `DeviceProxy` constructor internally makes some network calls which makes it *slow*. By using the *gevent green mode* you are allowing other python code to be executed in a cooperative way.

---

**Note:** The timeout parameter has no relation with the tango device client side timeout (gettable by `get_timeout_millis()` and settable through `set_timeout_millis()`)

---

**Parameters**

- **dev\_name** (*str*) – the device name or alias
- **need\_check\_acc** (*bool*) – in first version of the function it defaults to True. Determines if at creation time of DeviceProxy it should check for channel access (rarely used)
- **wait** (*bool*) – whether or not to wait for result of creating a DeviceProxy.
- **timeout** (*float*) – The number of seconds to wait for the result. If None, then there is no limit on the wait time. Ignored when wait is False.

**Returns**

**if wait is True:** *DeviceProxy*  
**else:** `gevent.event.AsyncResult`

**Throws**

- a *DevFailed* if wait is True and there is an error creating the device.
- a *gevent.timeout.Timeout* if wait is False, timeout is not None and the time to create the device has expired.

New in PyTango 8.1.0

## 5.2.5 API util

**class** `tango.ApiUtil`

This class allows you to access the tango synchronization model API. It is designed as a singleton. To get a reference to the singleton object you must do:

```
import tango
apiutil = tango.ApiUtil.instance()
```

New in PyTango 7.1.3

**get\_async\_cb\_sub\_model** (*self*) → *cb\_sub\_model*

Get the asynchronous callback sub-model.

**Parameters** None

**Return** (*cb\_sub\_model*) the active asynchronous callback sub-model.

*New in PyTango 7.1.3*

**get\_async\_replies** (*self*) → None

Fire callback methods for all (any device) asynchronous requests (command and attribute) with already arrived replied. Returns immediately if there is no replies already arrived or if there is no asynchronous requests.

**Parameters** None

**Return** None

**Throws** None, all errors are reported using the `err` and `errors` fields of the parameter passed to the `callback` method.

*New in PyTango 7.1.3*

**get\_async\_replies** (*self*) → None

Fire callback methods for all (any device) asynchronous requests (command and attributes) with already arrived replied. Wait and block the caller for timeout milliseconds if they are some device asynchronous requests which are not yet arrived. Returns immediately if there is no asynchronous request. If timeout is set to 0, the call waits until all the asynchronous requests sent has received a reply.

#### Parameters

**timeout** (*int*) timeout (milliseconds)

**Return** None

**Throws** *AsynReplyNotArrived*. All other errors are reported using the *err* and *errors* fields of the object passed to the *callback* methods.

*New in PyTango 7.1.3*

**pending\_asynch\_call** (*self, req*) → *int*

Return number of asynchronous pending requests (any device). The input parameter is an enumeration with three values which are:

- POLLING: Return only polling model asynchronous request number
- CALL\_BACK: Return only callback model asynchronous request number
- ALL\_ASYNC: Return all asynchronous request number

#### Parameters

**req** (*asyn\_req\_type*) asynchronous request type

**Return** (*int*) the number of pending requests for the given type

*New in PyTango 7.1.3*

**set\_asynch\_cb\_sub\_model** (*self, model*) → None

Set the asynchronous callback sub-model between the pull and push sub-model. The *cb\_sub\_model* data type is an enumeration with two values which are:

- PUSH\_CALLBACK: The push sub-model
- PULL\_CALLBACK: The pull sub-model

#### Parameters

**model** (*cb\_sub\_model*) the callback sub-model

**Return** None

*New in PyTango 7.1.3*

## 5.2.6 Information classes

See also *Event configuration information*

### Attribute

**class** `tango.AttributeAlarmInfo`

A structure containing available alarm information for an attribute with the following members:

- *min\_alarm* : (*str*) low alarm level

- `max_alarm` : (`str`) high alarm level
- `min_warning` : (`str`) low warning level
- `max_warning` : (`str`) high warning level
- `delta_t` : (`str`) time delta
- `delta_val` : (`str`) value delta
- `extensions` : (`StdStringVector`) extensions (currently not used)

**class** `tango.AttributeDimension`

A structure containing x and y attribute data dimensions with the following members:

- `dim_x` : (`int`) x dimension
- `dim_y` : (`int`) y dimension

**class** `tango.AttributeInfo`

A structure (inheriting from `DeviceAttributeConfig`) containing available information for an attribute with the following members:

- `disp_level` : (`DispLevel`) display level (OPERATOR, EXPERT)

Inherited members are:

- `name` : (`str`) attribute name
- `writable` : (`AttrWriteType`) write type (R, W, RW, R with W)
- `data_format` : (`AttrDataFormat`) data format (SCALAR, SPECTRUM, IMAGE)
- `data_type` : (`int`) attribute type (float, string,...)
- `max_dim_x` : (`int`) first dimension of attribute (spectrum or image attributes)
- `max_dim_y` : (`int`) second dimension of attribute(image attribute)
- `description` : (`int`) attribute description
- `label` : (`str`) attribute label (Voltage, time, ...)
- `unit` : (`str`) attribute unit (V, ms, ...)
- `standard_unit` : (`str`) standard unit
- `display_unit` : (`str`) display unit
- `format` : (`str`) how to display the attribute value (ex: for floats could be `“%6.2f”`)
- `min_value` : (`str`) minimum allowed value
- `max_value` : (`str`) maximum allowed value
- `min_alarm` : (`str`) low alarm level
- `max_alarm` : (`str`) high alarm level
- `writable_attr_name` : (`str`) name of the writable attribute
- `extensions` : (`StdStringVector`) extensions (currently not used)

**class** `tango.AttributeInfoEx`

A structure (inheriting from `AttributeInfo`) containing available information for an attribute with the following members:

- `alarms` : object containing alarm information (see `AttributeAlarmInfo`).
- `events` : object containing event information (see `AttributeEventInfo`).
- `sys_extensions` : `StdStringVector`

Inherited members are:

- `name` : (`str`) attribute name
- `writable` : (`AttrWriteType`) write type (R, W, RW, R with W)
- `data_format` : (`AttrDataFormat`) data format (SCALAR, SPECTRUM, IMAGE)
- `data_type` : (`int`) attribute type (float, string,...)



- `max_dim_x` : (`int`) first dimension of attribute (spectrum or image attributes)
- `max_dim_y` : (`int`) second dimension of attribute(image attribute)
- `description` : (`int`) attribute description
- `label` : (`str`) attribute label (Voltage, time, ...)
- `unit` : (`str`) attribute unit (V, ms, ...)
- `standard_unit` : (`str`) standard unit
- `display_unit` : (`str`) display unit
- `format` : (`str`) how to display the attribute value (ex: for floats could be `'%6.2f'`)
- `min_value` : (`str`) minimum allowed value
- `max_value` : (`str`) maximum allowed value
- `min_alarm` : (`str`) low alarm level
- `max_alarm` : (`str`) high alarm level
- `writable_attr_name` : (`str`) name of the writable attribute
- `extensions` : (`StdStringVector`) extensions (currently not used)
- `disp_level` : (`DispLevel`) display level (OPERATOR, EXPERT)

see also [AttributeInfo](#)

#### **class** `tango.DeviceAttributeConfig`

A base structure containing available information for an attribute with the following members:

- `name` : (`str`) attribute name
- `writable` : (`AttrWriteType`) write type (R, W, RW, R with W)
- `data_format` : (`AttrDataFormat`) data format (SCALAR, SPECTRUM, IMAGE)
- `data_type` : (`int`) attribute type (float, string,...)
- `max_dim_x` : (`int`) first dimension of attribute (spectrum or image attributes)
- `max_dim_y` : (`int`) second dimension of attribute(image attribute)
- `description` : (`int`) attribute description
- `label` : (`str`) attribute label (Voltage, time, ...)
- `unit` : (`str`) attribute unit (V, ms, ...)
- `standard_unit` : (`str`) standard unit
- `display_unit` : (`str`) display unit
- `format` : (`str`) how to display the attribute value (ex: for floats could be `'%6.2f'`)
- `min_value` : (`str`) minimum allowed value
- `max_value` : (`str`) maximum allowed value
- `min_alarm` : (`str`) low alarm level
- `max_alarm` : (`str`) high alarm level
- `writable_attr_name` : (`str`) name of the writable attribute
- `extensions` : (`StdStringVector`) extensions (currently not used)

## Command

#### **class** `tango.DevCommandInfo`

A device command info with the following members:

- `cmd_name` : (`str`) command name
- `cmd_tag` : command as binary value (for TACO)
- `in_type` : (`CmdArgType`) input type
- `out_type` : (`CmdArgType`) output type
- `in_type_desc` : (`str`) description of input type
- `out_type_desc` : (`str`) description of output type

New in PyTango 7.0.0

**class** tango.CommandInfo

A device command info (inheriting from *DevCommandInfo*) with the following members:

- `disp_level` : (*DispLevel*) command display level

Inherited members are (from *DevCommandInfo*):

- `cmd_name` : (*str*) command name
- `cmd_tag` : (*str*) command as binary value (for TACO)
- `in_type` : (*CmdArgType*) input type
- `out_type` : (*CmdArgType*) output type
- `in_type_desc` : (*str*) description of input type
- `out_type_desc` : (*str*) description of output type

## Other

**class** tango.DeviceInfo

A structure containing available information for a device with the following members:

- `dev_class` : (*str*) device class
- `server_id` : (*str*) server ID
- `server_host` : (*str*) host name
- `server_version` : (*str*) server version
- `doc_url` : (*str*) document url

**class** tango.LockerInfo

A structure with information about the locker with the following members:

- `ll` : (*tango.LockerLanguage*) the locker language
- `li` : (*pid\_t* / *UUID*) the locker id
- `locker_host` : (*str*) the host
- `locker_class` : (*str*) the class

`pid_t` should be an int, `UUID` should be a tuple of four numbers.

New in PyTango 7.0.0

**class** tango.PollDevice

A structure containing PollDevice information with the following members:

- `dev_name` : (*str*) device name
- `ind_list` : (*sequence<int>*) index list

New in PyTango 7.0.0

## 5.2.7 Storage classes

### Attribute: DeviceAttribute

**class** tango.DeviceAttribute

This is the fundamental type for RECEIVING data from device attributes.

It contains several fields. The most important ones depend on the ExtractAs method used to get the value. Normally they are:

- `value` : Normal scalar value or numpy array of values.
- `w_value` : The write part of the attribute.

See other ExtractAs for different possibilities. There are some more fields, these really fixed:

- `name` : (*str*)
- `data_format` : (*AttrDataFormat*) Attribute format
- `quality` : (*AttrQuality*)

- `time` : (*TimeVal*)
- `dim_x` : (*int*) attribute dimension x
- `dim_y` : (*int*) attribute dimension y
- `w_dim_x` : (*int*) attribute written dimension x
- `w_dim_y` : (*int*) attribute written dimension y
- `r_dimension` : (*tuple*) Attribute read dimensions.
- `w_dimension` : (*tuple*) Attribute written dimensions.
- `nb_read` : (*int*) attribute read total length
- `nb_written` : (*int*) attribute written total length

And two methods:

- `get_date`
- `get_err_stack`

```
ExtractAs = <ExtensionMock name='_tango.ExtractAs' id='140508296381608'>
```

`get_date` (*self*) → *TimeVal*

Get the time at which the attribute was read by the server.

Note: It's the same as reading the "time" attribute.

**Parameters** None

**Return** (*TimeVal*) The attribute read timestamp.

`get_err_stack` (*self*) → *sequence*<*DevError*>

Returns the error stack reported by the server when the attribute was read.

**Parameters** None

**Return** (*sequence*<*DevError*>)

`set_w_dim_x` (*self*, *val*) → None

Sets the write value dim x.

**Parameters**

**val** (*int*) new write dim x

**Return** None

*New in PyTango 8.0.0*

`set_w_dim_y` (*self*, *val*) → None

Sets the write value dim y.

**Parameters**

**val** (*int*) new write dim y

**Return** None

*New in PyTango 8.0.0*

## Command: DeviceData

Device data is the type used internally by Tango to deal with command parameters and return values. You don't usually need to deal with it, as `command_inout` will automatically convert the parameters from any other type and the result value to another type.

You can still use them, using `command_inout_raw` to get the result in a `DeviceData`.

You also may deal with it when reading command history.

### `class` `tango.DeviceData`

This is the fundamental type for sending and receiving data from device commands. The values can be inserted and extracted using the `insert()` and `extract()` methods.

**extract** (*self*) → any

Get the actual value stored in the `DeviceData`.

**Parameters** None

**Return** Whatever is stored there, or `None`.

**get\_type** (*self*) → `CmdArgType`

This method returns the Tango data type of the data inside the `DeviceData` object.

**Parameters** None

**Return** The content arg type.

**insert** (*self*, *data\_type*, *value*) → `None`

Inserts a value in the `DeviceData`.

**Parameters**

**data\_type**

**value** (any) The value to insert

**Return** Whatever is stored there, or `None`.

**is\_empty** (*self*) → `bool`

It can be used to test whether the `DeviceData` object has been initialized or not.

**Parameters** None

**Return** `True` or `False` depending on whether the `DeviceData` object contains data or not.

## 5.2.8 Callback related classes

If you subscribe a callback in a `DeviceProxy`, it will be run with a parameter. This parameter depends will be of one of the following classes depending on the callback type.

### `class` `tango.AttrReadEvent`

This class is used to pass data to the callback method in asynchronous callback model for `read_attribute(s)` execution.

It has the following members:

- `device` : (`DeviceProxy`) The `DeviceProxy` object on which the call was executed
- `attr_names` : (sequence<`str`>) The attribute name list
- `argout` : (`DeviceAttribute`) The attribute value

- `err` : (`bool`) A boolean flag set to true if the command failed. False otherwise
- `errors` : (sequence<`DevError`>) The error stack
- `ext` :

**class** `tango.AttrWrittenEvent`

This class is used to pass data to the callback method in asynchronous callback model for `write_attribute(s)` execution

It has the following members:

- `device` : (`DeviceProxy`) The DeviceProxy object on which the call was executed
- `attr_names` : (sequence<`str`>) The attribute name list
- `err` : (`bool`) A boolean flag set to true if the command failed. False otherwise
- `errors` : (`NamedDevFailedList`) The error stack
- `ext` :

**class** `tango.CmdDoneEvent`

This class is used to pass data to the callback method in asynchronous callback model for command execution.

It has the following members:

- `device` : (`DeviceProxy`) The DeviceProxy object on which the call was executed.
- `cmd_name` : (`str`) The command name
- `argout_raw` : (`DeviceData`) The command argout
- `argout` : The command argout
- `err` : (`bool`) A boolean flag set to true if the command failed. False otherwise
- `errors` : (sequence<`DevError`>) The error stack
- `ext` :

## 5.2.9 Event related classes

### Event configuration information

**class** `tango.AttributeEventInfo`

A structure containing available event information for an attribute with the following members:

- `ch_event` : (`ChangeEventInfo`) change event information
- `per_event` : (`PeriodicEventInfo`) periodic event information
- `arch_event` : (`ArchiveEventInfo`) archiving event information

**class** `tango.ArchiveEventInfo`

A structure containing available archiving event information for an attribute with the following members:

- `archive_rel_change` : (`str`) relative change that will generate an event
- `archive_abs_change` : (`str`) absolute change that will generate an event
- `archive_period` : (`str`) archive period
- `extensions` : (sequence<`str`>) extensions (currently not used)

**class** `tango.ChangeEventInfo`

A structure containing available change event information for an attribute with the following members:

- `rel_change` : (`str`) relative change that will generate an event
- `abs_change` : (`str`) absolute change that will generate an event
- `extensions` : (`StdStringVector`) extensions (currently not used)

**class** tango.PeriodicEventInfo

A structure containing available periodic event information for an attribute with the following members:

- period : (*str*) event period
- extensions : (*StdStringVector*) extensions (currently not used)

**Event arrived structures****class** tango.EventData

This class is used to pass data to the callback method when an event is sent to the client. It contains the following public fields:

- device : (*DeviceProxy*) The DeviceProxy object on which the call was executed.
- attr\_name : (*str*) The attribute name
- event : (*str*) The event name
- attr\_value : (*DeviceAttribute*) The attribute data (DeviceAttribute)
- err : (*bool*) A boolean flag set to true if the request failed. False otherwise
- errors : (*sequence<DevError>*) The error stack
- reception\_date: (*TimeVal*)

**class** tango.AttrConfEventData

This class is used to pass data to the callback method when a configuration event is sent to the client. It contains the following public fields:

- device : (*DeviceProxy*) The DeviceProxy object on which the call was executed
- attr\_name : (*str*) The attribute name
- event : (*str*) The event name
- attr\_conf : (*AttributeInfoEx*) The attribute data
- err : (*bool*) A boolean flag set to true if the request failed. False otherwise
- errors : (*sequence<DevError>*) The error stack
- reception\_date: (*TimeVal*)

**class** tango.DataReadyEventData

This class is used to pass data to the callback method when an attribute data ready event is sent to the client. It contains the following public fields:

- device : (*DeviceProxy*) The DeviceProxy object on which the call was executed
- attr\_name : (*str*) The attribute name
- event : (*str*) The event name
- attr\_data\_type : (*int*) The attribute data type
- ctr : (*int*) The user counter. Set to 0 if not defined when sent by the server
- err : (*bool*) A boolean flag set to true if the request failed. False otherwise
- errors : (*sequence<DevError>*) The error stack
- reception\_date: (*TimeVal*)

New in PyTango 7.0.0

**5.2.10 History classes****class** tango.DeviceAttributeHistory

See *DeviceAttribute*.

**class** tango.DeviceDataHistory

See *DeviceData*.

## 5.2.11 Enumerations & other classes

### Enumerations

#### **class** tango.**LockerLanguage**

An enumeration representing the programming language in which the client application who locked is written.

- CPP : C++/Python language
- JAVA : Java language

New in PyTango 7.0.0

#### **class** tango.**CmdArgType**

An enumeration representing the command argument type.

- DevVoid
- DevBoolean
- DevShort
- DevLong
- DevFloat
- DevDouble
- DevUShort
- DevULong
- DevString
- DevVarCharArray
- DevVarShortArray
- DevVarLongArray
- DevVarFloatArray
- DevVarDoubleArray
- DevVarUShortArray
- DevVarULongArray
- DevVarStringArray
- DevVarLongStringArray
- DevVarDoubleStringArray
- DevState
- ConstDevString
- DevVarBooleanArray
- DevUChar
- DevLong64
- DevULong64
- DevVarLong64Array
- DevVarULong64Array
- DevInt
- DevEncoded
- DevEnum
- DevPipeBlob

#### **class** tango.**MessBoxType**

An enumeration representing the MessBoxType

- STOP
- INFO

New in PyTango 7.0.0

#### **class** tango.**PollObjType**

An enumeration representing the PollObjType

- POLL\_CMD
- POLL\_ATTR
- EVENT\_HEARTBEAT
- STORE\_SUBDEV

New in PyTango 7.0.0

#### **class** tango.**PollCmdCode**

An enumeration representing the PollCmdCode

- POLL\_ADD\_OBJ
- POLL\_REM\_OBJ
- POLL\_START
- POLL\_STOP
- POLL\_UPD\_PERIOD
- POLL\_REM\_DEV
- POLL\_EXIT
- POLL\_REM\_EXT\_TRIG\_OBJ
- POLL\_ADD\_HEARTBEAT
- POLL\_REM\_HEARTBEAT

New in PyTango 7.0.0

**class** tango.**SerialModel**

An enumeration representing the type of serialization performed by the device server

- BY\_DEVICE
- BY\_CLASS
- BY\_PROCESS
- NO\_SYNC

**class** tango.**AttReqType**

An enumeration representing the type of attribute request

- READ\_REQ
- WRITE\_REQ

**class** tango.**LockCmdCode**

An enumeration representing the LockCmdCode

- LOCK\_ADD\_DEV
- LOCK\_REM\_DEV
- LOCK\_UNLOCK\_ALL\_EXIT
- LOCK\_EXIT

New in PyTango 7.0.0

**class** tango.**LogLevel**

An enumeration representing the LogLevel

- LOG\_OFF
- LOG\_FATAL
- LOG\_ERROR
- LOG\_WARN
- LOG\_INFO
- LOG\_DEBUG

New in PyTango 7.0.0

**class** tango.**LogTarget**

An enumeration representing the LogTarget

- LOG\_CONSOLE
- LOG\_FILE
- LOG\_DEVICE

New in PyTango 7.0.0

**class** tango.**EventType**

An enumeration representing event type

- CHANGE\_EVENT
- QUALITY\_EVENT
- PERIODIC\_EVENT
- ARCHIVE\_EVENT
- USER\_EVENT
- ATTR\_CONF\_EVENT



- DATA\_READY\_EVENT
- INTERFACE\_CHANGE\_EVENT
- PIPE\_EVENT

*DATA\_READY\_EVENT - New in PyTango 7.0.0* *INTERFACE\_CHANGE\_EVENT - New in PyTango 9.2.2* *PIPE\_EVENT - New in PyTango 9.2.2*

**class** tango.**KeepAliveCmdCode**

An enumeration representing the KeepAliveCmdCode

- EXIT\_TH

New in PyTango 7.0.0

**class** tango.**AccessControlType**

An enumeration representing the AccessControlType

- ACCESS\_READ
- ACCESS\_WRITE

New in PyTango 7.0.0

**class** tango.**asyn\_req\_type**

An enumeration representing the asynchronous request type

- POLLING
- CALLBACK
- ALL\_ASYNC

**class** tango.**cb\_sub\_model**

An enumeration representing callback sub model

- PUSH\_CALLBACK
- PULL\_CALLBACK

**class** tango.**AttrQuality**

An enumeration representing the attribute quality

- ATTR\_VALID
- ATTR\_INVALID
- ATTR\_ALARM
- ATTR\_CHANGING
- ATTR\_WARNING

**class** tango.**AttrWriteType**

An enumeration representing the attribute type

- READ
- READ\_WITH\_WRITE
- WRITE
- READ\_WRITE

**class** tango.**AttrDataFormat**

An enumeration representing the attribute format

- SCALAR
- SPECTRUM
- IMAGE
- FMT\_UNKNOWN

**class** tango.**PipeWriteType**

An enumeration representing the pipe type

- PIPE\_READ
- PIPE\_READ\_WRITE

**class** tango.**DevSource**

An enumeration representing the device source for data

- DEV
- CACHE
- CACHE\_DEV

**class** tango.**ErrSeverity**

An enumeration representing the error severity

- WARN
- ERR
- PANIC

**class** tango.**DevState**

An enumeration representing the device state

- ON
- OFF
- CLOSE
- OPEN
- INSERT
- EXTRACT
- MOVING
- STANDBY
- FAULT
- INIT
- RUNNING
- ALARM
- DISABLE
- UNKNOWN

**class** tango.**DispLevel**

An enumeration representing the display level

- OPERATOR
- EXPERT

**class** tango.**GreenMode**

An enumeration representing the GreenMode

- Synchronous
- Futures
- Gevent

New in PyTango 8.1.0

## Other classes

**class** tango.**Release**

Summarize release information as class attributes.

**Release information:**

- name: (*str*) package name
- version\_info: (*tuple*) The five components of the version number: major, minor, micro, releaselevel, and serial.
- version: (*str*) package version in format <major>.<minor>.<micro>
- release: (*str*) pre-release, post-release or development release; it is empty for final releases.
- version\_long: (*str*) package version in format <major>.<minor>.<micro><releaselevel><serial>
- version\_description: (*str*) short description for the current version
- version\_number: (*int*) <major>\*100 + <minor>\*10 + <micro>
- description : (*str*) package description
- long\_description: (*str*) longer package description
- authors: (*dict*<*str*(last name), *tuple*<*str*(full name),*str*(email)>>) package authors

- `url`: (`str`) package url
- `download_url`: (`str`) package download url
- `platform`: (`seq`) list of available platforms
- `keywords`: (`seq`) list of keywords
- `license`: (`str`) the license

**class** `tango.TimeVal`

Time value structure with the following members:

- `tv_sec`: seconds
- `tv_usec`: microseconds
- `tv_nsec`: nanoseconds

**isoformat** (`self, sep='T'`) → `str`

Returns a string in ISO 8601 format, YYYY-MM-DDTHH:MM:SS[.mmmmmm][+HH:MM]

**Parameters** `sep`: (`str`) `sep` is used to separate the year from the time, and defaults to 'T'

**Return** (`str`) a string representing the time according to a format specification.

New in version 7.1.0.

New in version 7.1.2: Documented

Changed in version 7.1.2: The `sep` parameter is not mandatory anymore and defaults to 'T' (same as `datetime.datetime.isoformat()`)

**strftime** (`self, format`) → `str`

Convert a time value to a string according to a format specification.

**Parameters** `format`: (`str`) See the python library reference manual for formatting codes

**Return** (`str`) a string representing the time according to a format specification.

New in version 7.1.0.

New in version 7.1.2: Documented

**totdatetime** (`self`) → `datetime.datetime`

Returns a `datetime.datetime` object representing the same time value

**Parameters** None

**Return** (`datetime.datetime`) the time value in datetime format

New in version 7.1.0.

**totime** (`self`) → `float`

Returns a float representing this time value

**Parameters** None

**Return** a float representing the time value

New in version 7.1.0.

## 5.3 Server API

### 5.3.1 High level server API

Server helper classes for writing Tango device servers.

- `Device`
- `attribute`
- `command`
- `pipe`
- `device_property`
- `class_property`
- `run()`
- `server_run()`

This module provides a high level device server API. It implements *TEPI*. It exposes an easier API for developing a Tango device server.

Here is a simple example on how to write a *Clock* device server using the high level API:

```
import time
from tango.server import run
from tango.server import Device
from tango.server import attribute, command

class Clock(Device):

    time = attribute()

    def read_time(self):
        return time.time()

    @command(din_type=str, dout_type=str)
    def strftime(self, format):
        return time.strftime(format)

if __name__ == "__main__":
    run((Clock,))
```

Here is a more complete example on how to write a *PowerSupply* device server using the high level API. The example contains:

1. a read-only double scalar attribute called *voltage*
2. a read/write double scalar expert attribute *current*
3. a read-only double image attribute called *noise*
4. a *ramp* command
5. a *host* device property
6. a *port* class property

```
1 from time import time
2 from numpy.random import random_sample
3
4 from tango import AttrQuality, AttrWriteType, DispLevel
5 from tango.server import Device, attribute, command
6 from tango.server import class_property, device_property
7
```

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```

8 class PowerSupply(Device):
9
10     voltage = attribute()
11
12     current = attribute(label="Current", dtype=float,
13                        display_level=DispLevel.EXPERT,
14                        access=AttrWriteType.READ_WRITE,
15                        unit="A", format="8.4f",
16                        min_value=0.0, max_value=8.5,
17                        min_alarm=0.1, max_alarm=8.4,
18                        min_warning=0.5, max_warning=8.0,
19                        fget="get_current", fset="set_current",
20                        doc="the power supply current")
21
22     noise = attribute(label="Noise", dtype=((float,)),
23                      max_dim_x=1024, max_dim_y=1024,
24                      fget="get_noise")
25
26     host = device_property(dtype=str)
27     port = class_property(dtype=int, default_value=9788)
28
29     def read_voltage(self):
30         self.info_stream("get voltage(%s, %d)" % (self.host, self.port))
31         return 10.0
32
33     def get_current(self):
34         return 2.3456, time(), AttrQuality.ATTR_WARNING
35
36     def set_current(self, current):
37         print("Current set to %f" % current)
38
39     def get_noise(self):
40         return random_sample((1024, 1024))
41
42     @command(dtype_in=float)
43     def ramp(self, value):
44         print("Ramping up...")
45
46 if __name__ == "__main__":
47     PowerSupply.run_server()

```

*Pretty cool, uh?*

## Data types

When declaring attributes, properties or commands, one of the most important information is the data type. It is given by the keyword argument *dtype*. In order to provide a more *pythonic* interface, this argument is not restricted to the *CmdArgType* options.

For example, to define a SCALAR DevLong attribute you have several possibilities:

1. `int`
2. `'int'`
3. `'int32'`
4. `'integer'`
5. `tango.CmdArgType.DevLong`
6. `'DevLong'`

7. `numpy.int32`

To define a *SPECTRUM* attribute simply wrap the scalar data type in any python sequence:

- using a *tuple*: `(:obj:`int`,)` or
- using a *list*: `[:obj:`int`]` or
- any other sequence type

To define an *IMAGE* attribute simply wrap the scalar data type in any python sequence of sequences:

- using a *tuple*: `((:obj:`int`,),)` or
- using a *list*: `[[:obj:`int`]]` or
- any other sequence type

Below is the complete table of equivalences.

dtype argument	converts to tango type
None	DevVoid
'None'	DevVoid
DevVoid	DevVoid
'DevVoid'	DevVoid
DevState	DevState
'DevState'	DevState
<code>bool</code>	DevBoolean
'bool'	DevBoolean
'boolean'	DevBoolean
DevBoolean	DevBoolean
'DevBoolean'	DevBoolean
<code>numpy.bool_</code>	DevBoolean
'char'	DevUChar
'chr'	DevUChar
'byte'	DevUChar
<code>chr</code>	DevUChar
DevUChar	DevUChar
'DevUChar'	DevUChar
<code>numpy.uint8</code>	DevUChar
'int16'	DevShort
DevShort	DevShort
'DevShort'	DevShort
<code>numpy.int16</code>	DevShort
'uint16'	DevUShort
DevUShort	DevUShort
'DevUShort'	DevUShort
<code>numpy.uint16</code>	DevUShort
<code>int</code>	DevLong
'int'	DevLong
'int32'	DevLong
DevLong	DevLong
'DevLong'	DevLong
<code>numpy.int32</code>	DevLong
'uint'	DevULong
'uint32'	DevULong
DevULong	DevULong
'DevULong'	DevULong
<code>numpy.uint32</code>	DevULong
'int64'	DevLong64

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Table 2 – continued from previous page

dtype argument	converts to tango type
DevLong64	DevLong64
'DevLong64'	DevLong64
numpy.int64	DevLong64
'uint64'	DevULong64
DevULong64	DevULong64
'DevULong64'	DevULong64
numpy.uint64	DevULong64
DevInt	DevInt
'DevInt'	DevInt
'float32'	DevFloat
DevFloat	DevFloat
'DevFloat'	DevFloat
numpy.float32	DevFloat
float	DevDouble
'double'	DevDouble
'float'	DevDouble
'float64'	DevDouble
DevDouble	DevDouble
'DevDouble'	DevDouble
numpy.float64	DevDouble
str	DevString
'str'	DevString
'string'	DevString
'text'	DevString
DevString	DevString
'DevString'	DevString
bytearray	DevEncoded
'bytearray'	DevEncoded
'bytes'	DevEncoded
DevEncoded	DevEncoded
'DevEncoded'	DevEncoded
DevVarBooleanArray	DevVarBooleanArray
'DevVarBooleanArray'	DevVarBooleanArray
DevVarCharArray	DevVarCharArray
'DevVarCharArray'	DevVarCharArray
DevVarShortArray	DevVarShortArray
'DevVarShortArray'	DevVarShortArray
DevVarLongArray	DevVarLongArray
'DevVarLongArray'	DevVarLongArray
DevVarLong64Array	DevVarLong64Array
'DevVarLong64Array'	DevVarLong64Array
DevVarULong64Array	DevVarULong64Array
'DevVarULong64Array'	DevVarULong64Array
DevVarFloatArray	DevVarFloatArray
'DevVarFloatArray'	DevVarFloatArray
DevVarDoubleArray	DevVarDoubleArray
'DevVarDoubleArray'	DevVarDoubleArray
DevVarUShortArray	DevVarUShortArray
'DevVarUShortArray'	DevVarUShortArray
DevVarULongArray	DevVarULongArray
'DevVarULongArray'	DevVarULongArray
DevVarStringArray	DevVarStringArray
'DevVarStringArray'	DevVarStringArray

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Table 2 – continued from previous page

dtype argument	converts to tango type
DevVarLongStringArray	DevVarLongStringArray
'DevVarLongStringArray'	DevVarLongStringArray
DevVarDoubleStringArray	DevVarDoubleStringArray
'DevVarDoubleStringArray'	DevVarDoubleStringArray
DevPipeBlob	DevPipeBlob
'DevPipeBlob'	DevPipeBlob

**class** `tango.server.Device` (*cl, name*)

Bases: `tango.server.BaseDevice`

Device class for the high-level API.

All device specific classes should inherit from this class.

**add\_attribute** (*self, attr, r\_meth=None, w\_meth=None, is\_allo\_meth=None*) → `Attr`

Add a new attribute to the device attribute list. Please, note that if you add an attribute to a device at device creation time, this attribute will be added to the device class attribute list. Therefore, all devices belonging to the same class created after this attribute addition will also have this attribute.

#### Parameters

**attr** (`Attr` or `AttrData`) the new attribute to be added to the list.

**r\_meth** (`callable`) the read method to be called on a read request

**w\_meth** (`callable`) the write method to be called on a write request (if `attr` is writable)

**is\_allo\_meth** (`callable`) the method that is called to check if it is possible to access the attribute or not

**Return** (`Attr`) the newly created attribute.

**Throws** `DevFailed`

**add\_command** (*self, cmd, level=TANGO::OPERATOR*) → `cmd`

Add a new command to the device command list.

#### Parameters

**cmd** the new command to be added to the list

**device\_level** Set this flag to true if the command must be added for only this device

**Return** `Command`

**Throws** `DevFailed`

**always\_executed\_hook** ()

Tango `always_executed_hook`. Default implementation does nothing

**append\_status** (*self, status, new\_line=False*) → `None`

Appends a string to the device status.

**Parameters** `status` : (`str`) the string to be appened to the device status  
`new_line` : (`bool`) If true, appends a new line character before the string. Default is `False`

**Return** `None`

**check\_command\_exists** (*self*) → `None`



This method check that a command is supported by the device and does not need input value. The method throws an exception if the command is not defined or needs an input value

**Parameters**

**cmd\_name** (`str`) the command name

**Return** None

**Throws** `DevFailed` `API_IncompatibleCmdArgumentType`,  
`API_CommandNotFound`

*New in PyTango 7.1.2*

**debug\_stream** (`self, msg, *args`) → None

Sends the given message to the tango debug stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_debug)
```

**Parameters**

**msg** (`str`) the message to be sent to the debug stream

**Return** None

**delete\_device** (`self`) → None

Delete the device.

**Parameters** None

**Return** None

**error\_stream** (`self, msg, *args`) → None

Sends the given message to the tango error stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_error)
```

**Parameters**

**msg** (`str`) the message to be sent to the error stream

**Return** None

**fatal\_stream** (`self, msg, *args`) → None

Sends the given message to the tango fatal stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_fatal)
```

**Parameters**

**msg** (`str`) the message to be sent to the fatal stream

**Return** None

**get\_attr\_min\_poll\_period** (`self`) → seq<str>

Returns the min attribute poll period

**Parameters** None

**Return** (`seq`) the min attribute poll period

*New in PyTango 7.2.0*

**get\_attr\_poll\_ring\_depth** (*self*, *attr\_name*) → int

Returns the attribute poll ring depth

**Parameters**

**attr\_name** (`str`) the attribute name

**Return** (`int`) the attribute poll ring depth

*New in PyTango 7.1.2*

**get\_attribute\_poll\_period** (*self*, *attr\_name*) → int

Returns the attribute polling period (ms) or 0 if the attribute is not polled.

**Parameters**

**attr\_name** (`str`) attribute name

**Return** (`int`) attribute polling period (ms) or 0 if it is not polled

*New in PyTango 8.0.0*

**get\_cmd\_min\_poll\_period** (*self*) → `seq<str>`

Returns the min command poll period

**Parameters** None

**Return** (`seq`) the min command poll period

*New in PyTango 7.2.0*

**get\_cmd\_poll\_ring\_depth** (*self*, *cmd\_name*) → int

Returns the command poll ring depth

**Parameters**

**cmd\_name** (`str`) the command name

**Return** (`int`) the command poll ring depth

*New in PyTango 7.1.2*

**get\_command\_poll\_period** (*self*, *cmd\_name*) → int

Returns the command polling period (ms) or 0 if the command is not polled.

**Parameters**

**cmd\_name** (`str`) command name

**Return** (`int`) command polling period (ms) or 0 if it is not polled

*New in PyTango 8.0.0*

**get\_dev\_idl\_version** (*self*) → int

Returns the IDL version

**Parameters** None

**Return** (`int`) the IDL version

*New in PyTango 7.1.2*

**get\_device\_attr** (*self*) → MultiAttribute

Get device multi attribute object.

**Parameters** None

**Return** (`MultiAttribute`) the device's MultiAttribute object

**get\_device\_properties** (*self*, *ds\_class = None*) → None

Utility method that fetches all the device properties from the database and converts them into members of this DeviceImpl.

**Parameters**

**ds\_class** (`DeviceClass`) the DeviceClass object. Optional. Default value is None meaning that the corresponding DeviceClass object for this DeviceImpl will be used

**Return** None

**Throws** `DevFailed`

**get\_exported\_flag** (*self*) → bool

Returns the state of the exported flag

**Parameters** None

**Return** (`bool`) the state of the exported flag

*New in PyTango 7.1.2*

**get\_logger** (*self*) → `Logger`

Returns the `Logger` object for this device

**Parameters** None

**Return** (`Logger`) the `Logger` object for this device

**get\_min\_poll\_period** (*self*) → `int`

Returns the min poll period

**Parameters** None

**Return** (`int`) the min poll period

*New in PyTango 7.2.0*

**get\_name** (*self*) → (`str`)

Get a COPY of the device name.

**Parameters** None

**Return** (`str`) the device name

**get\_non\_auto\_polled\_attr** (*self*) → `sequence<str>`

Returns a COPY of the list of non automatic polled attributes

**Parameters** None

**Return** (sequence<str>) a COPY of the list of non automatic polled attributes

*New in PyTango 7.1.2*

**get\_non\_auto\_polled\_cmd** (*self*) → sequence<str>

Returns a COPY of the list of non automatic polled commands

**Parameters** None

**Return** (sequence<str>) a COPY of the list of non automatic polled commands

*New in PyTango 7.1.2*

**get\_poll\_old\_factor** (*self*) → int

Returns the poll old factor

**Parameters** None

**Return** (int) the poll old factor

*New in PyTango 7.1.2*

**get\_poll\_ring\_depth** (*self*) → int

Returns the poll ring depth

**Parameters** None

**Return** (int) the poll ring depth

*New in PyTango 7.1.2*

**get\_polled\_attr** (*self*) → sequence<str>

Returns a COPY of the list of polled attributes

**Parameters** None

**Return** (sequence<str>) a COPY of the list of polled attributes

*New in PyTango 7.1.2*

**get\_polled\_cmd** (*self*) → sequence<str>

Returns a COPY of the list of polled commands

**Parameters** None

**Return** (sequence<str>) a COPY of the list of polled commands

*New in PyTango 7.1.2*

**get\_prev\_state** (*self*) → DevState

Get a COPY of the device's previous state.

**Parameters** None

**Return** (DevState) the device's previous state

**get\_state** (*self*) → DevState

Get a COPY of the device state.

**Parameters** None

**Return** (`DevState`) Current device state

**get\_status** (*self*) → `str`

Get a COPY of the device status.

**Parameters** None

**Return** (`str`) the device status

**info\_stream** (*self*, *msg*, \**args*) → None

Sends the given message to the tango info stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_info)
```

**Parameters**

**msg** (`str`) the message to be sent to the info stream

**Return** None

**init\_device** ()

Tango init\_device method. Default implementation calls `get_device_properties()`

**initialize\_dynamic\_attributes** ()

Method executed at initialization phase to create dynamic attributes. Default implementation does nothing. Overwrite when necessary.

**is\_device\_locked** (*self*) → `bool`

Returns if this device is locked by a client

**Parameters** None

**Return** (`bool`) True if it is locked or False otherwise

*New in PyTango 7.1.2*

**is\_polled** (*self*) → `bool`

Returns if it is polled

**Parameters** None

**Return** (`bool`) True if it is polled or False otherwise

*New in PyTango 7.1.2*

**is\_there\_subscriber** (*self*, *att\_name*, *event\_type*) → `bool`

Check if there is subscriber(s) listening for the event.

This method returns a boolean set to true if there are some subscriber(s) listening on the event specified by the two method arguments. Be aware that there is some delay (up to 600 sec) between this method returning false and the last subscriber unsubscription or crash...

The device interface change event is not supported by this method.

**Parameters**

**att\_name** (`str`) the attribute name

**event\_type (EventType)** the event type

**Return** True if there is at least one listener or False otherwise

**push\_archive\_event** (*self*, *attr\_name*) → None

**push\_archive\_event** (*self*, *attr\_name*, *except*) -> None

**push\_archive\_event** (*self*, *attr\_name*, *data*, *dim\_x* = 1, *dim\_y* = 0) -> None

**push\_archive\_event** (*self*, *attr\_name*, *str\_data*, *data*) -> None

**push\_archive\_event** (*self*, *attr\_name*, *data*, *time\_stamp*, *quality*, *dim\_x* = 1, *dim\_y* = 0) -> None

**push\_archive\_event** (*self*, *attr\_name*, *str\_data*, *data*, *time\_stamp*, *quality*) -> None

Push an archive event for the given attribute name. The event is pushed to the notification daemon.

#### Parameters

**attr\_name** (*str*) attribute name

**data** the data to be sent as attribute event data. Data must be compatible with the attribute type and format. for SPECTRUM and IMAGE attributes, data can be any type of sequence of elements compatible with the attribute type

**str\_data** (*str*) special variation for DevEncoded data type. In this case 'data' must be a str or an object with the buffer interface.

**except** (*DevFailed*) Instead of data, you may want to send an exception.

**dim\_x** (*int*) the attribute x length. Default value is 1

**dim\_y** (*int*) the attribute y length. Default value is 0

**time\_stamp** (*double*) the time stamp

**quality** (*AttrQuality*) the attribute quality factor

**Throws** *DevFailed* If the attribute data type is not coherent.

**push\_att\_conf\_event** (*self*, *attr*) → None

Push an attribute configuration event.

**Parameters** (*Attribute*) the attribute for which the configuration event will be sent.

**Return** None

*New in PyTango 7.2.1*

**push\_change\_event** (*self*, *attr\_name*) → None

**push\_change\_event** (*self*, *attr\_name*, *except*) -> None

**push\_change\_event** (*self*, *attr\_name*, *data*, *dim\_x* = 1, *dim\_y* = 0) -> None

**push\_change\_event** (*self*, *attr\_name*, *str\_data*, *data*) -> None

**push\_change\_event** (*self*, *attr\_name*, *data*, *time\_stamp*, *quality*, *dim\_x* = 1, *dim\_y* = 0) -> None

**push\_change\_event** (*self*, *attr\_name*, *str\_data*, *data*, *time\_stamp*, *quality*) -> None

Push a change event for the given attribute name. The event is pushed to the notification daemon.

**Parameters****attr\_name** (`str`) attribute name**data** the data to be sent as attribute event data. Data must be compatible with the attribute type and format. for SPECTRUM and IMAGE attributes, data can be any type of sequence of elements compatible with the attribute type**str\_data** (`str`) special variation for DevEncoded data type. In this case 'data' must be a str or an object with the buffer interface.**except** (`DevFailed`) Instead of data, you may want to send an exception.**dim\_x** (`int`) the attribute x length. Default value is 1**dim\_y** (`int`) the attribute y length. Default value is 0**time\_stamp** (`double`) the time stamp**quality** (`AttrQuality`) the attribute quality factor**Throws** `DevFailed` If the attribute data type is not coherent.**push\_data\_ready\_event** (`self, attr_name, counter = 0`) → None

Push a data ready event for the given attribute name. The event is pushed to the notification daemon.

The method needs only the attribute name and an optional "counter" which will be passed unchanged within the event

**Parameters****attr\_name** (`str`) attribute name**counter** (`int`) the user counter**Return** None**Throws** `DevFailed` If the attribute name is unknown.**push\_event** (`self, attr_name, filt_names, filt_vals`) → None**push\_event** (`self, attr_name, filt_names, filt_vals, data, dim_x = 1, dim_y = 0`) → None**push\_event** (`self, attr_name, filt_names, filt_vals, str_data, data`) → None**push\_event** (`self, attr_name, filt_names, filt_vals, data, time_stamp, quality, dim_x = 1, dim_y = 0`) → None**push\_event** (`self, attr_name, filt_names, filt_vals, str_data, data, time_stamp, quality`) → None

Push a user event for the given attribute name. The event is pushed to the notification daemon.

**Parameters****attr\_name** (`str`) attribute name**filt\_names** (`sequence<str>`) the filterable fields name**filt\_vals** (`sequence<double>`) the filterable fields value**data** the data to be sent as attribute event data. Data must be compatible with the attribute type and format. for SPECTRUM and IMAGE attributes, data can be any

type of sequence of elements compatible with the attribute type

**str\_data** (*str*) special variation for DevEncoded data type. In this case 'data' must be a str or an object with the buffer interface.

**dim\_x** (*int*) the attribute x length. Default value is 1

**dim\_y** (*int*) the attribute y length. Default value is 0

**time\_stamp** (*double*) the time stamp

**quality** (*AttrQuality*) the attribute quality factor

**Throws** *DevFailed* If the attribute data type is not coherent.

**push\_pipe\_event** (*self, blob*) → None

Push an pipe event.

**Parameters** the blob which pipe event will be send.

**Return** None

*New in PyTango 9.2.2*

**register\_signal** (*self, signo*) → None

Register a signal. Register this device as device to be informed when signal signo is sent to to the device server process

**Parameters**

**signo** (*int*) signal identifier

**Return** None

**remove\_attribute** (*self, attr\_name*) → None

Remove one attribute from the device attribute list.

**Parameters**

**attr\_name** (*str*) attribute name

**Return** None

**Throws** *DevFailed*

**remove\_command** (*self, attr\_name*) → None

Remove one command from the device command list.

**Parameters**

**cmd\_name** (*str*) command name to be removed from the list

**free\_it** Boolean set to true if the command object must be freed.

**clean\_db** Clean command related information (included polling info if the command is polled) from database.

**Return** None

**Throws** *DevFailed*



**classmethod run\_server** (*args=None, \*\*kwargs*)

Run the class as a device server. It is based on the `tango.server.run` method.

The difference is that the device class and server name are automatically given.

**Args:**

**args (iterable): args as given in the `tango.server.run` method** without the server name. If `None`, the `sys.argv` list is used

**kwargs: the other keywords argument are as given** in the `tango.server.run` method.

**set\_archive\_event** (*self, attr\_name, implemented, detect=True*) → `None`

Set an implemented flag for the attribute to indicate that the server fires archive events manually, without the polling to be started. If the `detect` parameter is set to `true`, the criteria specified for the archive event are verified and the event is only pushed if they are fulfilled. If `detect` is set to `false` the event is fired without any value checking!

**Parameters**

**attr\_name** (`str`) attribute name

**implemented** (`bool`) True when the server fires change events manually.

**detect** (`bool`) Triggers the verification of the change event properties when set to `true`. Default value is `true`.

**Return** `None`

**set\_change\_event** (*self, attr\_name, implemented, detect=True*) → `None`

Set an implemented flag for the attribute to indicate that the server fires change events manually, without the polling to be started. If the `detect` parameter is set to `true`, the criteria specified for the change event are verified and the event is only pushed if they are fulfilled. If `detect` is set to `false` the event is fired without any value checking!

**Parameters**

**attr\_name** (`str`) attribute name

**implemented** (`bool`) True when the server fires change events manually.

**detect** (`bool`) Triggers the verification of the change event properties when set to `true`. Default value is `true`.

**Return** `None`

**set\_state** (*self, new\_state*) → `None`

Set device state.

**Parameters**

**new\_state** (`DevState`) the new device state

**Return** `None`

**set\_status** (*self, new\_status*) → `None`

Set device status.

**Parameters**

**new\_status** (*str*) the new device status

**Return** None

**signal\_handler** (*self, signo*) → None

Signal handler. The method executed when the signal arrived in the device server process. This method is defined as virtual and then, can be redefined following device needs.

**Parameters**

**signo** (*int*) the signal number

**Return** None

**Throws** `DevFailed` This method does not throw exception but a redefined method can.

**stop\_polling** (*self*) → None

**stop\_polling** (*self, with\_db\_upd*) → None

Stop all polling for a device. if the device is polled, call this method before deleting it.

**Parameters**

**with\_db\_upd** (*bool*) Is it necessary to update db ?

**Return** None

*New in PyTango 7.1.2*

**unregister\_signal** (*self, signo*) → None

Unregister a signal. Unregister this device as device to be informed when signal signo is sent to to the device server process

**Parameters**

**signo** (*int*) signal identifier

**Return** None

**warn\_stream** (*self, msg, \*args*) → None

Sends the given message to the tango warn stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_warn)
```

**Parameters**

**msg** (*str*) the message to be sent to the warn stream

**Return** None

**write\_attr\_hardware** (*self*) → None

Write the hardware for attributes. Default method to implement an action necessary on a device to write the hardware involved in a a write attribute. This method must be redefined in sub-classes in order to support writable attribute

**Parameters**

**attr\_list** [(sequence<int>) list of indices in the device object attribute vector] of an attribute to be written.

**Return** None

**Throws** DevFailed This method does not throw exception but a redefined method can.

**class** tango.server.attribute (fget=None, \*\*kwargs)

Declares a new tango attribute in a *Device*. To be used like the python native `property` function. For example, to declare a scalar, *tango.DevDouble*, read-only attribute called *voltage* in a *PowerSupply Device* do:

```
class PowerSupply(Device):

    voltage = attribute()

    def read_voltage(self):
        return 999.999
```

The same can be achieved with:

```
class PowerSupply(Device):

    @attribute
    def voltage(self):
        return 999.999
```

It receives multiple keyword arguments.

parameter	type	default value	description
name	str	class member name	alternative attribute name
dtype	object	DevDouble	data type (see <i>Data type equivalence</i> )
dformat	AttrDataFormat	SCALAR	data format
max_dim_x	int	1	maximum size for x dimension (ignored for
max_dim_y	int	0	maximum size for y dimension (ignored for
display_level	DispLevel	OPERATOR	display level
polling_period	int	-1	polling period
memorized	bool	False	attribute should or not be memorized
hw_memorized	bool	False	write method should be called at startup wh
access	AttrWriteType	READ	read only/ read write / write only access
fget (or fread)	str or callable	'read_<attr_name>'	read method name or method object
fset (or fwrite)	str or callable	'write_<attr_name>'	write method name or method object
fisallowed	str or callable	'is_<attr_name>_allowed'	is allowed method name or method object
label	str	'<attr_name>'	attribute label
enum_labels	sequence	None	the list of enumeration labels (enum data ty
doc (or description)	str	''	attribute description
unit	str	''	physical units the attribute value is in
standard_unit	str	''	physical standard unit
display_unit	str	''	physical display unit (hint for clients)
format	str	'6.2f'	attribute representation format
min_value	str	None	minimum allowed value
max_value	str	None	maximum allowed value
min_alarm	str	None	minimum value to trigger attribute alarm
max_alarm	str	None	maximum value to trigger attribute alarm
min_warning	str	None	minimum value to trigger attribute warning
max_warning	str	None	maximum value to trigger attribute warning
delta_val	str	None	

Table 3 – continued from previous page

parameter	type	default value	description
delta_t	str	None	
abs_change	str	None	minimum value change between events that
rel_change	str	None	minimum relative change between events th
period	str	None	
archive_abs_change	str	None	
archive_rel_change	str	None	
archive_period	str	None	
green_mode	GreenMode	None	green mode for read and write. None means
read_green_mode	GreenMode	None	green mode for read. None means use serve
write_green_mode	GreenMode	None	green mode for write. None means use serv
forwarded	bool	False	the attribute should be forwarded if True

**Note:** avoid using *dformat* parameter. If you need a SPECTRUM attribute of say, boolean type, use instead `dtype=(bool,)`.

Example of a integer writable attribute with a customized label, unit and description:

```
class PowerSupply(Device):
    current = attribute(label="Current", unit="mA", dtype=int,
                       access=AttrWriteType.READ_WRITE,
                       doc="the power supply current")

    def init_device(self):
        Device.init_device(self)
        self._current = -1

    def read_current(self):
        return self._current

    def write_current(self, current):
        self._current = current
```

The same, but using attribute as a decorator:

```
class PowerSupply(Device):

    def init_device(self):
        Device.init_device(self)
        self._current = -1

    @attribute(label="Current", unit="mA", dtype=int)
    def current(self):
        """the power supply current"""
        return 999.999

    @current.write
    def current(self, current):
        self._current = current
```

In this second format, defining the *write* implicitly sets the attribute access to `READ_WRITE`.

New in version 8.1.7: added `green_mode`, `read_green_mode` and `write_green_mode` options

```
tango.server.command(f=None, dtype_in=None, dformat_in=None, doc_in="",
                    dtype_out=None, dformat_out=None, doc_out="", display_level=None,
                    polling_period=None, green_mode=None)
```

Declares a new tango command in a *Device*. To be used like a decorator in the methods you

want to declare as tango commands. The following example declares commands:

- *void TurnOn(void)*
- *void Ramp(DevDouble current)*
- *DevBool Pressurize(DevDouble pressure)*

```
class PowerSupply(Device):

    @command
    def TurnOn(self):
        self.info_stream('Turning on the power supply')

    @command(dtype_in=float)
    def Ramp(self, current):
        self.info_stream('Ramping on %f...' % current)

    @command(dtype_in=float, doc_in='the pressure to be set',
              dtype_out=bool, doc_out='True if it worked, False otherwise')
    def Pressurize(self, pressure):
        self.info_stream('Pressurizing to %f...' % pressure)
        return True
```

**Note:** avoid using *dformat* parameter. If you need a SPECTRUM attribute of say, boolean type, use instead `dtype=(bool,)`.

### Parameters

- **dtype\_in** – a *data type* describing the type of parameter. Default is None meaning no parameter.
- **dformat\_in** (*AttrDataFormat*) – parameter data format. Default is None.
- **doc\_in** (*str*) – parameter documentation
- **dtype\_out** – a *data type* describing the type of return value. Default is None meaning no return value.
- **dformat\_out** (*AttrDataFormat*) – return value data format. Default is None.
- **doc\_out** (*str*) – return value documentation
- **display\_level** (*DispLevel*) – display level for the command (optional)
- **polling\_period** (*int*) – polling period in milliseconds (optional)
- **green\_mode** – set green mode on this specific command. Default value is None meaning use the server green mode. Set it to Green-Mode.Synchronous to force a non green command in a green server.

New in version 8.1.7: added `green_mode` option

New in version 9.2.0: added `display_level` and `polling_period` optional argument

**class** `tango.server.pipe` (*fget=None, \*\*kwargs*)

Declares a new tango pipe in a *Device*. To be used like the python native `property` function.

Checkout the *pipe data types* to see what you should return on a pipe read request and what to expect as argument on a pipe write request.

For example, to declare a read-only pipe called *ROI* (for Region Of Interest), in a *Detector Device* do:

```
class Detector(Device):

    ROI = pipe()

    def read_ROI(self):
        return ('ROI', ({'name': 'x', 'value': 0},
                        {'name': 'y', 'value': 10},
                        {'name': 'width', 'value': 100},
                        {'name': 'height', 'value': 200}))
```

The same can be achieved with (also showing that a dict can be used to pass blob data):

```
class Detector(Device):

    @pipe
    def ROI(self):
        return 'ROI', dict(x=0, y=10, width=100, height=200)
```

It receives multiple keyword arguments.

parameter	type	default value	description
name	str	class member name	alternative pipe name
display_level	DispLevel	OPERATOR	display level
access	PipeWriteType	READ	read only/ read write access
fget (or fread)	str or callable	'read_<pipe_name>	read method name or method object
fset (or fwrite)	str or callable	'write_<pipe_name>	write method name or method object
isallowed	str or callable	'is_<pipe_name>_allowed'	allowed method name or method object
label	str	'<pipe_name>'	pipe label
doc (or description)	str	''	pipe description
green_mode	GreenMode	None	green mode for read and write. None means use server green mode.
read_green_mode	GreenMode	None	green mode for read. None means use server green mode.
write_green_mode	GreenMode	None	green mode for write. None means use server green mode.

The same example with a read-write ROI, a customized label and description:

```
class Detector(Device):

    ROI = pipe(label='Region Of Interest', doc='The active region of interest',
              access=PipeWriteType.PIPE_READ_WRITE)

    def init_device(self):
        Device.init_device(self)
        self.__roi = 'ROI', dict(x=0, y=10, width=100, height=200)

    def read_ROI(self):
        return self.__roi

    def write_ROI(self, roi):
        self.__roi = roi
```

The same, but using pipe as a decorator:

```

class Detector(Device):

    def init_device(self):
        Device.init_device(self)
        self.__roi = 'ROI', dict(x=0, y=10, width=100, height=200)

    @pipe(label="Region Of Interest")
    def ROI(self):
        """The active region of interest"""
        return self.__roi

    @ROI.write
    def ROI(self, roi):
        self.__roi = roi

```

In this second format, defining the *write* / *setter* implicitly sets the pipe access to READ\_WRITE.

New in version 9.2.0.

```

class tango.server.device_property(dtype, doc="", mandatory=False, default_value=None,
                                  update_db=False)

```

Declares a new tango device property in a *Device*. To be used like the python native `property` function. For example, to declare a scalar, *tango.DevString*, device property called *host* in a *PowerSupply Device* do:

```

from tango.server import Device, DeviceMeta
from tango.server import device_property

class PowerSupply(Device):

    host = device_property(dtype=str)
    port = device_property(dtype=int, mandatory=True)

```

#### Parameters

- **dtype** – Data type (see *Data types*)
- **doc** – property documentation (optional)
- **(optional *mandatory*)** – default is False
- **default\_value** – default value for the property (optional)
- **update\_db (*bool*)** – tells if set value should write the value to database. [default: False]

New in version 8.1.7: added `update_db` option

```

class tango.server.class_property(dtype, doc="", default_value=None, update_db=False)

```

Declares a new tango class property in a *Device*. To be used like the python native `property` function. For example, to declare a scalar, *tango.DevString*, class property called *port* in a *PowerSupply Device* do:

```

from tango.server import Device, DeviceMeta
from tango.server import class_property

class PowerSupply(Device):

    port = class_property(dtype=int, default_value=9788)

```

#### Parameters

- **dtype** – Data type (see *Data types*)
- **doc** – property documentation (optional)

- **default\_value** – default value for the property (optional)
- **update\_db** (*bool*) – tells if set value should write the value to database. [default: False]

New in version 8.1.7: added update\_db option

```
tango.server.run(classes, args=None, msg_stream=<_io.TextIOWrapper name='<stdout>'
mode='w' encoding='UTF-8'>, verbose=False, util=None, event_loop=None,
post_init_callback=None, green_mode=None, raises=False)
```

Provides a simple way to run a tango server. It handles exceptions by writing a message to the msg\_stream.

The *classes* parameter can be either a sequence of:

- : class:~tango.server.Device or
- a sequence of two elements *DeviceClass*, *DeviceImpl* or
- a sequence of three elements *DeviceClass*, *DeviceImpl*, tango class name (str)

or a dictionary where:

- key is the tango class name
- **value is either:**
  - a : class:~tango.server.Device class or
  - a sequence of two elements *DeviceClass*, *DeviceImpl* or
  - a sequence of three elements *DeviceClass*, *DeviceImpl*, tango class name (str)

The optional *post\_init\_callback* can be a callable (without arguments) or a tuple where the first element is the callable, the second is a list of arguments (optional) and the third is a dictionary of keyword arguments (also optional).

---

**Note:** the order of registration of tango classes defines the order tango uses to initialize the corresponding devices. if using a dictionary as argument for classes be aware that the order of registration becomes arbitrary. If you need a predefined order use a sequence or an *OrderedDict*.

---

Example 1: registering and running a *PowerSupply* inheriting from *Device*:

```
from tango.server import Device, DeviceMeta, run

class PowerSupply(Device):
    pass

run((PowerSupply,))
```

Example 2: registering and running a *MyServer* defined by tango classes *MyServerClass* and *MyServer*:

```
from tango import Device_4Impl, DeviceClass
from tango.server import run

class MyServer(Device_4Impl):
    pass

class MyServerClass(DeviceClass):
    pass

run({'MyServer': (MyServerClass, MyServer)})
```

Example 3: registering and running a *MyServer* defined by tango classes *MyServerClass* and *MyServer*:

```
from tango import Device_4Impl, DeviceClass
from tango.server import Device, DeviceMeta, run
```

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```

class PowerSupply(Device):
    pass

class MyServer(Device_4Impl):
    pass

class MyServerClass(DeviceClass):
    pass

run([PowerSupply, [MyServerClass, MyServer]])
# or: run({'MyServer': (MyServerClass, MyServer)})

```

**Parameters**

- **classes** (*sequence or dict*) – a sequence of *Device* classes or a dictionary where keyword is the tango class name and value is a sequence of Tango Device Class python class, and Tango Device python class
- **args** (*list*) – list of command line arguments [default: None, meaning use sys.argv]
- **msg\_stream** – stream where to put messages [default: sys.stdout]
- **util** (*Util*) – PyTango Util object [default: None meaning create a Util instance]
- **event\_loop** (*callable*) – event\_loop callable
- **post\_init\_callback** (*callable or tuple (see description above)*) – an optional callback that is executed between the calls Util.server\_init and Util.server\_run
- **raises** (*bool*) – Disable error handling and propagate exceptions from the server

**Returns** The Util singleton object**Return type** *Util*

New in version 8.1.2.

Changed in version 8.1.4: when classes argument is a sequence, the items can also be a sequence &lt;TangoClass, TangoClassClass&gt;[, tango class name]

Changed in version 9.2.2: *raises* argument has been added

```

tango.server.server_run(classes, args=None, msg_stream=<_io.TextIOWrapper
                        name='<stdout>' mode='w' encoding='UTF-8'>, verbose=False,
                        util=None, event_loop=None, post_init_callback=None,
                        green_mode=None)

```

Since PyTango 8.1.2 it is just an alias to *run()*. Use *run()* instead.

New in version 8.0.0.

Changed in version 8.0.3: Added *util* keyword parameter. Returns util objectChanged in version 8.1.1: Changed default msg\_stream from *stderr* to *stdout* Added *event\_loop* keyword parameter. Returns util objectChanged in version 8.1.2: Added *post\_init\_callback* keyword parameterDeprecated since version 8.1.2: Use *run()* instead.

## 5.3.2 Device

### DeviceImpl

**class** `tango.LatestDeviceImpl`

Latest implementation of the TANGO device base class (alias for `Device_5Impl`).

It inherits from CORBA classes where all the network layer is implemented.

**add\_attribute** (*self*, *attr*, *r\_meth=None*, *w\_meth=None*, *is\_allo\_meth=None*) → *Attr*

Add a new attribute to the device attribute list. Please, note that if you add an attribute to a device at device creation time, this attribute will be added to the device class attribute list. Therefore, all devices belonging to the same class created after this attribute addition will also have this attribute.

#### Parameters

**attr** (*Attr* or *AttrData*) the new attribute to be added to the list.

**r\_meth** (*callable*) the read method to be called on a read request

**w\_meth** (*callable*) the write method to be called on a write request (if *attr* is writable)

**is\_allo\_meth** (*callable*) the method that is called to check if it is possible to access the attribute or not

**Return** (*Attr*) the newly created attribute.

**Throws** *DevFailed*

**add\_command** (*self*, *cmd*, *level=TANGO::OPERATOR*) → *cmd*

Add a new command to the device command list.

#### Parameters

**cmd** the new command to be added to the list

**device\_level** Set this flag to true if the command must be added for only this device

**Return** *Command*

**Throws** *DevFailed*

**always\_executed\_hook** (*self*) → *None*

Hook method. Default method to implement an action necessary on a device before any command is executed. This method can be redefined in sub-classes in case of the default behaviour does not fullfill the needs

**Parameters** *None*

**Return** *None*

**Throws** *DevFailed* This method does not throw *exception* but a redefined method can.

**append\_status** (*self*, *status*, *new\_line=False*) → *None*

Appends a string to the device status.

**Parameters** *status* : (*str*) the string to be appened to the device status  
*new\_line* : (*bool*) If true, appends a new line character before the string. Default is *False*

**Return** *None*

**check\_command\_exists** (*self*) → None

This method check that a command is supported by the device and does not need input value. The method throws an exception if the command is not defined or needs an input value

**Parameters**

**cmd\_name** (*str*) the command name

**Return** None

**Throws** *DevFailed* API\_IncompatibleCmdArgumentType,  
API\_CommandNotFound

*New in PyTango 7.1.2*

**debug\_stream** (*self*, *msg*, \**args*) → None

Sends the given message to the tango debug stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_debug)
```

**Parameters**

**msg** (*str*) the message to be sent to the debug stream

**Return** None

**delete\_device** (*self*) → None

Delete the device.

**Parameters** None

**Return** None

**dev\_state** (*self*) → DevState

Get device state. Default method to get device state. The behaviour of this method depends on the device state. If the device state is ON or ALARM, it reads the attribute(s) with an alarm level defined, check if the read value is above/below the alarm and eventually change the state to ALARM, return the device state. For all th other device state, this method simply returns the state This method can be redefined in sub-classes in case of the default behaviour does not fullfill the needs.

**Parameters** None

**Return** (*DevState*) the device state

**Throws** *DevFailed* - If it is necessary to read attribute(s) and a problem occurs during the reading

**dev\_status** (*self*) → str

Get device status. Default method to get device status. It returns the contents of the device dev\_status field. If the device state is ALARM, alarm messages are added to the device status. This method can be redefined in sub-classes in case of the default behaviour does not fullfill the needs.

**Parameters** None

**Return** (*str*) the device status

**Throws** *DevFailed* - If it is necessary to read attribute(s) and a problem occurs during the reading

**error\_stream** (*self*, *msg*, \**args*) → None

Sends the given message to the tango error stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_error)
```

**Parameters**

**msg** (*str*) the message to be sent to the error stream

**Return** None

**fatal\_stream** (*self*, *msg*, \**args*) → None

Sends the given message to the tango fatal stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_fatal)
```

**Parameters**

**msg** (*str*) the message to be sent to the fatal stream

**Return** None

**get\_attr\_min\_poll\_period** (*self*) → seq<str>

Returns the min attribute poll period

**Parameters** None

**Return** (*seq*) the min attribute poll period

*New in PyTango 7.2.0*

**get\_attr\_poll\_ring\_depth** (*self*, *attr\_name*) → int

Returns the attribute poll ring depth

**Parameters**

**attr\_name** (*str*) the attribute name

**Return** (*int*) the attribute poll ring depth

*New in PyTango 7.1.2*

**get\_attribute\_poll\_period** (*self*, *attr\_name*) → int

Returns the attribute polling period (ms) or 0 if the attribute is not polled.

**Parameters**

**attr\_name** (*str*) attribute name

**Return** (*int*) attribute polling period (ms) or 0 if it is not polled

*New in PyTango 8.0.0*

**get\_cmd\_min\_poll\_period** (*self*) → seq<str>

Returns the min command poll period

**Parameters** None

**Return** (*seq*) the min command poll period

*New in PyTango 7.2.0*

**get\_cmd\_poll\_ring\_depth** (*self, cmd\_name*) → int

Returns the command poll ring depth

**Parameters**

**cmd\_name** (*str*) the command name

**Return** (*int*) the command poll ring depth

*New in PyTango 7.1.2*

**get\_command\_poll\_period** (*self, cmd\_name*) → int

Returns the command polling period (ms) or 0 if the command is not polled.

**Parameters**

**cmd\_name** (*str*) command name

**Return** (*int*) command polling period (ms) or 0 if it is not polled

*New in PyTango 8.0.0*

**get\_dev\_idl\_version** (*self*) → int

Returns the IDL version

**Parameters** None

**Return** (*int*) the IDL version

*New in PyTango 7.1.2*

**get\_device\_attr** (*self*) → MultiAttribute

Get device multi attribute object.

**Parameters** None

**Return** (*MultiAttribute*) the device's MultiAttribute object

**get\_device\_properties** (*self, ds\_class = None*) → None

Utility method that fetches all the device properties from the database and converts them into members of this DeviceImpl.

**Parameters**

**ds\_class** (*DeviceClass*) the DeviceClass object. Optional. Default value is None meaning that the corresponding DeviceClass object for this DeviceImpl will be used

**Return** None

**Throws** *DevFailed*

**get\_exported\_flag** (*self*) → bool

Returns the state of the exported flag

**Parameters** None

**Return** (`bool`) the state of the exported flag

*New in PyTango 7.1.2*

**get\_logger** (*self*) → `Logger`

Returns the `Logger` object for this device

**Parameters** `None`

**Return** (`Logger`) the `Logger` object for this device

**get\_min\_poll\_period** (*self*) → `int`

Returns the min poll period

**Parameters** `None`

**Return** (`int`) the min poll period

*New in PyTango 7.2.0*

**get\_name** (*self*) → (`str`)

Get a COPY of the device name.

**Parameters** `None`

**Return** (`str`) the device name

**get\_non\_auto\_polled\_attr** (*self*) → `sequence<str>`

Returns a COPY of the list of non automatic polled attributes

**Parameters** `None`

**Return** (`sequence<str>`) a COPY of the list of non automatic polled attributes

*New in PyTango 7.1.2*

**get\_non\_auto\_polled\_cmd** (*self*) → `sequence<str>`

Returns a COPY of the list of non automatic polled commands

**Parameters** `None`

**Return** (`sequence<str>`) a COPY of the list of non automatic polled commands

*New in PyTango 7.1.2*

**get\_poll\_old\_factor** (*self*) → `int`

Returns the poll old factor

**Parameters** `None`

**Return** (`int`) the poll old factor

*New in PyTango 7.1.2*

**get\_poll\_ring\_depth** (*self*) → `int`

Returns the poll ring depth

**Parameters** `None`

**Return** (`int`) the poll ring depth

*New in PyTango 7.1.2*

**get\_polled\_attr** (*self*) → sequence<str>

Returns a COPY of the list of polled attributes

**Parameters** None

**Return** (sequence<str>) a COPY of the list of polled attributes

*New in PyTango 7.1.2*

**get\_polled\_cmd** (*self*) → sequence<str>

Returns a COPY of the list of polled commands

**Parameters** None

**Return** (sequence<str>) a COPY of the list of polled commands

*New in PyTango 7.1.2*

**get\_prev\_state** (*self*) → DevState

Get a COPY of the device's previous state.

**Parameters** None

**Return** (*DevState*) the device's previous state

**get\_state** (*self*) → DevState

Get a COPY of the device state.

**Parameters** None

**Return** (*DevState*) Current device state

**get\_status** (*self*) → str

Get a COPY of the device status.

**Parameters** None

**Return** (str) the device status

**info\_stream** (*self*, *msg*, \**args*) → None

Sends the given message to the tango info stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_info)
```

**Parameters**

**msg** (str) the message to be sent to the info stream

**Return** None

**init\_device** (*self*) → None

Intialize the device.

**Parameters** None

**Return** None

**is\_device\_locked** (*self*) → bool

Returns if this device is locked by a client

**Parameters** None

**Return** (bool) True if it is locked or False otherwise

*New in PyTango 7.1.2*

**is\_polled** (*self*) → bool

Returns if it is polled

**Parameters** None

**Return** (bool) True if it is polled or False otherwise

*New in PyTango 7.1.2*

**is\_there\_subscriber** (*self, att\_name, event\_type*) → bool

Check if there is subscriber(s) listening for the event.

This method returns a boolean set to true if there are some subscriber(s) listening on the event specified by the two method arguments. Be aware that there is some delay (up to 600 sec) between this method returning false and the last subscriber unsubscription or crash...

The device interface change event is not supported by this method.

**Parameters**

**att\_name** (str) the attribute name

**event\_type** (EventType) the event type

**Return** True if there is at least one listener or False otherwise

**push\_archive\_event** (*self, attr\_name*) → None

**push\_archive\_event** (*self, attr\_name, except*) → None

**push\_archive\_event** (*self, attr\_name, data, dim\_x = 1, dim\_y = 0*) → None

**push\_archive\_event** (*self, attr\_name, str\_data, data*) → None

**push\_archive\_event** (*self, attr\_name, data, time\_stamp, quality, dim\_x = 1, dim\_y = 0*) → None

**push\_archive\_event** (*self, attr\_name, str\_data, data, time\_stamp, quality*) → None

Push an archive event for the given attribute name. The event is pushed to the notification daemon.

**Parameters**

**attr\_name** (str) attribute name

**data** the data to be sent as attribute event data. Data must be compatible with the attribute type and format. for SPECTRUM and IMAGE attributes, data can be any type of sequence of elements compatible with the attribute type

**str\_data** (str) special variation for DevEncoded data type. In this case 'data' must be a str or an object with the buffer interface.

**except** (*DevFailed*) Instead of data, you may want to send an exception.



**dim\_x** (*int*) the attribute x length. Default value is 1  
**dim\_y** (*int*) the attribute y length. Default value is 0  
**time\_stamp** (*double*) the time stamp  
**quality** (*AttrQuality*) the attribute quality factor

**Throws** *DevFailed* If the attribute data type is not coherent.

**push\_att\_conf\_event** (*self, attr*) → None

Push an attribute configuration event.

**Parameters** (Attribute) the attribute for which the configuration event will be sent.

**Return** None

*New in PyTango 7.2.1*

**push\_change\_event** (*self, attr\_name*) → None

**push\_change\_event** (*self, attr\_name, except*) → None

**push\_change\_event** (*self, attr\_name, data, dim\_x = 1, dim\_y = 0*) → None

**push\_change\_event** (*self, attr\_name, str\_data, data*) → None

**push\_change\_event** (*self, attr\_name, data, time\_stamp, quality, dim\_x = 1, dim\_y = 0*) → None

**push\_change\_event** (*self, attr\_name, str\_data, data, time\_stamp, quality*) → None

Push a change event for the given attribute name. The event is pushed to the notification daemon.

#### Parameters

**attr\_name** (*str*) attribute name

**data** the data to be sent as attribute event data. Data must be compatible with the attribute type and format. for SPECTRUM and IMAGE attributes, data can be any type of sequence of elements compatible with the attribute type

**str\_data** (*str*) special variation for DevEncoded data type. In this case 'data' must be a str or an object with the buffer interface.

**except** (*DevFailed*) Instead of data, you may want to send an exception.

**dim\_x** (*int*) the attribute x length. Default value is 1

**dim\_y** (*int*) the attribute y length. Default value is 0

**time\_stamp** (*double*) the time stamp

**quality** (*AttrQuality*) the attribute quality factor

**Throws** *DevFailed* If the attribute data type is not coherent.

**push\_data\_ready\_event** (*self, attr\_name, counter = 0*) → None

Push a data ready event for the given attribute name. The event is pushed to the notification daemon.

The method needs only the attribute name and an optional "counter" which will be passed unchanged within the event

**Parameters**

**attr\_name** (*str*) attribute name

**counter** (*int*) the user counter

**Return** None

**Throws** *DevFailed* If the attribute name is unknown.

**push\_event** (*self, attr\_name, filt\_names, filt\_vals*) → None

**push\_event** (*self, attr\_name, filt\_names, filt\_vals, data, dim\_x = 1, dim\_y = 0*) → None

**push\_event** (*self, attr\_name, filt\_names, filt\_vals, str\_data, data*) → None

**push\_event** (*self, attr\_name, filt\_names, filt\_vals, data, time\_stamp, quality, dim\_x = 1, dim\_y = 0*) → None

**push\_event** (*self, attr\_name, filt\_names, filt\_vals, str\_data, data, time\_stamp, quality*) → None

Push a user event for the given attribute name. The event is pushed to the notification daemon.

#### Parameters

**attr\_name** (*str*) attribute name

**filt\_names** (sequence<*str*>) the filterable fields name

**filt\_vals** (sequence<*double*>) the filterable fields value

**data** the data to be sent as attribute event data. Data must be compatible with the attribute type and format. for SPECTRUM and IMAGE attributes, data can be any type of sequence of elements compatible with the attribute type

**str\_data** (*str*) special variation for DevEncoded data type. In this case 'data' must be a *str* or an object with the buffer interface.

**dim\_x** (*int*) the attribute x length. Default value is 1

**dim\_y** (*int*) the attribute y length. Default value is 0

**time\_stamp** (*double*) the time stamp

**quality** (*AttrQuality*) the attribute quality factor

**Throws** *DevFailed* If the attribute data type is not coherent.

**push\_pipe\_event** (*self, blob*) → None

Push an pipe event.

**Parameters** the blob which pipe event will be send.

**Return** None

*New in PyTango 9.2.2*

**read\_attr\_hardware** (*self, attr\_list*) → None

Read the hardware to return attribute value(s). Default method to implement an action necessary on a device to read the hardware involved in a read attribute CORBA call. This method must be redefined in sub-classes in order to support attribute reading

**Parameters**

**attr\_list** [(sequence<int>) list of indices in the device object attribute vector] of an attribute to be read.

**Return** None

**Throws** *DevFailed* This method does not throw exception but a redefined method can.

**register\_signal** (*self*, *signo*) → None

Register a signal. Register this device as device to be informed when signal *signo* is sent to to the device server process

**Parameters**

**signo** (*int*) signal identifier

**Return** None

**remove\_attribute** (*self*, *attr\_name*) → None

Remove one attribute from the device attribute list.

**Parameters**

**attr\_name** (*str*) attribute name

**Return** None

**Throws** *DevFailed*

**remove\_command** (*self*, *attr\_name*) → None

Remove one command from the device command list.

**Parameters**

**cmd\_name** (*str*) command name to be removed from the list

**free\_it** Boolean set to true if the command object must be freed.

**clean\_db** Clean command related information (included polling info if the command is polled) from database.

**Return** None

**Throws** *DevFailed*

**set\_archive\_event** (*self*, *attr\_name*, *implemented*, *detect=True*) → None

Set an implemented flag for the attribute to indicate that the server fires archive events manually, without the polling to be started. If the detect parameter is set to true, the criteria specified for the archive event are verified and the event is only pushed if they are fulfilled. If detect is set to false the event is fired without any value checking!

**Parameters**

**attr\_name** (*str*) attribute name

**implemented** (*bool*) True when the server fires change events manually.

**detect** (*bool*) Triggers the verification of the change event properties when set to true. Default value is true.

**Return** None

**set\_change\_event** (*self*, *attr\_name*, *implemented*, *detect=True*) → None

Set an implemented flag for the attribute to indicate that the server fires change events manually, without the polling to be started. If the detect parameter is set to true, the criteria specified for the change event are verified and the event is only pushed if they are fulfilled. If detect is set to false the event is fired without any value checking!

**Parameters**

**attr\_name** (*str*) attribute name

**implemented** (*bool*) True when the server fires change events manually.

**detect** (*bool*) Triggers the verification of the change event properties when set to true. Default value is true.

**Return** None

**set\_state** (*self*, *new\_state*) → None

Set device state.

**Parameters**

**new\_state** (*DevState*) the new device state

**Return** None

**set\_status** (*self*, *new\_status*) → None

Set device status.

**Parameters**

**new\_status** (*str*) the new device status

**Return** None

**signal\_handler** (*self*, *signo*) → None

Signal handler. The method executed when the signal arrived in the device server process. This method is defined as virtual and then, can be redefined following device needs.

**Parameters**

**signo** (*int*) the signal number

**Return** None

**Throws** *DevFailed* This method does not throw exception but a redefined method can.

**stop\_polling** (*self*) → None

**stop\_polling** (*self*, *with\_db\_upd*) → None

Stop all polling for a device. if the device is polled, call this method before deleting it.

**Parameters**

**with\_db\_upd** (*bool*) Is it necessary to update db ?

**Return** None

*New in PyTango 7.1.2*

**unregister\_signal** (*self*, *signo*) → None

Unregister a signal. Unregister this device as device to be informed when signal signo is sent to to the device server process

**Parameters**

**signo** (*int*) signal identifier

**Return** None

**warn\_stream** (*self*, *msg*, \**args*) → None

Sends the given message to the tango warn stream.

Since PyTango 7.1.3, the same can be achieved with:

```
print(msg, file=self.log_warn)
```

**Parameters**

**msg** (*str*) the message to be sent to the warn stream

**Return** None

**write\_attr\_hardware** (*self*) → None

Write the hardware for attributes. Default method to implement an action necessary on a device to write the hardware involved in a a write attribute. This method must be redefined in sub-classes in order to support writable attribute

**Parameters**

**attr\_list** [(sequence<int>) list of indices in the device object attribute vector] of an attribute to be written.

**Return** None

**Throws** *DevFailed* This method does not throw exception but a redefined method can.

### 5.3.3 DeviceClass

**class** tango.**DeviceClass**

Base class for all TANGO device-class class. A TANGO device-class class is a class where is stored all data/method common to all devices of a TANGO device class

**add\_wiz\_class\_prop** (*self*, *str*, *str*) → None

**add\_wiz\_class\_prop** (*self*, *str*, *str*, *str*) -> None

For internal usage only

**Parameters** None

**Return** None

**add\_wiz\_dev\_prop** (*self*, *str*, *str*) → None

**add\_wiz\_dev\_prop** (*self*, *str*, *str*, *str*) -> None

For internal usage only

**Parameters** None

**Return** None

**create\_device** (*self*, *device\_name*, *alias=None*, *cb=None*) → None

Creates a new device of the given class in the database, creates a new DeviceImpl for it and calls `init_device` (just like it is done for existing devices when the DS starts up)

An optional parameter callback is called AFTER the device is registered in the database and BEFORE the `init_device` for the newly created device is called

**Throws `tango.DevFailed`:**

- the device name exists already or
- the given class is not registered for this DS.
- the cb is not a callable

*New in PyTango 7.1.2*

**Parameters**

**device\_name** (`str`) the device name

**alias** (`str`) optional alias. Default value is None meaning do not create device alias

**cb** (`callable`) a callback that is called AFTER the device is registered in the database and BEFORE the `init_device` for the newly created device is called. Typically you may want to put device and/or attribute properties in the database here. The callback must receive a parameter: device name (`str`). Default value is None meaning no callback

**Return** None

**delete\_device** (*self*, *class\_name*, *device\_name*) → None

Deletes an existing device from the database and from this running server

**Throws `tango.DevFailed`:**

- the device name doesn't exist in the database
- the device name doesn't exist in this DS.

*New in PyTango 7.1.2*

**Parameters**

**class\_name** (`str`) the device class name

**device\_name** (`str`) the device name

**Return** None

**device\_destroyer** (*name*)  
for internal usage only

**device\_factory** (*device\_list*)  
for internal usage only

**device\_name\_factory** (*self*, *dev\_name\_list*) → None

Create device(s) name list (for no database device server). This method can be re-defined in DeviceClass sub-class for device server started without database. Its rule is to initialise class device name. The default method does nothing.

**Parameters**

**dev\_name\_list** (*seq*) sequence of devices to be filled

**Return** None

**dyn\_attr** (*self, device\_list*) → None

Default implementation does not do anything Overwrite in order to provide dynamic attributes

**Parameters**

**device\_list** (*seq*) sequence of devices of this class

**Return** None

**export\_device** (*self, dev, corba\_dev\_name = 'Unused'*) → None

For internal usage only

**Parameters**

**dev** (*DeviceImpl*) device object

**corba\_dev\_name** (*str*) CORBA device name. Default value is 'Unused'

**Return** None

**get\_cmd\_by\_name** (*self, (str)cmd\_name*) → *tango.Command*

Get a reference to a command object.

**Parameters**

**cmd\_name** (*str*) command name

**Return** (*tango.Command*) *tango.Command* object

*New in PyTango 8.0.0*

**get\_command\_list** (*self*) → *sequence<tango.Command>*

Gets the list of *tango.Command* objects for this class

**Parameters** None

**Return** (*sequence<tango.Command>*) list of *tango.Command* objects for this class

*New in PyTango 8.0.0*

**get\_cvs\_location** (*self*) → None

Gets the cvs localtion

**Parameters** None

**Return** (*str*) cvs location

**get\_cvs\_tag** (*self*) → *str*

Gets the cvs tag

**Parameters** None

**Return** (*str*) cvs tag

**get\_device\_list** (*self*) → *sequence<tango.DeviceImpl>*

Gets the list of `tango.DeviceImpl` objects for this class

**Parameters** None

**Return** (sequence<`tango.DeviceImpl`>) list of `tango.DeviceImpl` objects for this class

**get\_doc\_url** (*self*) → str

Get the TANGO device class documentation URL.

**Parameters** None

**Return** (str) the TANGO device type name

**get\_name** (*self*) → str

Get the TANGO device class name.

**Parameters** None

**Return** (str) the TANGO device class name.

**get\_type** (*self*) → str

Gets the TANGO device type name.

**Parameters** None

**Return** (str) the TANGO device type name

**register\_signal** (*self*, *signo*) → None

**register\_signal** (*self*, *signo*, *own\_handler=false*) → None

Register a signal. Register this class as class to be informed when signal `signo` is sent to to the device server process. The second version of the method is available only under Linux.

**Throws `tango.DevFailed`:**

- if the signal number is out of range
- if the operating system failed to register a signal for the process.

**Parameters**

**signo** (int) signal identifier

**own\_handler** (bool) true if you want the device signal handler to be executed in its own handler instead of being executed by the signal thread. If this parameter is set to true, care should be taken on how the handler is written. A default false value is provided

**Return** None

**set\_type** (*self*, *dev\_type*) → None

Set the TANGO device type name.

**Parameters**

**dev\_type** (str) the new TANGO device type name

**Return** None



**signal\_handler** (*self, signo*) → None

Signal handler.

The method executed when the signal arrived in the device server process. This method is defined as virtual and then, can be redefined following device class needs.

**Parameters**

**signo** (*int*) signal identifier

**Return** None

**unregister\_signal** (*self, signo*) → None

Unregister a signal. Unregister this class as class to be informed when signal signo is sent to to the device server process

**Parameters**

**signo** (*int*) signal identifier

**Return** None

### 5.3.4 Logging decorators

#### LogIt

**class** `tango.LogIt` (*show\_args=False, show\_kwargs=False, show\_ret=False*)

A class designed to be a decorator of any method of a `tango.DeviceImpl` subclass. The idea is to log the entrance and exit of any decorated method.

Example:

```
class MyDevice(tango.Device_4Impl):

    @tango.LogIt()
    def read_Current(self, attr):
        attr.set_value(self._current, 1)
```

All log messages generated by this class have DEBUG level. If you wish to have different log level messages, you should implement subclasses that log to those levels. See, for example, `tango.InfoIt`.

**The constructor receives three optional arguments:**

- `show_args` - shows method arguments in log message (defaults to False)
- `show_kwargs` - shows keyword method arguments in log message (defaults to False)
- `show_ret` - shows return value in log message (defaults to False)

#### DebugIt

**class** `tango.DebugIt` (*show\_args=False, show\_kwargs=False, show\_ret=False*)

A class designed to be a decorator of any method of a `tango.DeviceImpl` subclass. The idea is to log the entrance and exit of any decorated method as DEBUG level records.

Example:

```
class MyDevice(tango.Device_4Impl):  
  
    @tango.DebugIt()  
    def read_Current(self, attr):  
        attr.set_value(self._current, 1)
```

All log messages generated by this class have DEBUG level.

**The constructor receives three optional arguments:**

- `show_args` - shows method arguments in log message (defaults to False)
- `show_kwargs` - shows keyword method arguments in log message (defaults to False)
- `show_ret` - shows return value in log message (defaults to False)

### InfoIt

**class** `tango.InfoIt` (*show\_args=False, show\_kwargs=False, show\_ret=False*)

A class designed to be a decorator of any method of a `tango.DeviceImpl` subclass. The idea is to log the entrance and exit of any decorated method as INFO level records.

Example:

```
class MyDevice(tango.Device_4Impl):  
  
    @tango.InfoIt()  
    def read_Current(self, attr):  
        attr.set_value(self._current, 1)
```

All log messages generated by this class have INFO level.

**The constructor receives three optional arguments:**

- `show_args` - shows method arguments in log message (defaults to False)
- `show_kwargs` - shows keyword method arguments in log message (defaults to False)
- `show_ret` - shows return value in log message (defaults to False)

### WarnIt

**class** `tango.WarnIt` (*show\_args=False, show\_kwargs=False, show\_ret=False*)

A class designed to be a decorator of any method of a `tango.DeviceImpl` subclass. The idea is to log the entrance and exit of any decorated method as WARN level records.

Example:

```
class MyDevice(tango.Device_4Impl):  
  
    @tango.WarnIt()  
    def read_Current(self, attr):  
        attr.set_value(self._current, 1)
```

All log messages generated by this class have WARN level.

**The constructor receives three optional arguments:**

- `show_args` - shows method arguments in log message (defaults to False)
- `show_kwargs` - shows keyword method arguments in log message (defaults to False)
- `show_ret` - shows return value in log message (defaults to False)

## ErrorIt

**class** `tango.ErrorIt` (*show\_args=False, show\_kwargs=False, show\_ret=False*)

A class designed to be a decorator of any method of a `tango.DeviceImpl` subclass. The idea is to log the entrance and exit of any decorated method as ERROR level records.

Example:

```
class MyDevice(tango.Device_4Impl):

    @tango.ErrorIt()
    def read_Current(self, attr):
        attr.set_value(self._current, 1)
```

All log messages generated by this class have ERROR level.

**The constructor receives three optional arguments:**

- `show_args` - shows method arguments in log message (defaults to False)
- `show_kwargs` - shows keyword method arguments in log message (defaults to False)
- `show_ret` - shows return value in log message (defaults to False)

## FatalIt

**class** `tango.FatalIt` (*show\_args=False, show\_kwargs=False, show\_ret=False*)

A class designed to be a decorator of any method of a `tango.DeviceImpl` subclass. The idea is to log the entrance and exit of any decorated method as FATAL level records.

Example:

```
class MyDevice(tango.Device_4Impl):

    @tango.FatalIt()
    def read_Current(self, attr):
        attr.set_value(self._current, 1)
```

All log messages generated by this class have FATAL level.

**The constructor receives three optional arguments:**

- `show_args` - shows method arguments in log message (defaults to False)
- `show_kwargs` - shows keyword method arguments in log message (defaults to False)
- `show_ret` - shows return value in log message (defaults to False)

## 5.3.5 Attribute classes

### Attr

**class** `tango.Attr`

This class represents a Tango writable attribute.

**get\_assoc** (*self*) → str

Get the associated name.

**Parameters** None

**Return** (bool) the associated name

**get\_cl\_name** (*self*) → str

Returns the class name

**Parameters** None

**Return** (`str`) the class name

*New in PyTango 7.2.0*

**get\_class\_properties** (*self*) → sequence<AttrProperty>

Get the class level attribute properties

**Parameters** None

**Return** (sequence<AttrProperty>) the class attribute properties

**get\_disp\_level** (*self*) → DispLevel

Get the attribute display level

**Parameters** None

**Return** (*DispLevel*) the attribute display level

**get\_format** (*self*) → AttrDataFormat

Get the attribute format

**Parameters** None

**Return** (*AttrDataFormat*) the attribute format

**get\_memorized** (*self*) → bool

Determine if the attribute is memorized or not.

**Parameters** None

**Return** (`bool`) True if the attribute is memorized

**get\_memorized\_init** (*self*) → bool

Determine if the attribute is written at startup from the memorized value if it is memorized

**Parameters** None

**Return** (`bool`) True if initialized with memorized value or not

**get\_name** (*self*) → str

Get the attribute name.

**Parameters** None

**Return** (`str`) the attribute name

**get\_polling\_period** (*self*) → int

Get the polling period (mS)

**Parameters** None

**Return** (`int`) the polling period (mS)

**get\_type** (*self*) → int

Get the attribute data type

**Parameters** None

**Return** (`int`) the attribute data type

**get\_user\_default\_properties** (*self*) → `sequence<AttrProperty>`

Get the user default attribute properties

**Parameters** None

**Return** (`sequence<AttrProperty>`) the user default attribute properties

**get\_writable** (*self*) → `AttrWriteType`

Get the attribute write type

**Parameters** None

**Return** (`AttrWriteType`) the attribute write type

**is\_archive\_event** (*self*) → `bool`

Check if the archive event is fired manually for this attribute.

**Parameters** None

**Return** (`bool`) true if a manual fire archive event is implemented.

**is\_assoc** (*self*) → `bool`

Determine if it is assoc.

**Parameters** None

**Return** (`bool`) if it is assoc

**is\_change\_event** (*self*) → `bool`

Check if the change event is fired manually for this attribute.

**Parameters** None

**Return** (`bool`) true if a manual fire change event is implemented.

**is\_check\_archive\_criteria** (*self*) → `bool`

Check if the archive event criteria should be checked when firing the event manually.

**Parameters** None

**Return** (`bool`) true if a archive event criteria will be checked.

**is\_check\_change\_criteria** (*self*) → `bool`

Check if the change event criteria should be checked when firing the event manually.

**Parameters** None

**Return** (`bool`) true if a change event criteria will be checked.

**is\_data\_ready\_event** (*self*) → `bool`

Check if the data ready event is fired for this attribute.

**Parameters** None

**Return** (`bool`) true if firing data ready event is implemented.

*New in PyTango 7.2.0*

**set\_archive\_event** (*self*) → None

Set a flag to indicate that the server fires archive events manually without the polling to be started for the attribute. If the detect parameter is set to true, the criteria specified for the archive event are verified and the event is only pushed if they are fulfilled.

If detect is set to false the event is fired without checking!

**Parameters**

**implemented** (`bool`) True when the server fires change events manually.

**detect** (`bool`) Triggers the verification of the archive event properties when set to true.

**Return** None

**set\_change\_event** (*self*, *implemented*, *detect*) → None

Set a flag to indicate that the server fires change events manually without the polling to be started for the attribute. If the detect parameter is set to true, the criteria specified for the change event are verified and the event is only pushed if they are fulfilled.

If detect is set to false the event is fired without checking!

**Parameters**

**implemented** (`bool`) True when the server fires change events manually.

**detect** (`bool`) Triggers the verification of the change event properties when set to true.

**Return** None

**set\_cl\_name** (*self*, *cl*) → None

Sets the class name

**Parameters**

**cl** (`str`) new class name

**Return** None

*New in PyTango 7.2.0*

**set\_class\_properties** (*self*, *props*) → None

Set the class level attribute properties

**Parameters**

**props** (`StdAttrPropertyVector`) new class level attribute properties

**Return** None

**set\_data\_ready\_event** (*self*, *implemented*) → None

Set a flag to indicate that the server fires data ready events.

**Parameters**

**implemented** (`bool`) True when the server fires data ready events

**Return** None

*New in PyTango 7.2.0*

**set\_default\_properties** (*self*) → None

Set default attribute properties.

**Parameters**

**attr\_prop** (*UserDefaultAttrProp*) the user default property class

**Return** None

**set\_disp\_level** (*self, disp\_level*) → None

Set the attribute display level.

**Parameters**

**disp\_level** (*DispLevel*) the new display level

**Return** None

**set\_memorized** (*self*) → None

Set the attribute as memorized in database (only for scalar and writable attribute)  
With no argument the setpoint will be written to the attribute during initialisation!

**Parameters** None

**Return** None

**set\_memorized\_init** (*self, write\_on\_init*) → None

Set the initialisation flag for memorized attributes true = the setpoint value will be written to the attribute on initialisation false = only the attribute setpoint is initialised. No action is taken on the attribute

**Parameters**

**write\_on\_init** (`bool`) if true the setpoint value will be written to the attribute on initialisation

**Return** None

**set\_polling\_period** (*self, period*) → None

Set the attribute polling update period.

**Parameters**

**period** (`int`) the attribute polling period (in mS)

**Return** None

## Attribute

**class** `tango.Attribute`

This class represents a Tango attribute.

**check\_alarm** (*self*) → bool

Check if the attribute read value is below/above the alarm level.

**Parameters** None

**Return** (bool) true if the attribute is in alarm condition.

**Throws** *DevFailed* If no alarm level is defined.

**get\_assoc\_ind** (*self*) → int

Get index of the associated writable attribute.

**Parameters** None

**Return** (int) the index in the main attribute vector of the associated writable attribute

**get\_assoc\_name** (*self*) → str

Get name of the associated writable attribute.

**Parameters** None

**Return** (str) the associated writable attribute name

**get\_attr\_serial\_model** (*self*) → AttrSerialModel

Get attribute serialization model.

**Parameters** None

**Return** (AttrSerialModel) The attribute serialization model

*New in PyTango 7.1.0*

**get\_data\_format** (*self*) → AttrDataFormat

Get attribute data format.

**Parameters** None

**Return** (AttrDataFormat) the attribute data format

**get\_data\_size** (*self*) → None

Get attribute data size.

**Parameters** None

**Return** (int) the attribute data size

**get\_data\_type** (*self*) → int

Get attribute data type.

**Parameters** None

**Return** (int) the attribute data type

**get\_date** (*self*) → TimeVal



Get a COPY of the attribute date.

**Parameters** None

**Return** (*TimeVal*) the attribute date

**get\_label** (*self*) → str

Get attribute label property.

**Parameters** None

**Return** (*str*) the attribute label

**get\_max\_dim\_x** (*self*) → int

Get attribute maximum data size in x dimension.

**Parameters** None

**Return** (*int*) the attribute maximum data size in x dimension. Set to 1 for scalar attribute

**get\_max\_dim\_y** (*self*) → int

Get attribute maximum data size in y dimension.

**Parameters** None

**Return** (*int*) the attribute maximum data size in y dimension. Set to 0 for scalar attribute

**get\_name** (*self*) → str

Get attribute name.

**Parameters** None

**Return** (*str*) The attribute name

**get\_polling\_period** (*self*) → int

Get attribute polling period.

**Parameters** None

**Return** (*int*) The attribute polling period in mS. Set to 0 when the attribute is not polled

**get\_properties** (*self*, *attr\_cfg = None*) → AttributeConfig

Get attribute properties.

**Parameters**

**conf** the config object to be filled with the attribute configuration. Default is None meaning the method will create internally a new AttributeConfig\_5 and return it. Can be AttributeConfig, AttributeConfig\_2, AttributeConfig\_3, AttributeConfig\_5 or MultiAttrProp

**Return** (*AttributeConfig*) the config object filled with attribute configuration information

*New in PyTango 7.1.4*

**get\_quality** (*self*) → AttrQuality

Get a COPY of the attribute data quality.

**Parameters** None

**Return** (*AttrQuality*) the attribute data quality

**get\_writable** (*self*) → AttrWriteType

Get the attribute writable type (RO/WO/RW).

**Parameters** None

**Return** (*AttrWriteType*) The attribute write type.

**get\_x** (*self*) → int

Get attribute data size in x dimension.

**Parameters** None

**Return** (*int*) the attribute data size in x dimension. Set to 1 for scalar attribute

**get\_y** (*self*) → int

Get attribute data size in y dimension.

**Parameters** None

**Return** (*int*) the attribute data size in y dimension. Set to 1 for scalar attribute

**is\_archive\_event** (*self*) → bool

Check if the archive event is fired manually (without polling) for this attribute.

**Parameters** None

**Return** (*bool*) True if a manual fire archive event is implemented.

*New in PyTango 7.1.0*

**is\_change\_event** (*self*) → bool

Check if the change event is fired manually (without polling) for this attribute.

**Parameters** None

**Return** (*bool*) True if a manual fire change event is implemented.

*New in PyTango 7.1.0*

**is\_check\_archive\_criteria** (*self*) → bool

Check if the archive event criteria should be checked when firing the event manually.

**Parameters** None

**Return** (*bool*) True if a archive event criteria will be checked.

*New in PyTango 7.1.0*

**is\_check\_change\_criteria** (*self*) → bool

Check if the change event criteria should be checked when firing the event manually.

**Parameters** None

**Return** (`bool`) True if a change event criteria will be checked.

*New in PyTango 7.1.0*

**`is_data_ready_event`** (*self*) → `bool`

Check if the data ready event is fired manually (without polling) for this attribute.

**Parameters** None

**Return** (`bool`) True if a manual fire data ready event is implemented.

*New in PyTango 7.2.0*

**`is_max_alarm`** (*self*) → `bool`

Check if the attribute is in maximum alarm condition.

**Parameters** None

**Return** (`bool`) true if the attribute is in alarm condition (read value above the max. alarm).

**`is_max_warning`** (*self*) → `bool`

Check if the attribute is in maximum warning condition.

**Parameters** None

**Return** (`bool`) true if the attribute is in warning condition (read value above the max. warning).

**`is_min_alarm`** (*self*) → `bool`

Check if the attribute is in minimum alarm condition.

**Parameters** None

**Return** (`bool`) true if the attribute is in alarm condition (read value below the min. alarm).

**`is_min_warning`** (*self*) → `bool`

Check if the attribute is in minimum warning condition.

**Parameters** None

**Return** (`bool`) true if the attribute is in warning condition (read value below the min. warning).

**`is_polled`** (*self*) → `bool`

Check if the attribute is polled.

**Parameters** None

**Return** (`bool`) true if the attribute is polled.

**`is_rds_alarm`** (*self*) → `bool`

Check if the attribute is in RDS alarm condition.

**Parameters** None

**Return** (`bool`) true if the attribute is in RDS condition (Read Different than Set).

**is\_write\_associated** (*self*) → `bool`

Check if the attribute has an associated writable attribute.

**Parameters** None

**Return** (`bool`) True if there is an associated writable attribute

**remove\_configuration** (*self*) → `None`

Remove the attribute configuration from the database. This method can be used to clean-up all the configuration of an attribute to come back to its default values or the remove all configuration of a dynamic attribute before deleting it.

The method removes all configured attribute properties and removes the attribute from the list of polled attributes.

**Parameters** None

**Return** None

*New in PyTango 7.1.0*

**set\_archive\_event** (*self*, *implemented*, *detect = True*) → `None`

Set a flag to indicate that the server fires archive events manually, without the polling to be started for the attribute. If the `detect` parameter is set to true, the criteria specified for the archive event are verified and the event is only pushed if they are fulfilled.

**Parameters**

**implemented** (`bool`) True when the server fires archive events manually.

**detect** (`bool`) (optional, default is True) Triggers the verification of the archive event properties when set to true.

**Return** None

*New in PyTango 7.1.0*

**set\_assoc\_ind** (*self*, *index*) → `None`

Set index of the associated writable attribute.

**Parameters**

**index** (`int`) The new index in the main attribute vector of the associated writable attribute

**Return** None

**set\_attr\_serial\_model** (*self*, *ser\_model*) → `void`

Set attribute serialization model. This method allows the user to choose the attribute serialization model.

**Parameters**

**ser\_model** (`AttrSerialModel`) The new serialisation model. The serialization model must be one of `ATTR_BY_KERNEL`, `ATTR_BY_USER` or `ATTR_NO_SYNC`

**Return** None

*New in PyTango 7.1.0*

**set\_change\_event** (*self, implemented, detect = True*) → None

Set a flag to indicate that the server fires change events manually, without the polling to be started for the attribute. If the detect parameter is set to true, the criteria specified for the change event are verified and the event is only pushed if they are fulfilled. If detect is set to false the event is fired without any value checking!

#### Parameters

**implemented** (*bool*) True when the server fires change events manually.

**detect** (*bool*) (optional, default is True) Triggers the verification of the change event properties when set to true.

**Return** None

*New in PyTango 7.1.0*

**set\_data\_ready\_event** (*self, implemented*) → None

Set a flag to indicate that the server fires data ready events.

#### Parameters

**implemented** (*bool*) True when the server fires data ready events manually.

**Return** None

*New in PyTango 7.2.0*

**set\_date** (*self, new\_date*) → None

Set attribute date.

#### Parameters

**new\_date** (*TimeVal*) the attribute date

**Return** None

**set\_properties** (*self, attr\_cfg, dev*) → None

Set attribute properties.

This method sets the attribute properties value with the content of the files in the AttributeConfig/ AttributeConfig\_3 object

#### Parameters

**conf** (AttributeConfig or AttributeConfig\_3) the config object.

**dev** (DeviceImpl) the device (not used, maintained for backward compatibility)

*New in PyTango 7.1.4*

**set\_quality** (*self, quality, send\_event=False*) → None

Set attribute data quality.

#### Parameters

**quality** (*AttrQuality*) the new attribute data quality

**send\_event** (`bool`) true if a change event should be sent. Default is false.

**Return** None

**set\_value** (*self*, *data*, *dim\_x* = 1, *dim\_y* = 0) → None <= DEPRECATED

**set\_value** (*self*, *data*) -> None

**set\_value** (*self*, *str\_data*, *data*) -> None

Set internal attribute value. This method stores the attribute read value inside the object. This method also stores the date when it is called and initializes the attribute quality factor.

#### Parameters

**data** the data to be set. Data must be compatible with the attribute type and format. In the DEPRECATED form for SPECTRUM and IMAGE attributes, data can be any type of FLAT sequence of elements compatible with the attribute type. In the new form (without *dim\_x* or *dim\_y*) data should be any sequence for SPECTRUM and a SEQUENCE of equal-length SEQUENCES for IMAGE attributes. The recommended sequence is a C continuous and aligned numpy array, as it can be optimized.

**str\_data** (`str`) special variation for DevEncoded data type. In this case 'data' must be a str or an object with the buffer interface.

**dim\_x** (`int`) [DEPRECATED] the attribute x length. Default value is 1

**dim\_y** (`int`) [DEPRECATED] the attribute y length. Default value is 0

**Return** None

**set\_value\_date\_quality** (*self*, *data*, *time\_stamp*, *quality*, *dim\_x* = 1, *dim\_y* = 0) → None <= DEPRECATED

**set\_value\_date\_quality** (*self*, *data*, *time\_stamp*, *quality*) -> None

**set\_value\_date\_quality** (*self*, *str\_data*, *data*, *time\_stamp*, *quality*) -> None

Set internal attribute value, date and quality factor. This method stores the attribute read value, the date and the attribute quality factor inside the object.

#### Parameters

**data** the data to be set. Data must be compatible with the attribute type and format. In the DEPRECATED form for SPECTRUM and IMAGE attributes, data can be any type of FLAT sequence of elements compatible with the attribute type. In the new form (without *dim\_x* or *dim\_y*) data should be any sequence for SPECTRUM and a SEQUENCE of equal-length SEQUENCES for IMAGE attributes. The recommended sequence is a C continuous and aligned numpy array, as it can be optimized.

**str\_data** (*str*) special variation for DevEncoded data type. In this case 'data' must be a str or an object with the buffer interface.

**dim\_x** (*int*) [DEPRECATED] the attribute x length. Default value is 1

**dim\_y** (*int*) [DEPRECATED] the attribute y length. Default value is 0

**time\_stamp** (*double*) the time stamp

**quality** (*AttrQuality*) the attribute quality factor

**Return** None

## WAttribute

**class** tango.WAttribute

This class represents a Tango writable attribute.

**get\_max\_value** (*self*) → obj

Get attribute maximum value or throws an exception if the attribute does not have a maximum value.

**Parameters** None

**Return** (obj) an object with the python maximum value

**get\_min\_value** (*self*) → obj

Get attribute minimum value or throws an exception if the attribute does not have a minimum value.

**Parameters** None

**Return** (obj) an object with the python minimum value

**get\_write\_value** (*self, lst*) → None <= DEPRECATED

**get\_write\_value** (*self, extract\_as=ExtractAs.Numpy*) → obj

Retrieve the new value for writable attribute.

**Parameters**

**extract\_as** (*ExtractAs*)

**lst** [out] (list) a list object that will be filled with the attribute write value (DEPRECATED)

**Return** (obj) the attribute write value.

**get\_write\_value\_length** (*self*) → int

Retrieve the new value length (data number) for writable attribute.

**Parameters** None

**Return** (*int*) the new value data length

**is\_max\_value** (*self*) → bool

Check if the attribute has a maximum value.

**Parameters** None

**Return** (`bool`) true if the attribute has a maximum value defined

`is_min_value` (*self*) → `bool`

Check if the attribute has a minimum value.

**Parameters** None

**Return** (`bool`) true if the attribute has a minimum value defined

`set_max_value` (*self*, *data*) → `None`

Set attribute maximum value.

**Parameters**

**data** the attribute maximum value. python data type must be compatible with the attribute data format and type.

**Return** `None`

`set_min_value` (*self*, *data*) → `None`

Set attribute minimum value.

**Parameters**

**data** the attribute minimum value. python data type must be compatible with the attribute data format and type.

**Return** `None`

## MultiAttribute

**class** `tango.MultiAttribute`

There is one instance of this class for each device. This class is mainly an aggregate of `Attribute` or `WAttribute` objects. It eases management of multiple attributes

`check_alarm` (*self*) → `bool`

`check_alarm` (*self*, *attr\_name*) → `bool`

`check_alarm` (*self*, *ind*) → `bool`

- The 1st version of the method checks alarm on all attribute(s) with an alarm defined.
- The 2nd version of the method checks alarm for one attribute with a given name.
- The 3rd version of the method checks alarm for one attribute from its index in the main attributes vector.

**Parameters**

**attr\_name** (`str`) attribute name

**ind** (`int`) the attribute index

**Return** (`bool`) True if at least one attribute is in alarm condition

**Throws** `DevFailed` If at least one attribute does not have any alarm level defined

*New in PyTango 7.0.0*

`get_attr_by_ind` (*self*, *ind*) → `Attribute`



Get *Attribute* object from its index. This method returns an *Attribute* object from the index in the main attribute vector.

**Parameters**

**ind** (*int*) the attribute index

**Return** (*Attribute*) the attribute object

**get\_attr\_by\_name** (*self, attr\_name*) → *Attribute*

Get *Attribute* object from its name. This method returns an *Attribute* object with a name passed as parameter. The equality on attribute name is case independant.

**Parameters**

**attr\_name** (*str*) attribute name

**Return** (*Attribute*) the attribute object

**Throws** *DevFailed* If the attribute is not defined.

**get\_attr\_ind\_by\_name** (*self, attr\_name*) → *int*

Get Attribute index into the main attribute vector from its name. This method returns the index in the Attribute vector (stored in the *MultiAttribute* object) of an attribute with a given name. The name equality is case independant.

**Parameters**

**attr\_name** (*str*) attribute name

**Return** (*int*) the attribute index

**Throws** *DevFailed* If the attribute is not found in the vector.

*New in PyTango 7.0.0*

**get\_attr\_nb** (*self*) → *int*

Get attribute number.

**Parameters** None

**Return** (*int*) the number of attributes

*New in PyTango 7.0.0*

**get\_attribute\_list** (*self*) → *seq*<*Attribute*>

Get the list of attribute objects.

**Return** (*seq*) list of attribute objects

*New in PyTango 7.2.1*

**get\_w\_attr\_by\_ind** (*self, ind*) → *WAttribute*

Get a writable attribute object from its index. This method returns an *WAttribute* object from the index in the main attribute vector.

**Parameters**

**ind** (*int*) the attribute index

**Return** (*WAttribute*) the attribute object

**get\_w\_attr\_by\_name** (*self*, *attr\_name*) → WAttribute

Get a writable attribute object from its name. This method returns an *WAttribute* object with a name passed as parameter. The equality on attribute name is case independant.

**Parameters**

**attr\_name** (*str*) attribute name

**Return** (*WAttribute*) the attribute object

**Throws** *DevFailed* If the attribute is not defined.

**read\_alarm** (*self*, *status*) → None

Add alarm message to device status. This method add alarm message to the string passed as parameter. A message is added for each attribute which is in alarm condition

**Parameters**

**status** (*str*) a string (should be the device status)

**Return** None

*New in PyTango 7.0.0*

## UserDefaultAttrProp

**class** `tango.UserDefaultAttrProp`

User class to set attribute default properties. This class is used to set attribute default properties. Three levels of attributes properties setting are implemented within Tango. The highest property setting level is the database. Then the user default (set using this `UserDefaultAttrProp` class) and finally a Tango library default value

**set\_abs\_change** (*self*, *def\_abs\_change*) → None <= DEPRECATED

Set default change event `abs_change` property.

**Parameters**

**def\_abs\_change** (*str*) the user default change event `abs_change` property

**Return** None

Deprecated since PyTango 8.0. Please use `set_event_abs_change` instead.

**set\_archive\_abs\_change** (*self*, *def\_archive\_abs\_change*) → None <= DEPRECATED

Set default archive event `abs_change` property.

**Parameters**

**def\_archive\_abs\_change** (*str*) the user default archive event `abs_change` property

**Return** None

Deprecated since PyTango 8.0. Please use `set_archive_event_abs_change` instead.

**set\_archive\_event\_abs\_change** (*self*, *def\_archive\_abs\_change*) → None

Set default archive event `abs_change` property.

**Parameters**

**def\_archive\_abs\_change** (`str`) the user default archive event abs\_change property

**Return** None

*New in PyTango 8.0*

**set\_archive\_event\_period** (`self`, `def_archive_period`) → None

Set default archive event period property.

**Parameters**

**def\_archive\_period** (`str`) t

**Return** None

*New in PyTango 8.0*

**set\_archive\_event\_rel\_change** (`self`, `def_archive_rel_change`) → None

Set default archive event rel\_change property.

**Parameters**

**def\_archive\_rel\_change** (`str`) the user default archive event rel\_change property

**Return** None

*New in PyTango 8.0*

**set\_archive\_period** (`self`, `def_archive_period`) → None <= DEPRECATED

Set default archive event period property.

**Parameters**

**def\_archive\_period** (`str`) t

**Return** None

Deprecated since PyTango 8.0. Please use set\_archive\_event\_period instead.

**set\_archive\_rel\_change** (`self`, `def_archive_rel_change`) → None <= DEPRECATED

Set default archive event rel\_change property.

**Parameters**

**def\_archive\_rel\_change** (`str`) the user default archive event rel\_change property

**Return** None

Deprecated since PyTango 8.0. Please use set\_archive\_event\_rel\_change instead.

**set\_delta\_t** (`self`, `def_delta_t`) → None

Set default RDS alarm delta\_t property.

**Parameters**

**def\_delta\_t** (`str`) the user default RDS alarm delta\_t property

**Return** None

**set\_delta\_val** (*self*, *def\_delta\_val*) → None

Set default RDS alarm delta\_val property.

**Parameters**

**def\_delta\_val** (*str*) the user default RDS alarm delta\_val property

**Return** None

**set\_description** (*self*, *def\_description*) → None

Set default description property.

**Parameters**

**def\_description** (*str*) the user default description property

**Return** None

**set\_display\_unit** (*self*, *def\_display\_unit*) → None

Set default display unit property.

**Parameters**

**def\_display\_unit** (*str*) the user default display unit property

**Return** None

**set\_enum\_labels** (*self*, *enum\_labels*) → None

Set default enumeration labels.

**Parameters**

**enum\_labels** (*seq*) list of enumeration labels

*New in PyTango 9.2.0*

**set\_event\_abs\_change** (*self*, *def\_abs\_change*) → None

Set default change event abs\_change property.

**Parameters**

**def\_abs\_change** (*str*) the user default change event abs\_change property

**Return** None

*New in PyTango 8.0*

**set\_event\_period** (*self*, *def\_period*) → None

Set default periodic event period property.

**Parameters**

**def\_period** (*str*) the user default periodic event period property

**Return** None

*New in PyTango 8.0*

**set\_event\_rel\_change** (*self*, *def\_rel\_change*) → None

Set default change event rel\_change property.

**Parameters**

**def\_rel\_change** (`str`) the user default change event rel\_change property

**Return** None

*New in PyTango 8.0*

**set\_format** (*self*, *def\_format*) → None

Set default format property.

**Parameters**

**def\_format** (`str`) the user default format property

**Return** None

**set\_label** (*self*, *def\_label*) → None

Set default label property.

**Parameters**

**def\_label** (`str`) the user default label property

**Return** None

**set\_max\_alarm** (*self*, *def\_max\_alarm*) → None

Set default max\_alarm property.

**Parameters**

**def\_max\_alarm** (`str`) the user default max\_alarm property

**Return** None

**set\_max\_value** (*self*, *def\_max\_value*) → None

Set default max\_value property.

**Parameters**

**def\_max\_value** (`str`) the user default max\_value property

**Return** None

**set\_max\_warning** (*self*, *def\_max\_warning*) → None

Set default max\_warning property.

**Parameters**

**def\_max\_warning** (`str`) the user default max\_warning property

**Return** None

**set\_min\_alarm** (*self*, *def\_min\_alarm*) → None

Set default min\_alarm property.

**Parameters**

**def\_min\_alarm** (`str`) the user default min\_alarm property

**Return** None

**set\_min\_value** (*self*, *def\_min\_value*) → None

Set default min\_value property.

**Parameters**

**def\_min\_value** (*str*) the user default min\_value property

**Return** None

**set\_min\_warning** (*self*, *def\_min\_warning*) → None

Set default min\_warning property.

**Parameters**

**def\_min\_warning** (*str*) the user default min\_warning property

**Return** None

**set\_period** (*self*, *def\_period*) → None <= DEPRECATED

Set default periodic event period property.

**Parameters**

**def\_period** (*str*) the user default periodic event period property

**Return** None

Deprecated since PyTango 8.0. Please use set\_event\_period instead.

**set\_rel\_change** (*self*, *def\_rel\_change*) → None <= DEPRECATED

Set default change event rel\_change property.

**Parameters**

**def\_rel\_change** (*str*) the user default change event rel\_change property

**Return** None

Deprecated since PyTango 8.0. Please use set\_event\_rel\_change instead.

**set\_standard\_unit** (*self*, *def\_standard\_unit*) → None

Set default standard unit property.

**Parameters**

**def\_standard\_unit** (*str*) the user default standard unit property

**Return** None

**set\_unit** (*self*, *def\_unit*) → None

Set default unit property.

**Parameters**

**def\_unit** (*str*) te user default unit property

**Return** None

### 5.3.6 Util

#### **class** `tango.Util`

This class is used to store TANGO device server process data and to provide the user with a set of utilities method.

This class is implemented using the singleton design pattern. Therefore a device server process can have only one instance of this class and its constructor is not public. Example:

```
util = tango.Util.instance()
print(util.get_host_name())
```

#### **add\_Cpp\_TgClass** (*device\_class\_name, tango\_device\_class\_name*)

Register a new C++ tango class.

If there is a shared library file called MotorClass.so which contains a MotorClass class and a `_create_MotorClass_class` method. Example:

```
util.add_Cpp_TgClass('MotorClass', 'Motor')
```

---

**Note:** the parameter 'device\_class\_name' must match the shared library name.

---

Deprecated since version 7.1.2: Use `tango.Util.add_class()` instead.

#### **add\_TgClass** (*class\_device\_class, class\_device, device\_class\_name=None*)

Register a new python tango class. Example:

```
util.add_TgClass(MotorClass, Motor)
util.add_TgClass(MotorClass, Motor, 'Motor') # equivalent to previous line
```

Deprecated since version 7.1.2: Use `tango.Util.add_class()` instead.

#### **add\_class** (*self, class<DeviceClass>, class<DeviceImpl>, language="python"*) → None

Register a new tango class ('python' or 'c++').

If language is 'python' then args must be the same as `tango.Util.add_TgClass()`. Otherwise, args should be the ones in `tango.Util.add_Cpp_TgClass()`. Example:

```
util.add_class(MotorClass, Motor)
util.add_class('CounterClass', 'Counter', language='c++')
```

*New in PyTango 7.1.2*

#### **connect\_db** (*self*) → None

Connect the process to the TANGO database. If the connection to the database failed, a message is displayed on the screen and the process is aborted

**Parameters** None

**Return** None

#### **create\_device** (*self, class\_name, device\_name, alias=None, cb=None*) → None

Creates a new device of the given class in the database, creates a new DeviceImpl for it and calls `init_device` (just like it is done for existing devices when the DS starts up)

An optional parameter callback is called AFTER the device is registered in the database and BEFORE the `init_device` for the newly created device is called

**Throws** `tango.DevFailed`:

- the device name exists already or
- the given class is not registered for this DS.
- the cb is not a callable

*New in PyTango 7.1.2*

**Parameters**

**class\_name** (*str*) the device class name

**device\_name** (*str*) the device name

**alias** (*str*) optional alias. Default value is None meaning do not create device alias

**cb** (*callable*) a callback that is called AFTER the device is registered in the database and BEFORE the `init_device` for the newly created device is called. Typically you may want to put device and/or attribute properties in the database here. The callback must receive a parameter: device name (*str*). Default value is None meaning no callback

**Return** None

**delete\_device** (*self, class\_name, device\_name*) → None

Deletes an existing device from the database and from this running server

**Throws `tango.DevFailed`:**

- the device name doesn't exist in the database
- the device name doesn't exist in this DS.

*New in PyTango 7.1.2*

**Parameters**

**class\_name** (*str*) the device class name

**device\_name** (*str*) the device name

**Return** None

**get\_class\_list** (*self*) → seq<DeviceClass>

Returns a list of objects of inheriting from DeviceClass

**Parameters** None

**Return** (*seq*) a list of objects of inheriting from DeviceClass

**get\_database** (*self*) → Database

Get a reference to the TANGO database object

**Parameters** None

**Return** (*Database*) the database

*New in PyTango 7.0.0*

**get\_device\_by\_name** (*self, dev\_name*) → DeviceImpl

Get a device reference from its name

**Parameters**

**dev\_name** (*str*) The TANGO device name



**Return** (`DeviceImpl`) The device reference

*New in PyTango 7.0.0*

**get\_device\_list** (*self*) → `sequence<DeviceImpl>`

Get device list from name. It is possible to use a wild card (\*) in the name parameter (e.g. "\*", "/tango/tangotest/n\*", ...)

**Parameters** None

**Return** (`sequence<DeviceImpl>`) the list of device objects

*New in PyTango 7.0.0*

**get\_device\_list\_by\_class** (*self*, *class\_name*) → `sequence<DeviceImpl>`

Get the list of device references for a given TANGO class. Return the list of references for all devices served by one implementation of the TANGO device pattern implemented in the process.

**Parameters**

**class\_name** (`str`) The TANGO device class name

**Return** (`sequence<DeviceImpl>`) The device reference list

*New in PyTango 7.0.0*

**get\_ds\_exec\_name** (*self*) → `str`

Get a COPY of the device server executable name.

**Parameters** None

**Return** (`str`) a COPY of the device server executable name.

*New in PyTango 3.0.4*

**get\_ds\_inst\_name** (*self*) → `str`

Get a COPY of the device server instance name.

**Parameters** None

**Return** (`str`) a COPY of the device server instance name.

*New in PyTango 3.0.4*

**get\_ds\_name** (*self*) → `str`

Get the device server name. The device server name is the <device server executable name>/<the device server instance name>

**Parameters** None

**Return** (`str`) device server name

*New in PyTango 3.0.4*

**get\_dserver\_device** (*self*) → `DServer`

Get a reference to the dserver device attached to the device server process

**Parameters** None

**Return** (`DServer`) A reference to the dserver device

*New in PyTango 7.0.0*

**get\_host\_name** (*self*) → str

Get the host name where the device server process is running.

**Parameters** None

**Return** (str) the host name where the device server process is running

*New in PyTango 3.0.4*

**get\_pid** (*self*) → TangoSys\_Pid

Get the device server process identifier.

**Parameters** None

**Return** (int) the device server process identifier

**get\_pid\_str** (*self*) → str

Get the device server process identifier as a string.

**Parameters** None

**Return** (str) the device server process identifier as a string

*New in PyTango 3.0.4*

**get\_polling\_threads\_pool\_size** (*self*) → int

Get the polling threads pool size.

**Parameters** None

**Return** (int) the maximum number of threads in the polling threads pool

**get\_serial\_model** (*self*) → SerialModel

Get the serialization model.

**Parameters** None

**Return** (*SerialModel*) the serialization model

**get\_server\_version** (*self*) → str

Get the device server version.

**Parameters** None

**Return** (str) the device server version.

**get\_sub\_dev\_diag** (*self*) → SubDevDiag

Get the internal sub device manager

**Parameters** None

**Return** (SubDevDiag) the sub device manager

*New in PyTango 7.0.0*

**get\_tango\_lib\_release** (*self*) → int

Get the TANGO library version number.

**Parameters** None

**Return** (`int`) The Tango library release number coded in 3 digits (for instance 550,551,552,600,...)

**get\_trace\_level** (`self`) → `int`

Get the process trace level.

**Parameters** None

**Return** (`int`) the process trace level.

**get\_version\_str** (`self`) → `str`

Get the IDL TANGO version.

**Parameters** None

**Return** (`str`) the IDL TANGO version.

*New in PyTango 3.0.4*

**is\_device\_restarting** (`self`, (`str`)`dev_name`) → `bool`

Check if the device is actually restarted by the device server process admin device with its DevRestart command

**Parameters** `dev_name` : (`str`) device name

**Return** (`bool`) True if the device is restarting.

*New in PyTango 8.0.0*

**is\_svr\_shutting\_down** (`self`) → `bool`

Check if the device server process is in its shutting down sequence

**Parameters** None

**Return** (`bool`) True if the server is in its shutting down phase.

*New in PyTango 8.0.0*

**is\_svr\_starting** (`self`) → `bool`

Check if the device server process is in its starting phase

**Parameters** None

**Return** (`bool`) True if the server is in its starting phase

*New in PyTango 8.0.0*

**reset\_filedatabase** (`self`) → `None`

Reread the file database

**Parameters** None

**Return** `None`

*New in PyTango 7.0.0*

**server\_init** (`self`, `with_window = False`) → `None`

Initialize all the device server pattern(s) embedded in a device server process.

**Parameters**

**with\_window** (`bool`) default value is `False`

**Return** `None`

**Throws** `DevFailed` If the device pattern initialistaion failed

**server\_run** (`self`) → `None`

Run the CORBA event loop. This method runs the CORBA event loop. For UNIX or Linux operating system, this method does not return. For Windows in a non-console mode, this method start a thread which enter the CORBA event loop.

**Parameters** `None`

**Return** `None`

**server\_set\_event\_loop** (`self`, `event_loop`) → `None`

This method registers an event loop function in a Tango server. This function will be called by the process main thread in an infinite loop The process will not use the classical ORB blocking event loop. It is the user responsibility to code this function in a way that it implements some kind of blocking in order not to load the computer CPU. The following piece of code is an example of how you can use this feature:

```
_LOOP_NB = 1
def looping():
    global _LOOP_NB
    print "looping", _LOOP_NB
    time.sleep(0.1)
    _LOOP_NB += 1
    return _LOOP_NB > 100

def main():
    py = tango.Util(sys.argv)

    # ...

    U = tango.Util.instance()
    U.server_set_event_loop(looping)
    U.server_init()
    U.server_run()
```

**Parameters** `None`

**Return** `None`

*New in PyTango 8.1.0*

**set\_polling\_threads\_pool\_size** (`self`, `thread_nb`) → `None`

Set the polling threads pool size.

**Parameters**

**thread\_nb** (`int`) the maximun number of threads in the polling threads pool

**Return** `None`

*New in PyTango 7.0.0*

**set\_serial\_model** (`self`, `ser`) → `None`

Set the serialization model.

**Parameters**

**ser** (*SerialModel*) the new serialization model. The serialization model must be one of BY\_DEVICE, BY\_CLASS, BY\_PROCESS or NO\_SYNC

**Return** None

**set\_server\_version** (*self, vers*) → None

Set the device server version.

**Parameters**

**vers** (*str*) the device server version

**Return** None

**set\_trace\_level** (*self, level*) → None

Set the process trace level.

**Parameters**

**level** (*int*) the new process level

**Return** None

**trigger\_attr\_polling** (*self, dev, name*) → None

Trigger polling for polled attribute. This method send the order to the polling thread to poll one object registered with an update period defined as “externally triggered”

**Parameters**

**dev** (*DeviceImpl*) the TANGO device

**name** (*str*) the attribute name which must be polled

**Return** None

**trigger\_cmd\_polling** (*self, dev, name*) → None

Trigger polling for polled command. This method send the order to the polling thread to poll one object registered with an update period defined as “externally triggered”

**Parameters**

**dev** (*DeviceImpl*) the TANGO device

**name** (*str*) the command name which must be polled

**Return** None

**Throws** *DevFailed* If the call failed

**unregister\_server** (*self*) → None

Unregister a device server process from the TANGO database. If the database call fails, a message is displayed on the screen and the process is aborted

**Parameters** None

**Return** None

*New in PyTango 7.0.0*

## 5.4 Database API

### **class** tango.Database

Database is the high level Tango object which contains the link to the static database. Database provides methods for all database commands : `get_device_property()`, `put_device_property()`, `info()`, etc.. To create a Database, use the default constructor. Example:

```
db = Database()
```

The constructor uses the `TANGO_HOST` env. variable to determine which instance of the Database to connect to.

**add\_device** (*self, dev\_info*) → None

Add a device to the database. The device name, server and class are specified in the `DbDevInfo` structure

#### Example

```
dev_info = DbDevInfo()
dev_info.name = 'my/own/device'
dev_info._class = 'MyDevice'
dev_info.server = 'MyServer/test'
db.add_device(dev_info)
```

#### Parameters

**dev\_info** (*DbDevInfo*) device information

**Return** None

**add\_server** (*self, servername, dev\_info, with\_dserver=False*) → None

Add a (group of) devices to the database. This is considered as a low level call because it may render the database inconsistent if it is not used properly.

If `with_dserver` parameter is set to `False` (default), this call will only register the given `dev_info(s)`. You should include in the list of `dev_info` an entry to the usually hidden **DServer** device.

If `with_dserver` parameter is set to `True`, the call will add an additional **DServer** device if it is not included in the `dev_info` parameter.

Example using `with_dserver=True`:

```
dev_info1 = DbDevInfo()
dev_info1.name = 'my/own/device'
dev_info1._class = 'MyDevice'
dev_info1.server = 'MyServer/test'
db.add_server(dev_info1.server, dev_info, with_dserver=True)
```

Same example using `with_dserver=False`:

```
dev_info1 = DbDevInfo()
dev_info1.name = 'my/own/device'
dev_info1._class = 'MyDevice'
dev_info1.server = 'MyServer/test'

dev_info2 = DbDevInfo()
dev_info2.name = 'dserver/' + dev_info1.server
```

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```

dev_info1._class = 'DServer
dev_info1.server = dev_info1.server

dev_info = dev_info1, dev_info2
db.add_server(dev_info1.server, dev_info)

```

New in version 8.1.7: added *with\_dserver* parameter

#### Parameters

**servername** (`str`) server name

**dev\_info** (sequence<DbDevInfo> | DbDevInfos | DbDevInfo) containing the server device(s) information

**with\_dserver** (`bool`) whether or not to auto create **DServer** device in server

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**build\_connection** (*self*) → None

Tries to build a connection to the Database server.

**Parameters** None

**Return** None

*New in PyTango 7.0.0*

**check\_access\_control** (*self*, *dev\_name*) → AccessControlType

Check the access for the given device for this client.

#### Parameters

**dev\_name** (`str`) device name

**Return** the access control type as a AccessControlType object

*New in PyTango 7.0.0*

**check\_tango\_host** (*self*, *tango\_host\_env*) → None

Check the TANGO\_HOST environment variable syntax and extract database server host(s) and port(s) from it.

#### Parameters

**tango\_host\_env** (`str`) The TANGO\_HOST env. variable value

**Return** None

*New in PyTango 7.0.0*

**delete\_attribute\_alias** (*self*, *alias*) → None

Remove the alias associated to an attribute name.

#### Parameters

**alias** (`str`) alias

**Return** None

Throws *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**delete\_class\_attribute\_property** (*self*, *class\_name*, *value*) → None

Delete a list of attribute properties for the specified class.

**Parameters**

**class\_name** (*str*) class name

**propnames** can be one of the following:

1. DbData [in] - several property data to be deleted
2. sequence<str> [in]- several property data to be deleted
3. sequence<DbDatum> [in] - several property data to be deleted
4. dict<str, seq<str>> keys are attribute names and value being a list of attribute property names

**Return** None

Throws *ConnectionFailed*, *CommunicationFailed* *DevFailed* from device (DB\_SQLError)

**delete\_class\_property** (*self*, *class\_name*, *value*) → None

Delete a the given of properties for the specified class.

**Parameters**

**class\_name** (*str*) class name

**value** can be one of the following:

1. str [in] - single property data to be deleted
2. DbDatum [in] - single property data to be deleted
3. DbData [in] - several property data to be deleted
4. sequence<str> [in]- several property data to be deleted
5. sequence<DbDatum> [in] - several property data to be deleted
6. dict<str, obj> [in] - keys are property names to be deleted (values are ignored)
7. dict<str, DbDatum> [in] - several DbDatum.name are property names to be deleted (keys are ignored)

**Return** None

Throws *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**delete\_device** (*self*, *dev\_name*) → None

Delete the device of the specified name from the database.

**Parameters**

**dev\_name** (*str*) device name

**Return** None



**delete\_device\_alias** (*self, alias*) → void

Delete a device alias

**Parameters**

**alias** (*str*) alias name

**Return** None

**delete\_device\_attribute\_property** (*self, dev\_name, value*) → None

Delete a list of attribute properties for the specified device.

**Parameters**

**devname** (*string*) device name

**propnames** can be one of the following: 1. DbData [in] - several property data to be deleted 2. sequence<str> [in]- several property data to be deleted 3. sequence<DbDatum> [in] - several property data to be deleted 3. dict<str, seq<str>> keys are attribute names and value being a list of attribute property names

**Return** None

**Throws** *ConnectionFailed, CommunicationFailed, DevFailed* from device (DB\_SQLError)

**delete\_device\_property** (*self, dev\_name, value*) → None

Delete a the given of properties for the specified device.

**Parameters**

**dev\_name** (*str*) object name

**value** can be one of the following: 1. str [in] - single property data to be deleted 2. DbDatum [in] - single property data to be deleted 3. DbData [in] - several property data to be deleted 4. sequence<str> [in]- several property data to be deleted 5. sequence<DbDatum> [in] - several property data to be deleted 6. dict<str, obj> [in] - keys are property names to be deleted (values are ignored) 7. dict<str, DbDatum> [in] - several DbDatum.name are property names to be deleted (keys are ignored)

**Return** None

**Throws** *ConnectionFailed, CommunicationFailed, DevFailed* from device (DB\_SQLError)

**delete\_property** (*self, obj\_name, value*) → None

Delete a the given of properties for the specified object.

**Parameters**

**obj\_name** (*str*) object name

**value** can be one of the following:

1. str [in] - single property data to be deleted
2. DbDatum [in] - single property data to be deleted
3. DbData [in] - several property data to be deleted
4. sequence<string> [in]- several property data to be deleted

5. `sequence<DbDatum> [in]` - several property data to be deleted
6. `dict<str, obj> [in]` - keys are property names to be deleted (values are ignored)
7. `dict<str, DbDatum> [in]` - several `DbDatum.name` are property names to be deleted (keys are ignored)

**Return** None

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

**delete\_server** (`self, server`) → None

Delete the device server and its associated devices from database.

**Parameters**

**server** (`str`) name of the server to be deleted with format: `<server name>/<instance>`

**Return** None

**delete\_server\_info** (`self, server`) → None

Delete server information of the specified server from the database.

**Parameters**

**server** (`str`) name of the server to be deleted with format: `<server name>/<instance>`

**Return** None

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

*New in PyTango 3.0.4*

**export\_device** (`self, dev_export`) → None

Update the export info for this device in the database.

**Example**

```
dev_export = DbDevExportInfo()
dev_export.name = 'my/own/device'
dev_export.iior = <the real iior>
dev_export.host = <the host>
dev_export.version = '3.0'
dev_export.pid = '....'
db.export_device(dev_export)
```

**Parameters**

**dev\_export** (`DbDevExportInfo`) export information

**Return** None

**export\_event** (`self, event_data`) → None

Export an event to the database.

**Parameters**

**eventdata** (sequence<str>) event data (same as DbExportEvent Database command)

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 7.0.0*

**export\_server** (*self*, *dev\_info*) → None

Export a group of devices to the database.

**Parameters**

**devinfo** (sequence<DbDevExportInfo> | DbDevExportInfos | DbDevExportInfo) containing the device(s) to export information

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**get\_access\_except\_errors** (*self*) → DevErrorList

Returns a reference to the control access exceptions.

**Parameters** None

**Return** DevErrorList

*New in PyTango 7.0.0*

**get\_alias** (*self*, *alias*) → str

Get the device alias name from its name.

**Parameters**

**alias** (str) device name

**Return** alias

*New in PyTango 3.0.4*

Deprecated since version 8.1.0: Use *get\_alias\_from\_device()* instead

**get\_alias\_from\_attribute** (*self*, *attr\_name*) → str

Get the attribute alias from the full attribute name.

**Parameters**

**attr\_name** (str) full attribute name

**Return** attribute alias

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 8.1.0*

**get\_alias\_from\_device** (*self*, *alias*) → str

Get the device alias name from its name.

**Parameters**

**alias** (`str`) device name

**Return** alias

*New in PyTango 8.1.0*

**get\_attribute\_alias** (*self*, *alias*) → `str`

Get the full attribute name from an alias.

**Parameters**

**alias** (`str`) attribute alias

**Return** full attribute name

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

Deprecated since version 8.1.0: Use `:class:`Database().get_attribute_from_alias`` instead

**get\_attribute\_alias\_list** (*self*, *filter*) → `DbDatum`

Get attribute alias list. The parameter alias is a string to filter the alias list returned. Wildcard (\*) is supported. For instance, if the string alias passed as the method parameter is initialised with only the \* character, all the defined attribute alias will be returned. If there is no alias with the given filter, the returned array will have a 0 size.

**Parameters**

**filter** (`str`) attribute alias filter

**Return** `DbDatum` containing the list of matching attribute alias

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

**get\_attribute\_from\_alias** (*self*, *alias*) → `str`

Get the full attribute name from an alias.

**Parameters**

**alias** (`str`) attribute alias

**Return** full attribute name

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

*New in PyTango 8.1.0*

**get\_class\_attribute\_list** (*self*, *class\_name*, *wildcard*) → `DbDatum`

Query the database for a list of attributes defined for the specified class which match the specified wildcard.

**Parameters**

**class\_name** (`str`) class name

**wildcard** (`str`) attribute name

**Return** `DbDatum` containing the list of matching attributes for the given class

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

*New in PyTango 7.0.0*

**get\_class\_attribute\_property** (*self*, *class\_name*, *value*) → dict<str, dict<str, seq<str>>

Query the database for a list of class attribute properties for the specified class. The method returns all the properties for the specified attributes.

#### Parameters

**class\_name** (*str*) class name

**propnames** can be one of the following:

1. *str* [*in*] - single attribute properties to be fetched
2. *DbDatum* [*in*] - single attribute properties to be fetched
3. *DbData* [*in,out*] - several attribute properties to be fetched In this case (direct C++ API) the *DbData* will be filled with the property values
4. *sequence<str>* [*in*] - several attribute properties to be fetched
5. *sequence<DbDatum>* [*in*] - several attribute properties to be fetched
6. *dict<str, obj>* [*in,out*] - keys are attribute names In this case the given dict values will be changed to contain the several attribute property values

**Return** a dictionary which keys are the attribute names the value associated with each key being a another dictionary where keys are property names and value is a sequence of strings being the property value.

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (*DB\_SQLError*)

**get\_class\_attribute\_property\_history** (*self*, *dev\_name*, *attr\_name*, *prop\_name*) → *DbHistoryList*

Delete a list of properties for the specified class. This corresponds to the pure C++ API call.

#### Parameters

**dev\_name** (*str*) device name

**attr\_name** (*str*) attribute name

**prop\_name** (*str*) property name

**Return** *DbHistoryList* containing the list of modifications

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (*DB\_SQLError*)

*New in PyTango 7.0.0*

**get\_class\_for\_device** (*self*, *dev\_name*) → *str*

Return the class of the specified device.

#### Parameters

**dev\_name** (*str*) device name

**Return** a string containing the device class

**get\_class\_inheritance\_for\_device** (*self, dev\_name*) → DbDatum

Return the class inheritance scheme of the specified device.

**Parameters**

**devn\_ame** (*str*) device name

**Return** DbDatum with the inheritance class list

*New in PyTango 7.0.0*

**get\_class\_list** (*self, wildcard*) → DbDatum

Query the database for a list of classes which match the specified wildcard

**Parameters**

**wildcard** (*str*) class wildcard

**Return** DbDatum containing the list of matching classes

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 7.0.0*

**get\_class\_property** (*self, class\_name, value*) → dict<str, seq<str>>

Query the database for a list of class properties.

**Parameters**

**class\_name** (*str*) class name

**value** can be one of the following:

1. str [in] - single property data to be fetched
2. tango.DbDatum [in] - single property data to be fetched
3. tango.DbData [in,out] - several property data to be fetched  
In this case (direct C++ API) the DbData will be filled with the property values
4. sequence<str> [in] - several property data to be fetched
5. sequence<DbDatum> [in] - several property data to be fetched
6. dict<str, obj> [in,out] - keys are property names In this case the given dict values will be changed to contain the several property values

**Return** a dictionary which keys are the property names the value associated with each key being a a sequence of strings being the property value.

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**get\_class\_property\_history** (*self, class\_name, prop\_name*) → DbHistoryList

Get the list of the last 10 modifications of the specified class property. Note that propname can contain a wildcard character (eg: 'prop\*').

**Parameters**

**class\_name** (*str*) class name

**prop\_name** (*str*) property name

**Return** DbHistoryList containing the list of modifications

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 7.0.0*

**get\_class\_property\_list** (*self*, *class\_name*) → DbDatum

Query the database for a list of properties defined for the specified class.

**Parameters**

**class\_name** (*str*) class name

**Return** DbDatum containing the list of properties for the specified class

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**get\_device\_alias** (*self*, *alias*) → str

Get the device name from an alias.

**Parameters**

**alias** (*str*) alias

**Return** device name

Deprecated since version 8.1.0: Use *get\_device\_from\_alias()* instead

**get\_device\_alias\_list** (*self*, *filter*) → DbDatum

Get device alias list. The parameter alias is a string to filter the alias list returned. Wildcard (\*) is supported.

**Parameters**

**filter** (*str*) a string with the alias filter (wildcard (\*) is supported)

**Return** DbDatum with the list of device names

*New in PyTango 7.0.0*

**get\_device\_attribute\_property** (*self*, *dev\_name*, *value*) → dict<str, dict<str, seq<str>>>

Query the database for a list of device attribute properties for the specified device. The method returns all the properties for the specified attributes.

**Parameters**

**dev\_name** (*string*) device name

**value** can be one of the following:

1. str [in] - single attribute properties to be fetched
2. DbDatum [in] - single attribute properties to be fetched
3. DbData [in,out] - several attribute properties to be fetched In this case (direct C++ API) the DbData will be filled with the property values
4. sequence<str> [in] - several attribute properties to be fetched
5. sequence<DbDatum> [in] - several attribute properties to be fetched

- dict<str, obj> [in,out] - keys are attribute names In this case the given dict values will be changed to contain the several attribute property values

**Return** a dictionary which keys are the attribute names the value associated with each key being a another dictionary where keys are property names and value is a DbDatum containing the property value.

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**get\_device\_attribute\_property\_history** (*self*, *dev\_name*, *att\_name*, *prop\_name*) → DbHistoryList

Get the list of the last 10 modifications of the specified device attribute property. Note that proname and devname can contain a wildcard character (eg: 'prop\*').

#### Parameters

**dev\_name** (*str*) device name

**attn\_ame** (*str*) attribute name

**prop\_name** (*str*) property name

**Return** DbHistoryList containing the list of modifications

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 7.0.0*

**get\_device\_class\_list** (*self*, *server*) → DbDatum

Query the database for a list of devices and classes served by the specified server. Return a list with the following structure: [device name, class name, device name, class name, ...]

#### Parameters

**server** (*str*) name of the server with format: <server name>/<instance>

**Return** DbDatum containing list with the following structure: [device\_name, class name]

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 3.0.4*

**get\_device\_domain** (*self*, *wildcard*) → DbDatum

Query the database for a list of of device domain names which match the wildcard provided (\* is wildcard for any character(s)). Domain names are case insensitive.

#### Parameters

**wildcard** (*str*) domain filter

**Return** DbDatum with the list of device domain names

**get\_device\_exported** (*self*, *filter*) → DbDatum

Query the database for a list of exported devices whose names satisfy the supplied filter (\* is wildcard for any character(s))



**Parameters****filter** (`str`) device name filter (wildcard)**Return** DbDatum with the list of exported devices**get\_device\_exported\_for\_class** (*self*, *class\_name*) → DbDatum

Query database for list of exported devices for the specified class.

**Parameters****class\_name** (`str`) class name**Return** DbDatum with the list of exported devices for the*New in PyTango 7.0.0***get\_device\_family** (*self*, *wildcard*) → DbDatum

Query the database for a list of device family names which match the wildcard provided (\* is wildcard for any character(s)). Family names are case insensitive.

**Parameters****wildcard** (`str`) family filter**Return** DbDatum with the list of device family names**get\_device\_from\_alias** (*self*, *alias*) → str

Get the device name from an alias.

**Parameters****alias** (`str`) alias**Return** device name*New in PyTango 8.1.0***get\_device\_info** (*self*, *dev\_name*) → DbDevFullInfo

Query the database for the full info of the specified device.

**Example**

```

dev_info = db.get_device_info('my/own/device')
print(dev_info.name)
print(dev_info.class_name)
print(dev_info.ds_full_name)
print(dev_info.exported)
print(dev_info.iior)
print(dev_info.version)
print(dev_info.pid)
print(dev_info.started_date)
print(dev_info.stopped_date)

```

**Parameters****dev\_name** (`str`) device name**Return** DbDevFullInfo*New in PyTango 8.1.0***get\_device\_member** (*self*, *wildcard*) → DbDatum

Query the database for a list of device member names which match the wildcard provided (\* is wildcard for any character(s)). Member names are case insensitive.

**Parameters**

**wildcard** (*str*) member filter

**Return** DbDatum with the list of device member names

**get\_device\_name** (*self, serv\_name, class\_name*) → DbDatum

Query the database for a list of devices served by a server for a given device class

**Parameters**

**serv\_name** (*str*) server name

**class\_name** (*str*) device class name

**Return** DbDatum with the list of device names

**get\_device\_property** (*self, dev\_name, value*) → dict<str, seq<str>>

Query the database for a list of device properties.

**Parameters**

**dev\_name** (*str*) object name

**value** can be one of the following:

1. *str* [in] - single property data to be fetched
2. DbDatum [in] - single property data to be fetched
3. DbData [in,out] - several property data to be fetched In this case (direct C++ API) the DbData will be filled with the property values
4. sequence<str> [in] - several property data to be fetched
5. sequence<DbDatum> [in] - several property data to be fetched
6. dict<str, obj> [in,out] - keys are property names In this case the given dict values will be changed to contain the several property values

**Return** a dictionary which keys are the property names the value associated with each key being a a sequence of strings being the property value.

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**get\_device\_property\_history** (*self, dev\_name, prop\_name*) → DbHistoryList

Get the list of the last 10 modifications of the specified device property. Note that propname can contain a wildcard character (eg: 'prop\*'). This corresponds to the pure C++ API call.

**Parameters**

**serv\_name** (*str*) server name

**prop\_name** (*str*) property name

**Return** DbHistoryList containing the list of modifications

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 7.0.0*

**get\_device\_property\_list** (*self*, *dev\_name*, *wildcard*, *array=None*) → DbData

Query the database for a list of properties defined for the specified device and which match the specified wildcard. If array parameter is given, it must be an object implementing the 'append' method. If given, it is filled with the matching property names. If not given the method returns a new DbDatum containing the matching property names.

*New in PyTango 7.0.0*

**Parameters**

**dev\_name** (*str*) device name

**wildcard** (*str*) property name wildcard

**array** [out] (sequence) (optional) array that will contain the matching property names.

**Return** if container is None, return is a new DbDatum containing the matching property names. Otherwise returns the given array filled with the property names

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device

**get\_device\_service\_list** (*self*, *dev\_name*) → DbDatum

Query database for the list of services provided by the given device.

**Parameters**

**dev\_name** (*str*) device name

**Return** DbDatum with the list of services

*New in PyTango 8.1.0*

**get\_file\_name** (*self*) → str

Returns the database file name or throws an exception if not using a file database

**Parameters** None

**Return** a string containing the database file name

**Throws** *DevFailed*

*New in PyTango 7.2.0*

**get\_host\_list** (*self*) → DbDatum

**get\_host\_list** (*self*, *wildcard*) → DbDatum

Returns the list of all host names registered in the database.

**Parameters**

**wildcard** (*str*) (optional) wildcard (eg: 'l-c0\*')

**Return** DbDatum with the list of registered host names

**get\_host\_server\_list** (*self*, *host\_name*) → DbDatum

Query the database for a list of servers registered on the specified host.

**Parameters**

**host\_name** (*str*) host name

**Return** DbDatum containing list of servers for the specified host

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 3.0.4*

**get\_info** (*self*) → str

Query the database for some general info about the tables.

**Parameters** None

**Return** a multiline string

**get\_instance\_name\_list** (*self*, *serv\_name*) → DbDatum

Return the list of all instance names existing in the database for the specified server.

**Parameters**

**serv\_name** (*str*) server name with format <server name>

**Return** DbDatum containing list of instance names for the specified server

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 3.0.4*

**get\_object\_list** (*self*, *wildcard*) → DbDatum

Query the database for a list of object (free properties) for which properties are defined and which match the specified wildcard.

**Parameters**

**wildcard** (*str*) object wildcard

**Return** DbDatum containing the list of object names matching the given wildcard

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 7.0.0*

**get\_object\_property\_list** (*self*, *obj\_name*, *wildcard*) → DbDatum

Query the database for a list of properties defined for the specified object and which match the specified wildcard.

**Parameters**

**obj\_name** (*str*) object name

**wildcard** (*str*) property name wildcard

**Return** DbDatum with list of properties defined for the specified object and which match the specified wildcard

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 7.0.0*

**get\_property** (*self*, *obj\_name*, *value*) → dict<str, seq<str>>

Query the database for a list of object (i.e non-device) properties.

#### Parameters

**obj\_name** (`str`) object name

**value** can be one of the following:

1. `str` [in] - single property data to be fetched
2. `DbDatum` [in] - single property data to be fetched
3. `DbData` [in,out] - several property data to be fetched In this case (direct C++ API) the `DbData` will be filled with the property values
4. `sequence<str>` [in] - several property data to be fetched
5. `sequence<DbDatum>` [in] - several property data to be fetched
6. `dict<str, obj>` [in,out] - keys are property names In this case the given dict values will be changed to contain the several property values

**Return** a dictionary which keys are the property names the value associated with each key being a a sequence of strings being the property value.

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

**get\_property\_forced** (`obj_name`, `value`)

`get_property(self, obj_name, value) -> dict<str, seq<str>>`

Query the database for a list of object (i.e non-device) properties.

#### Parameters

**obj\_name** (`str`) object name

**value** can be one of the following:

1. `str` [in] - single property data to be fetched
2. `DbDatum` [in] - single property data to be fetched
3. `DbData` [in,out] - several property data to be fetched In this case (direct C++ API) the `DbData` will be filled with the property values
4. `sequence<str>` [in] - several property data to be fetched
5. `sequence<DbDatum>` [in] - several property data to be fetched
6. `dict<str, obj>` [in,out] - keys are property names In this case the given dict values will be changed to contain the several property values

**Return** a dictionary which keys are the property names the value associated with each key being a a sequence of strings being the property value.

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

**get\_property\_history** (`self`, `obj_name`, `prop_name`) → `DbHistoryList`

Get the list of the last 10 modifications of the specified object property. Note that propname can contain a wildcard character (eg: 'prop\*')

**Parameters**

**serv\_name** (*str*) server name

**prop\_name** (*str*) property name

**Return** DbHistoryList containing the list of modifications

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 7.0.0*

**get\_server\_class\_list** (*self*, *server*) → DbDatum

Query the database for a list of classes instanced by the specified server. The DServer class exists in all TANGO servers and for this reason this class is removed from the returned list.

**Parameters**

**server** (*str*) name of the server to be deleted with format: <server name>/<instance>

**Return** DbDatum containing list of class names instanced by the specified server

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 3.0.4*

**get\_server\_info** (*self*, *server*) → DbServerInfo

Query the database for server information.

**Parameters**

**server** (*str*) name of the server to be unexported with format: <server name>/<instance>

**Return** DbServerInfo with server information

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 3.0.4*

**get\_server\_list** (*self*) → DbDatum

**get\_server\_list** (*self*, *wildcard*) → DbDatum

Return the list of all servers registered in the database. If wildcard parameter is given, then the the list matching servers will be returned (ex: Serial/\*)

**Parameters**

**wildcard** (*str*) host wildcard (ex: Serial/\*)

**Return** DbDatum containing list of registered servers

**get\_server\_name\_list** (*self*) → DbDatum

Return the list of all server names registered in the database.

**Parameters** None

**Return** DbDatum containing list of server names

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 3.0.4*

**get\_services** (*self*, *serv\_name*, *inst\_name*) → DbDatum

Query database for specified services.

**Parameters**

**serv\_name** (*str*) service name

**inst\_name** (*str*) instance name (can be a wildcard character ('\*'))

**Return** DbDatum with the list of available services

*New in PyTango 3.0.4*

**import\_device** (*self*, *dev\_name*) → DbDevImportInfo

Query the database for the export info of the specified device.

**Example**

```
dev_imp_info = db.import_device('my/own/device')
print(dev_imp_info.name)
print(dev_imp_info.exported)
print(dev_imp_info.iior)
print(dev_imp_info.version)
```

**Parameters**

**dev\_name** (*str*) device name

**Return** DbDevImportInfo

**is\_control\_access\_checked** (*self*) → bool

Returns True if control access is checked or False otherwise.

**Parameters** None

**Return** (*bool*) True if control access is checked or False

*New in PyTango 7.0.0*

**is\_multi\_tango\_host** (*self*) → bool

Returns if in multi tango host.

**Parameters** None

**Return** True if multi tango host or False otherwise

*New in PyTango 7.1.4*

**put\_attribute\_alias** (*self*, *attr\_name*, *alias*) → None

Set an alias for an attribute name. The attribute alias is specified by aliasname and the attribute name is specified by attrname. If the given alias already exists, a DevFailed exception is thrown.

**Parameters**

**attr\_name** (*str*) full attribute name

**alias** (*str*) alias

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**put\_class\_attribute\_property** (*self*, *class\_name*, *value*) → None

Insert or update a list of properties for the specified class.

**Parameters**

**class\_name** (*str*) class name

**propdata** can be one of the following:

1. tango.DbData - several property data to be inserted
2. sequence<DbDatum> - several property data to be inserted
3. dict<str, dict<str, obj>> keys are attribute names and value being another dictionary which keys are the attribute property names and the value associated with each key being:
  - 3.1 seq<str>
  - 3.2 tango.DbDatum

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**put\_class\_property** (*self*, *class\_name*, *value*) → None

Insert or update a list of properties for the specified class.

**Parameters**

**class\_name** (*str*) class name

**value** can be one of the following: 1. DbDatum - single property data to be inserted 2. DbData - several property data to be inserted 3. sequence<DbDatum> - several property data to be inserted 4. dict<str, DbDatum> - keys are property names and value has data to be inserted 5. dict<str, obj> - keys are property names and str(obj) is property value 6. dict<str, seq<str>> - keys are property names and value has data to be inserted

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**put\_device\_alias** (*self*, *dev\_name*, *alias*) → None

Query database for list of exported devices for the specified class.

**Parameters**

**dev\_name** (*str*) device name

**alias** (*str*) alias name

**Return** None

**put\_device\_attribute\_property** (*self*, *dev\_name*, *value*) → None

Insert or update a list of properties for the specified device.



**Parameters****dev\_name** (*str*) device name**value** can be one of the following:

1. DbData - several property data to be inserted
2. sequence<DbDatum> - several property data to be inserted
3. dict<str, dict<str, obj>> keys are attribute names and value being another dictionary which keys are the attribute property names and the value associated with each key being:
  - 3.1 seq<str>
  - 3.2 tango.DbDatum

**Return** None**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)**put\_device\_property** (*self*, *dev\_name*, *value*) → None

Insert or update a list of properties for the specified device.

**Parameters****dev\_name** (*str*) object name**value** can be one of the following:

1. DbDatum - single property data to be inserted
2. DbData - several property data to be inserted
3. sequence<DbDatum> - several property data to be inserted
4. dict<str, DbDatum> - keys are property names and value has data to be inserted
5. dict<str, obj> - keys are property names and str(obj) is property value
6. dict<str, seq<str>> - keys are property names and value has data to be inserted

**Return** None**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)**put\_property** (*self*, *obj\_name*, *value*) → None

Insert or update a list of properties for the specified object.

**Parameters****obj\_name** (*str*) object name**value** can be one of the following:

1. DbDatum - single property data to be inserted
2. DbData - several property data to be inserted
3. sequence<DbDatum> - several property data to be inserted
4. dict<str, DbDatum> - keys are property names and value has data to be inserted
5. dict<str, obj> - keys are property names and str(obj) is property value

- dict<str, seq<str>> - keys are property names and value has data to be inserted

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

**put\_server\_info** (*self*, *info*) → None

Add/update server information in the database.

**Parameters**

**info** (*DbServerInfo*) new server information

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 3.0.4*

**register\_service** (*self*, *serv\_name*, *inst\_name*, *dev\_name*) → None

Register the specified service within the database.

**Parameters**

**serv\_name** (*str*) service name

**inst\_name** (*str*) instance name

**dev\_name** (*str*) device name

**Return** None

*New in PyTango 3.0.4*

**rename\_server** (*self*, *old\_ds\_name*, *new\_ds\_name*) → None

Rename a device server process.

**Parameters**

**old\_ds\_name** (*str*) old name

**new\_ds\_name** (*str*) new name

**Return** None

**Throws** *ConnectionFailed*, *CommunicationFailed*, *DevFailed* from device (DB\_SQLError)

*New in PyTango 8.1.0*

**reread\_filedatabase** (*self*) → None

Force a complete refresh over the database if using a file based database.

**Parameters** None

**Return** None

*New in PyTango 7.0.0*

**set\_access\_checked** (*self*, *val*) → None

Sets or unsets the control access check.

**Parameters**

**val** (`bool`) True to set or False to unset the access control

**Return** None

*New in PyTango 7.0.0*

**unexport\_device** (*self*, *dev\_name*) → None

Mark the specified device as unexported in the database

**Example**

```
db.unexport_device('my/own/device')
```

**Parameters**

**dev\_name** (`str`) device name

**Return** None

**unexport\_event** (*self*, *event*) → None

Un-export an event from the database.

**Parameters**

**event** (`str`) event

**Return** None

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

*New in PyTango 7.0.0*

**unexport\_server** (*self*, *server*) → None

Mark all devices exported for this server as unexported.

**Parameters**

**server** (`str`) name of the server to be unexported with format:  
<server name>/<instance>

**Return** None

**Throws** `ConnectionFailed`, `CommunicationFailed`, `DevFailed` from device (`DB_SQLError`)

**unregister\_service** (*self*, *serv\_name*, *inst\_name*) → None

Unregister the specified service from the database.

**Parameters**

**serv\_name** (`str`) service name

**inst\_name** (`str`) instance name

**Return** None

*New in PyTango 3.0.4*

**write\_filedatabase** (*self*) → None

Force a write to the file if using a file based database.

**Parameters** None

**Return** None

*New in PyTango 7.0.0*

**class** `tango.DbDatum`

A single database value which has a name, type, address and value and methods for inserting and extracting C++ native types. This is the fundamental type for specifying database properties. Every property has a name and has one or more values associated with it. A status flag indicates if there is data in the DbDatum object or not. An additional flag allows the user to activate exceptions.

**Note: DbDatum is extended to support the python sequence API.** This way the DbDatum behaves like a sequence of strings. This allows the user to work with a DbDatum as if it was working with the old list of strings.

*New in PyTango 7.0.0*

**is\_empty** (*self*) → bool

Returns True or False depending on whether the DbDatum object contains data or not. It can be used to test whether a property is defined in the database or not.

**Parameters** None

**Return** (`bool`) True if no data or False otherwise.

*New in PyTango 7.0.0*

**size** (*self*) → int

Returns the number of separate elements in the value.

**Parameters** None

**Return** the number of separate elements in the value.

*New in PyTango 7.0.0*

**class** `tango.DbDevExportInfo`

import info for a device (should be retrieved from the database) with the following members:

- `name` : (`str`) device name
- `ior` : (`str`) CORBA reference of the device
- `host` : name of the computer hosting the server
- `version` : (`str`) version
- `pid` : process identifier

**class** `tango.DbDevExportInfo`

import info for a device (should be retrieved from the database) with the following members:

- `name` : (`str`) device name
- `ior` : (`str`) CORBA reference of the device
- `host` : name of the computer hosting the server
- `version` : (`str`) version
- `pid` : process identifier

**class** `tango.DbDevImportInfo`

import info for a device (should be retrieved from the database) with the following members:

- `name` : (`str`) device name
- `exported` : 1 if device is running, 0 else
- `ior` : (`str`)CORBA reference of the device
- `version` : (`str`) version

**class** `tango.DbDevInfo`

A structure containing available information for a device with the following members:

- `name` : (`str`) name

- `_class`: (`str`) device class
- `server`: (`str`) server

**class** `tango.DbHistory`

A structure containing the modifications of a property. No public members.

**get\_attribute\_name** (`self`) → `str`

Returns the attribute name (empty for object properties or device properties)

**Parameters** None

**Return** (`str`) attribute name

**get\_date** (`self`) → `str`

Returns the update date

**Parameters** None

**Return** (`str`) update date

**get\_name** (`self`) → `str`

Returns the property name.

**Parameters** None

**Return** (`str`) property name

**get\_value** (`self`) → `DbDatum`

Returns a COPY of the property value

**Parameters** None

**Return** (`DbDatum`) a COPY of the property value

**is\_deleted** (`self`) → `bool`

Returns True if the property has been deleted or False otherwise

**Parameters** None

**Return** (`bool`) True if the property has been deleted or False otherwise

**class** `tango.DbServerInfo`

A structure containing available information for a device server with the following members:

- `name`: (`str`) name
- `host`: (`str`) host
- `mode`: (`str`) mode
- `level`: (`str`) level

## 5.5 Encoded API

*This feature is only possible since PyTango 7.1.4*

**class** `tango.EncodedAttribute`

**decode\_gray16** (`da`, `extract_as`=`<ExtensionMock name='_tango.ExtractAs.Numpy' id='140508294387864'>`)

Decode a 16 bits grayscale image (GRAY16) and returns a 16 bits gray scale image.

**param da** *DeviceAttribute* that contains the image  
**type da** *DeviceAttribute*  
**param extract\_as** defaults to `ExtractAs.Numpy`  
**type extract\_as** `ExtractAs`  
**return** the decoded data

- In case String string is chosen as extract method, a tuple is returned:  
width<int>, height<int>, buffer<str>
- In case Numpy is chosen as extract method, a `numpy.ndarray` is returned with `ndim=2`, `shape=(height, width)` and `dtype=numpy.uint16`.
- In case Tuple or List are chosen, a tuple<tuple<int>> or list<list<int>> is returned.

**Warning:** The PyTango calls that return a *DeviceAttribute* (like `DeviceProxy.read_attribute()` or `DeviceProxy.command_inout()`) automatically extract the contents by default. This method requires that the given *DeviceAttribute* is obtained from a call which **DOESN'T** extract the contents. Example:

```
dev = tango.DeviceProxy("a/b/c")
da = dev.read_attribute("my_attr", extract_as=tango.ExtractAs.Nothing)
enc = tango.EncodedAttribute()
data = enc.decode_gray16(da)
```

**decode\_gray8** (*da*, *extract\_as*=<ExtensionMock name='\_tango.ExtractAs.Numpy' id='140508294387864'>)  
 Decode a 8 bits grayscale image (JPEG\_GRAY8 or GRAY8) and returns a 8 bits gray scale image.

**param da** *DeviceAttribute* that contains the image  
**type da** *DeviceAttribute*  
**param extract\_as** defaults to `ExtractAs.Numpy`  
**type extract\_as** `ExtractAs`  
**return** the decoded data

- In case String string is chosen as extract method, a tuple is returned:  
width<int>, height<int>, buffer<str>
- In case Numpy is chosen as extract method, a `numpy.ndarray` is returned with `ndim=2`, `shape=(height, width)` and `dtype=numpy.uint8`.
- In case Tuple or List are chosen, a tuple<tuple<int>> or list<list<int>> is returned.

**Warning:** The PyTango calls that return a *DeviceAttribute* (like `DeviceProxy.read_attribute()` or `DeviceProxy.command_inout()`) automatically extract the contents by default. This method requires that the given *DeviceAttribute* is obtained from a call which **DOESN'T** extract the contents. Example:

```
dev = tango.DeviceProxy("a/b/c")
da = dev.read_attribute("my_attr", extract_as=tango.ExtractAs.Nothing)
enc = tango.EncodedAttribute()
data = enc.decode_gray8(da)
```

**decode\_rgb32** (*da*, *extract\_as*=<ExtensionMock name='\_tango.ExtractAs.Numpy' id='140508294387864'>)

Decode a color image (JPEG\_RGB or RGB24) and returns a 32 bits RGB image.

**param da** *DeviceAttribute* that contains the image

**type da** *DeviceAttribute*

**param extract\_as** defaults to *ExtractAs.Numpy*

**type extract\_as** *ExtractAs*

**return** the decoded data

- In case String string is choosen as extract method, a tuple is returned:  
width<int>, height<int>, buffer<str>
- In case Numpy is choosen as extract method, a `numpy.ndarray` is returned with `ndim=2`, `shape=(height, width)` and `dtype=numpy.uint32`.
- In case Tuple or List are choosen, a tuple<tuple<int>> or list<list<int>> is returned.

**Warning:** The PyTango calls that return a *DeviceAttribute* (like *DeviceProxy.read\_attribute()* or *DeviceProxy.command\_inout()*) automatically extract the contents by default. This method requires that the given *DeviceAttribute* is obtained from a call which **DOESN'T** extract the contents. Example:

```
dev = tango.DeviceProxy("a/b/c")
da = dev.read_attribute("my_attr", extract_as=tango.ExtractAs.Nothing)
enc = tango.EncodedAttribute()
data = enc.decode_rgb32(da)
```

**encode\_gray16** (*gray16*, *width=0*, *height=0*)

Encode a 16 bit grayscale image (no compression)

**param gray16** an object containing image information

**type gray16** *str* or *buffer* or *numpy.ndarray* or *seq<element>*

**param width** image width. **MUST** be given if *gray16* is a string or if it is a *numpy.ndarray* with `ndims != 2`. Otherwise it is calculated internally.

**type width** *int*

**param height** image height. **MUST** be given if *gray16* is a string or if it is a *numpy.ndarray* with `ndims != 2`. Otherwise it is calculated internally.

**type height** *int*

**Note:** When *numpy.ndarray* is given:

- *gray16* **MUST** be CONTIGUOUS, ALIGNED
- if *gray16.ndims != 2*, *width* and *height* **MUST** be given and *gray16.nbytes/2* **MUST** match *width\*height*
- if *gray16.ndims == 2*, *gray16.itemsize* **MUST** be 2 (typically, *gray16.dtype* is one of *numpy.dtype.int16*, *numpy.dtype.uint16*, *numpy.dtype.short* or *numpy.dtype.ushort*)

Example :

```
def read_myattr(self, attr):
    enc = tango.EncodedAttribute()
    data = numpy.arange(100, dtype=numpy.int16)
    data = numpy.array((data, data, data))
    enc.encode_gray16(data)
    attr.set_value(enc)
```

**encode\_gray8** (*gray8, width=0, height=0*)

Encode a 8 bit grayscale image (no compression)

**param gray8** an object containing image information

**type gray8** `str` or `numpy.ndarray` or `seq< seq<element> >`

**param width** image width. **MUST** be given if `gray8` is a string or if it is a `numpy.ndarray` with `ndims != 2`. Otherwise it is calculated internally.

**type width** `int`

**param height** image height. **MUST** be given if `gray8` is a string or if it is a `numpy.ndarray` with `ndims != 2`. Otherwise it is calculated internally.

**type height** `int`

---

**Note:** When `numpy.ndarray` is given:

- `gray8` **MUST** be CONTIGUOUS, ALIGNED
  - if `gray8.ndims != 2`, `width` and `height` **MUST** be given and `gray8.nbytes` **MUST** match `width*height`
  - if `gray8.ndims == 2`, `gray8.itemsize` **MUST** be 1 (typically, `gray8.dtype` is one of `numpy.dtype.byte`, `numpy.dtype.ubyte`, `numpy.dtype.int8` or `numpy.dtype.uint8`)
- 

Example :

```
def read_myattr(self, attr):
    enc = tango.EncodedAttribute()
    data = numpy.arange(100, dtype=numpy.byte)
    data = numpy.array((data, data, data))
    enc.encode_gray8(data)
    attr.set_value(enc)
```

**encode\_jpeg\_gray8** (*gray8, width=0, height=0, quality=100.0*)

Encode a 8 bit grayscale image as JPEG format

**param gray8** an object containing image information

**type gray8** `str` or `numpy.ndarray` or `seq< seq<element> >`

**param width** image width. **MUST** be given if `gray8` is a string or if it is a `numpy.ndarray` with `ndims != 2`. Otherwise it is calculated internally.

**type width** `int`

**param height** image height. **MUST** be given if `gray8` is a string or if it is a `numpy.ndarray` with `ndims != 2`. Otherwise it is calculated internally.



**type height** `int`

**param quality** Quality of JPEG (0=poor quality 100=max quality) (default is 100.0)

**type quality** `float`

---

**Note:** When `numpy.ndarray` is given:

- `gray8` **MUST** be CONTIGUOUS, ALIGNED
  - if `gray8.ndim` != 2, width and height **MUST** be given and `gray8.nbytes` **MUST** match `width*height`
  - if `gray8.ndim` == 2, `gray8.itemsize` **MUST** be 1 (typically, `gray8.dtype` is one of `numpy.dtype.byte`, `numpy.dtype.ubyte`, `numpy.dtype.int8` or `numpy.dtype.uint8`)
- 

**Example :**

```
def read_myattr(self, attr):
    enc = tango.EncodedAttribute()
    data = numpy.arange(100, dtype=numpy.byte)
    data = numpy.array((data, data, data))
    enc.encode_jpeg_gray8(data)
    attr.set_value(enc)
```

**encode\_jpeg\_rgb24** (`rgb24`, `width=0`, `height=0`, `quality=100.0`)

Encode a 24 bit rgb color image as JPEG format.

**param rgb24** an object containning image information

**type rgb24** `str` or `numpy.ndarray` or `seq< seq<element> >`

**param width** image width. **MUST** be given if `rgb24` is a string or if it is a `numpy.ndarray` with `ndim` != 3. Otherwise it is calculated internally.

**type width** `int`

**param height** image height. **MUST** be given if `rgb24` is a string or if it is a `numpy.ndarray` with `ndim` != 3. Otherwise it is calculated internally.

**type height** `int`

**param quality** Quality of JPEG (0=poor quality 100=max quality) (default is 100.0)

**type quality** `float`

---

**Note:** When `numpy.ndarray` is given:

- `rgb24` **MUST** be CONTIGUOUS, ALIGNED
  - if `rgb24.ndim` != 3, width and height **MUST** be given and `rgb24.nbytes/3` **MUST** match `width*height`
  - if `rgb24.ndim` == 3, `rgb24.itemsize` **MUST** be 1 (typically, `rgb24.dtype` is one of `numpy.dtype.byte`, `numpy.dtype.ubyte`, `numpy.dtype.int8` or `numpy.dtype.uint8`) and shape **MUST** be (`height`, `width`, 3)
- 

**Example :**

```
def read_myattr(self, attr):
    enc = tango.EncodedAttribute()
    # create an 'image' where each pixel is R=0x01, G=0x01,
    ↪B=0x01
    arr = numpy.ones((10,10,3), dtype=numpy.uint8)
    enc.encode_jpeg_rgb24(data)
    attr.set_value(enc)
```

**encode\_jpeg\_rgb32** (*rgb32, width=0, height=0, quality=100.0*)

Encode a 32 bit rgb color image as JPEG format.

**param rgb32** an object containing image information

**type rgb32** `str` or `numpy.ndarray` or `seq< seq<element> >`

**param width** image width. **MUST** be given if `rgb32` is a string or if it is a `numpy.ndarray` with `ndims != 2`. Otherwise it is calculated internally.

**type width** `int`

**param height** image height. **MUST** be given if `rgb32` is a string or if it is a `numpy.ndarray` with `ndims != 2`. Otherwise it is calculated internally.

**type height** `int`

---

**Note:** When `numpy.ndarray` is given:

- `rgb32` **MUST** be CONTIGUOUS, ALIGNED
  - if `rgb32.ndims != 2`, `width` and `height` **MUST** be given and `rgb32.nbytes/4` **MUST** match `width*height`
  - if `rgb32.ndims == 2`, `rgb32.itemsize` **MUST** be 4 (typically, `rgb32.dtype` is one of `numpy.dtype.int32`, `numpy.dtype.uint32`)
- 

**Example :**

```
def read_myattr(self, attr):
    enc = tango.EncodedAttribute()
    data = numpy.arange(100, dtype=numpy.int32)
    data = numpy.array((data,data,data))
    enc.encode_jpeg_rgb32(data)
    attr.set_value(enc)
```

**encode\_rgb24** (*rgb24, width=0, height=0*)

Encode a 24 bit color image (no compression)

**param rgb24** an object containing image information

**type rgb24** `str` or `numpy.ndarray` or `seq< seq<element> >`

**param width** image width. **MUST** be given if `rgb24` is a string or if it is a `numpy.ndarray` with `ndims != 3`. Otherwise it is calculated internally.

**type width** `int`

**param height** image height. **MUST** be given if `rgb24` is a string or if it is a `numpy.ndarray` with `ndims != 3`. Otherwise it is calculated internally.

**type height** `int`

---

**Note:** When `numpy.ndarray` is given:

- `rgb24` **MUST** be CONTIGUOUS, ALIGNED
  - if `rgb24.ndim` != 3, width and height **MUST** be given and `rgb24.nbytes/3` **MUST** match `width*height`
  - if `rgb24.ndim` == 3, `rgb24.itemsize` **MUST** be 1 (typically, `rgb24.dtype` is one of `numpy.dtype.byte`, `numpy.dtype.ubyte`, `numpy.dtype.int8` or `numpy.dtype.uint8`) and shape **MUST** be (height, width, 3)
- 

**Example :**

```
def read_myattr(self, attr):
    enc = tango.EncodedAttribute()
    # create an 'image' where each pixel is R=0x01, G=0x01,
    ↪B=0x01
    arr = numpy.ones((10,10,3), dtype=numpy.uint8)
    enc.encode_rgb24(data)
    attr.set_value(enc)
```

## 5.6 The Utilities API

```
class tango.utils.EventCallback (format='{date} {dev_name} {name} {type} {value}',
                                fd=<_io.TextIOWrapper name='<stdout>' mode='w'
                                encoding='UTF-8'>, max_buf=100)
```

Useful event callback for test purposes

Usage:

```
>>> dev = tango.DeviceProxy(dev_name)
>>> cb = tango.utils.EventCallback()
>>> id = dev.subscribe_event("state", tango.EventType.CHANGE_EVENT, cb, [])
2011-04-06 15:33:18.910474 sys/tg_test/1 STATE CHANGE [ATTR_VALID] ON
```

Allowed format keys are:

- `date` (event timestamp)
- `reception_date` (event reception timestamp)
- `type` (event type)
- `dev_name` (device name)
- `name` (attribute name)
- `value` (event value)

New in PyTango 7.1.4

**get\_events** ()

Returns the list of events received by this callback

**Returns** the list of events received by this callback

**Return type** sequence<obj>

**push\_event** (evt)

Internal usage only

`tango.utils.get_enum_labels` (enum\_cls)

Return list of enumeration labels from Enum class.

The list is useful when creating an attribute, for the `enum_labels` parameter. The enumeration values are checked to ensure they are unique, start at zero, and increment by one.

**Parameters** `enum_cls` (`enum.Enum`) – the Enum class to be inspected

**Returns** List of label strings

**Return type** `list`

**Raises** `EnumTypeError` – in case the given class is invalid

`tango.utils.is_pure_str(obj)`

Tells if the given object is a python string.

In python 2.x this means any subclass of basestring. In python 3.x this means any subclass of str.

**Parameters** `obj` (`object`) – the object to be inspected

**Returns** True is the given obj is a string or False otherwise

**Return type** `bool`

`tango.utils.is_seq(obj)`

Tells if the given object is a python sequence.

It will return True for any collections.Sequence (list, tuple, str, bytes, unicode), bytearray and (if numpy is enabled) numpy.ndarray

**Parameters** `obj` (`object`) – the object to be inspected

**Returns** True is the given obj is a sequence or False otherwise

**Return type** `bool`

`tango.utils.is_non_str_seq(obj)`

Tells if the given object is a python sequence (excluding string sequences).

It will return True for any collections.Sequence (list, tuple (and bytes in python3)), bytearray and (if numpy is enabled) numpy.ndarray

**Parameters** `obj` (`object`) – the object to be inspected

**Returns** True is the given obj is a sequence or False otherwise

**Return type** `bool`

`tango.utils.is_integer(obj)`

Tells if the given object is a python integer.

It will return True for any int, long (in python 2) and (if numpy is enabled) numpy.integer

**Parameters** `obj` (`object`) – the object to be inspected

**Returns** True is the given obj is a python integer or False otherwise

**Return type** `bool`

`tango.utils.is_number(obj)`

Tells if the given object is a python number.

It will return True for any numbers.Number and (if numpy is enabled) numpy.number

**Parameters** `obj` (`object`) – the object to be inspected

**Returns** True is the given obj is a python number or False otherwise

**Return type** `bool`

`tango.utils.is_bool(tg_type, inc_array=False)`

Tells if the given tango type is boolean

**Parameters**

- **tg\_type** (`tango.CmdArgType`) – tango type
- **inc\_array** (`bool`) – (optional, default is False) determines if include array in the list of checked types

**Returns** True if the given tango type is boolean or False otherwise

**Return type** `bool`

`tango.utils.is_scalar_type` (*tg\_type*)

Tells if the given tango type is a scalar

**Parameters** `tg_type` (*tango.CmdArgType*) – tango type

**Returns** True if the given tango type is a scalar or False otherwise

**Return type** `bool`

`tango.utils.is_array_type` (*tg\_type*)

Tells if the given tango type is an array type

**Parameters** `tg_type` (*tango.CmdArgType*) – tango type

**Returns** True if the given tango type is an array type or False otherwise

**Return type** `bool`

`tango.utils.is_numerical_type` (*tg\_type, inc\_array=False*)

Tells if the given tango type is numerical

**Parameters**

- `tg_type` (*tango.CmdArgType*) – tango type
- `inc_array` (`bool`) – (optional, default is False) determines if include array in the list of checked types

**Returns** True if the given tango type is a numerical or False otherwise

**Return type** `bool`

`tango.utils.is_int_type` (*tg\_type, inc\_array=False*)

Tells if the given tango type is integer

**Parameters**

- `tg_type` (*tango.CmdArgType*) – tango type
- `inc_array` (`bool`) – (optional, default is False) determines if include array in the list of checked types

**Returns** True if the given tango type is integer or False otherwise

**Return type** `bool`

`tango.utils.is_float_type` (*tg\_type, inc\_array=False*)

Tells if the given tango type is float

**Parameters**

- `tg_type` (*tango.CmdArgType*) – tango type
- `inc_array` (`bool`) – (optional, default is False) determines if include array in the list of checked types

**Returns** True if the given tango type is float or False otherwise

**Return type** `bool`

`tango.utils.is_bool_type` (*tg\_type, inc\_array=False*)

Tells if the given tango type is boolean

**Parameters**

- `tg_type` (*tango.CmdArgType*) – tango type
- `inc_array` (`bool`) – (optional, default is False) determines if include array in the list of checked types

**Returns** True if the given tango type is boolean or False otherwise

**Return type** `bool`

`tango.utils.is_binary_type` (*tg\_type, inc\_array=False*)

Tells if the given tango type is binary

**Parameters**

- **tg\_type** (*tango.CmdArgType*) – tango type
- **inc\_array** (*bool*) – (optional, default is False) determines if include array in the list of checked types

**Returns** True if the given tango type is binary or False otherwise

**Return type** *bool*

`tango.utils.is_str_type` (*tg\_type, inc\_array=False*)

Tells if the given tango type is string

**Parameters**

- **tg\_type** (*tango.CmdArgType*) – tango type
- **inc\_array** (*bool*) – (optional, default is False) determines if include array in the list of checked types

**Returns** True if the given tango type is string or False otherwise

**Return type** *bool*

`tango.utils.obj_2_str` (*obj, tg\_type=None*)

Converts a python object into a string according to the given tango type

**Parameters**

- **obj** (*object*) – the object to be converted
- **tg\_type** (*tango.CmdArgType*) – tango type

**Returns** a string representation of the given object

**Return type** *str*

`tango.utils.seqStr_2_obj` (*seq, tg\_type, tg\_format=None*)

Translates a sequence<str> to a sequence of objects of give type and format

**Parameters**

- **seq** (*sequence<str>*) – the sequence
- **tg\_type** (*tango.CmdArgType*) – tango type
- **tg\_format** (*tango.AttrDataFormat*) – (optional, default is None, meaning SCALAR) tango format

**Returns** a new sequence

`tango.utils.scalar_to_array_type` (*tg\_type*)

Gives the array tango type corresponding to the given tango scalar type. Example: giving Dev-Long will return DevVarLongArray.

**Parameters** **tg\_type** (*tango.CmdArgType*) – tango type

**Returns** the array tango type for the given scalar tango type

**Return type** *tango.CmdArgType*

**Raises** **ValueError** – in case the given dtype is not a tango scalar type

`tango.utils.get_home` ()

Find user's home directory if possible. Otherwise raise error.

**Returns** user's home directory

**Return type** *str*

New in PyTango 7.1.4

`tango.utils.requires_pyango` (*min\_version=None, conflicts=(), software\_name='Software'*)

Determines if the required PyTango version for the running software is present. If not an exception is thrown. Example usage:

```
from tango import requires_pyango

requires_pyango('7.1', conflicts=['8.1.1'], software='MyDS')
```

#### Parameters

- **min\_version** (*None*, *str*, *LooseVersion*) – minimum PyTango version [default: *None*, meaning no minimum required]. If a string is given, it must be in the valid version number format (see: *LooseVersion*)
- **conflicts** (*seq*<*str*/*LooseVersion*>) – a sequence of PyTango versions which conflict with the software using it
- **software\_name** (*str*) – software name using tango. Used in the exception message

**Raises** **Exception** – if the required PyTango version is not met

New in PyTango 8.1.4

`tango.utils.requires_tango` (*min\_version=None*, *conflicts=()*, *software\_name='Software'*)  
Determines if the required Tango version for the running software is present. If not an exception is thrown. Example usage:

```
from tango import requires_tango

requires_tango('7.1', conflicts=['8.1.1'], software='MyDS')
```

#### Parameters

- **min\_version** (*None*, *str*, *LooseVersion*) – minimum Tango version [default: *None*, meaning no minimum required]. If a string is given, it must be in the valid version number format (see: *LooseVersion*)
- **conflicts** (*seq*<*str*/*LooseVersion*>) – a sequence of Tango versions which conflict with the software using it
- **software\_name** (*str*) – software name using Tango. Used in the exception message

**Raises** **Exception** – if the required Tango version is not met

New in PyTango 8.1.4

## 5.7 Exception API

### 5.7.1 Exception definition

All the exceptions that can be thrown by the underlying Tango C++ API are available in the PyTango python module. Hence a user can catch one of the following exceptions:

- *DevFailed*
- *ConnectionFailed*
- *CommunicationFailed*
- *WrongNameSyntax*
- *NonDbDevice*
- *WrongData*
- *NonSupportedFeature*
- *AsyncCall*

- `AsynReplyNotArrived`
- `EventSystemFailed`
- `NamedDevFailedList`
- `DeviceUnlocked`

When an exception is caught, the `sys.exc_info()` function returns a tuple of three values that give information about the exception that is currently being handled. The values returned are (type, value, traceback). Since most functions don't need access to the traceback, the best solution is to use something like `exctype, value = sys.exc_info()[:2]` to extract only the exception type and value. If one of the Tango exceptions is caught, the `exctype` will be class name of the exception (`DevFailed`, .. etc) and the value a tuple of dictionary objects all of which containing the following kind of key-value pairs:

- **reason**: a string describing the error type (more readable than the associated error code)
- **desc**: a string describing in plain text the reason of the error.
- **origin**: a string giving the name of the (C++ API) method which thrown the exception
- **severity**: one of the strings `WARN`, `ERR`, `PANIC` giving severity level of the error.

```
1 import tango
2
3 # How to protect the script from exceptions raised by the Tango
4 try:
5     # Get proxy on a non existing device should throw an exception
6     device = tango.DeviceProxy("non/existing/device")
7 except DevFailed as df:
8     print("Failed to create proxy to non/existing/device:\n%s" % df)
```

## 5.7.2 Throwing exception in a device server

The C++ `tango::Except` class with its most important methods have been wrapped to Python. Therefore, in a Python device server, you have the following methods to throw, re-throw or print a `Tango::DevFailed` exception :

- `throw_exception()` which is a static method
- `re_throw_exception()` which is also a static method
- `print_exception()` which is also a static method

The following code is an example of a command method requesting a command on a sub-device and re-throwing the exception in case of:

```
1 try:
2     dev.command_inout("SubDevCommand")
3 except tango.DevFailed as df:
4     tango.Except.re_throw_exception(df,
5         "MyClass_CommandFailed",
6         "Sub device command SubdevCommand failed",
7         "Command() ")
```

**line 2** Send the command to the sub device in a try/catch block

**line 4-6** Re-throw the exception and add a new level of information in the exception stack

## 5.7.3 Exception API

**class** `tango.Except`

A container for the static methods:

- `throw_exception`



- `re_throw_exception`
- `print_exception`
- `compare_exception`

**class** `tango.DevError`

Structure describing any error resulting from a command execution, or an attribute query, with following members:

- `reason` : (`str`) reason
- `severity` : (`ErrSeverity`) error severity (WARN, ERR, PANIC)
- `desc` : (`str`) error description
- `origin` : (`str`) Tango server method in which the error happened

**exception** `tango.DevFailed`

**exception** `tango.ConnectionFailed`

This exception is thrown when a problem occurs during the connection establishment between the application and the device. The API is stateless. This means that DeviceProxy constructors filter most of the exception except for cases described in the following table.

The desc DevError structure field allows a user to get more precise information. These informations are :

**DB\_DeviceNotDefined** The name of the device not defined in the database

**API\_CommandFailed** The device and command name

**API\_CantConnectToDevice** The device name

**API\_CorbaException** The name of the CORBA exception, its reason, its locality, its completed flag and its minor code

**API\_CantConnectToDatabase** The database server host and its port number

**API\_DeviceNotExported** The device name

**exception** `tango.CommunicationFailed`

This exception is thrown when a communication problem is detected during the communication between the client application and the device server. It is a two levels Tango::DevError structure. In case of time-out, the DevError structures fields are:

Level	Reason	Desc	Severity
0	API_CorbaException	CORBA exception fields translated into a string	ERR
1	API_DeviceTimedOut	String with time-out value and device name	ERR

For all other communication errors, the DevError structures fields are:

Level	Reason	Desc	Severity
0	API_CorbaException	CORBA exception fields translated into a string	ERR
1	API_CommunicationFailed	String with device, method, command/attribute name	ERR

**exception** `tango.WrongNameSyntax`

This exception has only one level of Tango::DevError structure. The possible value for the reason field are :

**API\_UnsupportedProtocol** This error occurs when trying to build a DeviceProxy or an AttributeProxy instance for a device with an unsupported protocol. Refer to the appendix on device naming syntax to get the list of supported database modifier

**API\_UnsupportedDBaseModifier** This error occurs when trying to build a DeviceProxy or an AttributeProxy instance for a device/attribute with a database modifier unsupported. Refer to the appendix on device naming syntax to get the list of supported database modifier

**API\_WrongDeviceNameSyntax** This error occurs for all the other error in device name syntax. It is thrown by the DeviceProxy class constructor.

**API\_WrongAttributeNameSyntax** This error occurs for all the other error in attribute name syntax. It is thrown by the AttributeProxy class constructor.

**API\_WrongWildcardUsage** This error occurs if there is a bad usage of the wildcard character

**exception** `tango.NonDbDevice`

This exception has only one level of Tango::DevError structure. The reason field is set to API\_NonDatabaseDevice. This exception is thrown by the API when using the DeviceProxy or AttributeProxy class database access for non-database device.

**exception** `tango.WrongData`

This exception has only one level of Tango::DevError structure. The possible value for the reason field are :

**API\_EmptyDbDatum** This error occurs when trying to extract data from an empty DbDatum object

**API\_IncompatibleArgumentType** This error occurs when trying to extract data with a type different than the type used to send the data

**API\_EmptyDeviceAttribute** This error occurs when trying to extract data from an empty DeviceAttribute object

**API\_IncompatibleAttrArgumentType** This error occurs when trying to extract attribute data with a type different than the type used to send the data

**API\_EmptyDeviceData** This error occurs when trying to extract data from an empty DeviceData object

**API\_IncompatibleCmdArgumentType** This error occurs when trying to extract command data with a type different than the type used to send the data

**exception** `tango.NonSupportedFeature`

This exception is thrown by the API layer when a request to a feature implemented in Tango device interface release n is requested for a device implementing Tango device interface n-x. There is one possible value for the reason field which is API\_UnsupportedFeature.

**exception** `tango.AsynCall`

This exception is thrown by the API layer when a the asynchronous model id badly used. This exception has only one level of Tango::DevError structure. The possible value for the reason field are :

**API\_BadAsynPollId** This error occurs when using an asynchronous request identifier which is not valid any more.

**API\_BadAsyn** This error occurs when trying to fire callback when no callback has been previously registered

**API\_BadAsynReqType** This error occurs when trying to get result of an asynchronous request with an asynchronous request identifier returned by a non-coherent asynchronous request (For instance, using the asynchronous request identifier returned by a `command_inout_asynch()` method with a `read_attribute_reply()` attribute).

**exception** `tango.AsynReplyNotArrived`

This exception is thrown by the API layer when:

- a request to get asynchronous reply is made and the reply is not yet arrived
- a blocking wait with timeout for asynchronous reply is made and the timeout expired.

There is one possible value for the reason field which is `API_AsynReplyNotArrived`.

**exception** `tango.EventSystemFailed`

This exception is thrown by the API layer when subscribing or unsubscribing from an event failed. This exception has only one level of `Tango::DevError` structure. The possible value for the reason field are :

**API\_NotificationServiceFailed** This error occurs when the `subscribe_event()` method failed trying to access the CORBA notification service

**API\_EventNotFound** This error occurs when you are using an incorrect `event_id` in the `unsubscribe_event()` method

**API\_InvalidArgs** This error occurs when NULL pointers are passed to the `subscribe` or `unsubscribe` event methods

**API\_MethodArgument** This error occurs when trying to subscribe to an event which has already been subscribed to

**API\_DSFailedRegisteringEvent** This error means that the device server to which the device belongs to failed when it tries to register the event. Most likely, it means that there is no event property defined

**API\_EventNotFound** Occurs when using a wrong event identifier in the `unsubscribe_event` method

**exception** `tango.DeviceUnlocked`

This exception is thrown by the API layer when a device locked by the process has been unlocked by an admin client. This exception has two levels of `Tango::DevError` structure. There is only possible value for the reason field which is

**API\_DeviceUnlocked** The device has been unlocked by another client (administration client)

The first level is the message reported by the Tango kernel from the server side. The second layer is added by the client API layer with informations on which API call generates the exception and device name.

**exception** `tango.NotAllowed`**exception** `tango.NamedDevFailedList`

This exception is only thrown by the `DeviceProxy::write_attributes()` method. In this case, it is necessary to have a new class of exception to transfer the error stack for several attribute(s) which failed during the writing. Therefore, this exception class contains for each attributes which failed :

- The name of the attribute
- Its index in the vector passed as argumen tof the `write_attributes()` method
- The error stack



This is a small list of how-tos specific to PyTango. A more general Tango how-to list can be found [here](#).

## 6.1 How to contribute

Everyone is welcome to contribute to PyTango project. If you don't feel comfortable with writing core PyTango we are looking for contributors to documentation or/and tests.

It refers to the next section, see *How to Contribute*.

## 6.2 Check the default TANGO host

The default TANGO host can be defined using the environment variable TANGO\_HOST or in a *tangorc* file (see [Tango environment variables](#) for complete information)

To check what is the current value that TANGO uses for the default configuration simple do:

```
1 >>> import tango
2 >>> tango.ApiUtil.get_env_var("TANGO_HOST")
3 'homer.simpson.com:10000'
```

## 6.3 Check TANGO version

There are two library versions you might be interested in checking: The PyTango version:

```
1 >>> import tango
2 >>> tango.__version__
3 '9.2.5'
4 >>> tango.__version_info__
5 (9, 2, 5)
```

and the Tango C++ library version that PyTango was compiled with:

```
1 >>> import tango
2 >>> tango.constants.TgLibVers
3 '9.2.5'
```

## 6.4 Report a bug

Bugs can be reported as tickets in [TANGO Source forge](#).

When making a bug report don't forget to select *PyTango* in **Category**.

It is also helpfull if you can put in the ticket description the PyTango information. It can be a dump of:

```
$ python -c "from tango.utils import info; print(info())"
```

## 6.5 Test the connection to the Device and get it's current state

One of the most basic examples is to get a reference to a device and determine if it is running or not:

```
1 from tango import DeviceProxy
2
3 # Get proxy on the tango_test1 device
4 print("Creating proxy to TangoTest device...")
5 tango_test = DeviceProxy("sys/tg_test/1")
6
7 # ping it
8 print(tango_test.ping())
9
10 # get the state
11 print(tango_test.state())
```

## 6.6 Read and write attributes

Basic read/write attribute operations:

```
1 from tango import DeviceProxy
2
3 # Get proxy on the tango_test1 device
4 print("Creating proxy to TangoTest device...")
5 tango_test = DeviceProxy("sys/tg_test/1")
6
7 # Read a scalar attribute. This will return a tango.DeviceAttribute
8 # Member 'value' contains the attribute value
9 scalar = tango_test.read_attribute("long_scalar")
10 print("Long_scalar value = {0}".format(scalar.value))
11
12 # PyTango provides a shorter way:
13 scalar = tango_test.long_scalar.value
14 print("Long_scalar value = {0}".format(scalar))
15
16 # Read a spectrum attribute
17 spectrum = tango_test.read_attribute("double_spectrum")
18 # ... or, the shorter version:
19 spectrum = tango_test.double_spectrum
20
21 # Write a scalar attribute
```

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```

22 scalar_value = 18
23 tango_test.write_attribute("long_scalar", scalar_value)
24
25 # PyTango provides a shorter way:
26 tango_test.long_scalar = scalar_value
27
28 # Write a spectrum attribute
29 spectrum_value = [1.2, 3.2, 12.3]
30 tango_test.write_attribute("double_spectrum", spectrum_value)
31 # ... or, the shorter version:
32 tango_test.double_spectrum = spectrum_value
33
34 # Write an image attribute
35 image_value = [ [1, 2], [3, 4] ]
36 tango_test.write_attribute("long_image", image_value)
37 # ... or, the shorter version:
38 tango_test.long_image = image_value

```

Note that if PyTango is compiled with numpy support the values got when reading a spectrum or an image will be numpy arrays. This results in a faster and more memory efficient PyTango. You can also use numpy to specify the values when writing attributes, especially if you know the exact attribute type:

```

1 import numpy
2 from tango import DeviceProxy
3
4 # Get proxy on the tango_test1 device
5 print("Creating proxy to TangoTest device...")
6 tango_test = DeviceProxy("sys/tg_test/1")
7
8 data_1d_long = numpy.arange(0, 100, dtype=numpy.int32)
9
10 tango_test.long_spectrum = data_1d_long
11
12 data_2d_float = numpy.zeros((10,20), dtype=numpy.float64)
13
14 tango_test.double_image = data_2d_float

```

## 6.7 Execute commands

As you can see in the following example, when scalar types are used, the Tango binding automatically manages the data types, and writing scripts is quite easy:

```

1 from tango import DeviceProxy
2
3 # Get proxy on the tango_test1 device
4 print("Creating proxy to TangoTest device...")
5 tango_test = DeviceProxy("sys/tg_test/1")
6
7 # First use the classical command_inout way to execute the DevString command
8 # (DevString in this case is a command of the Tango_Test device)
9
10 result = tango_test.command_inout("DevString", "First hello to device")
11 print("Result of execution of DevString command = {0}".format(result))
12
13 # the same can be achieved with a helper method
14 result = tango_test.DevString("Second Hello to device")
15 print("Result of execution of DevString command = {0}".format(result))

```

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```
16
17 # Please note that argin argument type is automatically managed by python
18 result = tango_test.DevULong(12456)
19 print("Result of execution of DevULong command = {0}".format(result))
```

## 6.8 Execute commands with more complex types

In this case you have to use put your arguments data in the correct python structures:

```
1 from tango import DeviceProxy
2
3 # Get proxy on the tango_test1 device
4 print("Creating proxy to TangoTest device...")
5 tango_test = DeviceProxy("sys/tg_test/1")
6
7 # The input argument is a DevVarLongStringArray so create the argin
8 # variable containing an array of longs and an array of strings
9 argin = ([1,2,3], ["Hello", "TangoTest device"])
10
11 result = tango_test.DevVarLongArray(argin)
12 print("Result of execution of DevVarLongArray command = {0}".format(result))
```

## 6.9 Work with Groups

---

**Todo:** write this how to

---

## 6.10 Handle errors

---

**Todo:** write this how to

---

For now check *Exception API*.

## 6.11 Registering devices

Here is how to define devices in the Tango DataBase:

```
1 from tango import Database, DbDevInfo
2
3 # A reference on the DataBase
4 db = Database()
5
6 # The 3 devices name we want to create
7 # Note: these 3 devices will be served by the same DServer
8 new_device_name1 = "px1/tdl/mouse1"
9 new_device_name2 = "px1/tdl/mouse2"
10 new_device_name3 = "px1/tdl/mouse3"
11
12 # Define the Tango Class served by this DServer
```

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```

13 new_device_info_mouse = DbDevInfo()
14 new_device_info_mouse._class = "Mouse"
15 new_device_info_mouse.server = "ds_Mouse/server_mouse"
16
17 # add the first device
18 print("Creating device: %s" % new_device_name1)
19 new_device_info_mouse.name = new_device_name1
20 db.add_device(new_device_info_mouse)
21
22 # add the next device
23 print("Creating device: %s" % new_device_name2)
24 new_device_info_mouse.name = new_device_name2
25 db.add_device(new_device_info_mouse)
26
27 # add the third device
28 print("Creating device: %s" % new_device_name3)
29 new_device_info_mouse.name = new_device_name3
30 db.add_device(new_device_info_mouse)

```

### 6.11.1 Setting up device properties

A more complex example using python subtilities. The following python script example (containing some functions and instructions manipulating a Galil motor axis device server) gives an idea of how the Tango API should be accessed from Python:

```

1 from tango import DeviceProxy
2
3 # connecting to the motor axis device
4 axis1 = DeviceProxy("microxas/motorisation/galilbox")
5
6 # Getting Device Properties
7 property_names = ["AxisBoxAttachement",
8                  "AxisEncoderType",
9                  "AxisNumber",
10                 "CurrentAcceleration",
11                 "CurrentAccuracy",
12                 "CurrentBacklash",
13                 "CurrentDeceleration",
14                 "CurrentDirection",
15                 "CurrentMotionAccuracy",
16                 "CurrentOvershoot",
17                 "CurrentRetry",
18                 "CurrentScale",
19                 "CurrentSpeed",
20                 "CurrentVelocity",
21                 "EncoderMotorRatio",
22                 "logging_level",
23                 "logging_target",
24                 "UserEncoderRatio",
25                 "UserOffset"]
26
27 axis_properties = axis1.get_property(property_names)
28 for prop in axis_properties.keys():
29     print("%s: %s" % (prop, axis_properties[prop][0]))
30
31 # Changing Properties
32 axis_properties["AxisBoxAttachement"] = ["microxas/motorisation/galilbox"]
33 axis_properties["AxisEncoderType"] = ["1"]
34 axis_properties["AxisNumber"] = ["6"]
35 axis1.put_property(axis_properties)

```

## 6.12 Write a server

Before reading this chapter you should be aware of the TANGO basic concepts. This chapter does not explain what a Tango device or a device server is. This is explained in details in the [Tango control system manual](#)

Since version 8.1, PyTango provides a helper module which simplifies the development of a Tango device server. This helper is provided through the `tango.server` module.

Here is a simple example on how to write a *Clock* device server using the high level API

```

1  import time
2  from tango.server import Device, attribute, command, pipe
3
4
5  class Clock(Device):
6
7      @attribute
8      def time(self):
9          return time.time()
10
11     @command(dtype_in=str, dtype_out=str)
12     def strftime(self, format):
13         return time.strftime(format)
14
15     @pipe
16     def info(self):
17         return ('Information',
18                dict(manufacturer='Tango',
19                    model='PS2000',
20                    version_number=123))
21
22
23  if __name__ == "__main__":
24      Clock.run_server()

```

**line 2** import the necessary symbols

**line 5** tango device class definition. A Tango device must inherit from `tango.server.Device`

**line 7-9** definition of the *time* attribute. By default, attributes are double, scalar, read-only. Check the [attribute](#) for the complete list of attribute options.

**line 11-13** the method *strftime* is exported as a Tango command. It receives a string as argument and it returns a string. If a method is to be exported as a Tango command, it must be decorated as such with the `command()` decorator

**line 15-20** definition of the *info* pipe. Check the [pipe](#) for the complete list of pipe options.

**line 24** start the Tango run loop. The mandatory argument is a list of python classes that are to be exported as Tango classes. Check `run()` for the complete list of options

Here is a more complete example on how to write a *PowerSupply* device server using the high level API. The example contains:

1. a read-only double scalar attribute called *voltage*
2. a read/write double scalar expert attribute *current*
3. a read-only double image attribute called *noise*
4. a *ramp* command
5. a *host* device property
6. a *port* class property

```

1 from time import time
2 from numpy.random import random_sample
3
4 from tango import AttrQuality, AttrWriteType, DispLevel
5 from tango.server import Device, attribute, command
6 from tango.server import class_property, device_property
7
8
9 class PowerSupply(Device):
10
11     current = attribute(label="Current", dtype=float,
12                        display_level=DispLevel.EXPERT,
13                        access=AttrWriteType.READ_WRITE,
14                        unit="A", format="8.4f",
15                        min_value=0.0, max_value=8.5,
16                        min_alarm=0.1, max_alarm=8.4,
17                        min_warning=0.5, max_warning=8.0,
18                        fget="get_current", fset="set_current",
19                        doc="the power supply current")
20
21     noise = attribute(label="Noise", dtype=((float,)),
22                      max_dim_x=1024, max_dim_y=1024,
23                      fget="get_noise")
24
25     host = device_property(dtype=str)
26     port = class_property(dtype=int, default_value=9788)
27
28     @attribute
29     def voltage(self):
30         self.info_stream("get voltage(%s, %d)" % (self.host, self.port))
31         return 10.0
32
33     def get_current(self):
34         return 2.3456, time(), AttrQuality.ATTR_WARNING
35
36     def set_current(self, current):
37         print("Current set to %f" % current)
38
39     def get_noise(self):
40         return random_sample((1024, 1024))
41
42     @command(dtype_in=float)
43     def ramp(self, value):
44         print("Ramping up...")
45
46
47 if __name__ == "__main__":
48     PowerSupply.run_server()

```

## 6.13 Server logging

This chapter instructs you on how to use the tango logging API (log4tango) to create tango log messages on your device server.

The logging system explained here is the Tango Logging Service (TLS). For detailed information on how this logging system works please check:

- [3.5 The tango logging service](#)
- [9.3 The tango logging service](#)

The easiest way to start seeing log messages on your device server console is by starting it with the verbose option. Example:

```
python PyDsExp.py PyDs1 -v4
```

This activates the console tango logging target and filters messages with importance level DEBUG or more. The links above provided detailed information on how to configure log levels and log targets. In this document we will focus on how to write log messages on your device server.

### 6.13.1 Basic logging

The most basic way to write a log message on your device is to use the *Device* logging related methods:

- `debug_stream()`
- `info_stream()`
- `warn_stream()`
- `error_stream()`
- `fatal_stream()`

Example:

```
1 def read_voltage(self):
2     self.info_stream("read voltage attribute")
3     # ...
4     return voltage_value
```

This will print a message like:

```
1282206864 [-1215867200] INFO test/power_supply/1 read voltage attribute
```

every time a client asks to read the *voltage* attribute value.

The logging methods support argument list feature (since PyTango 8.1). Example:

```
1 def read_voltage(self):
2     self.info_stream("read_voltage(%s, %d)", self.host, self.port)
3     # ...
4     return voltage_value
```

### 6.13.2 Logging with print statement

*This feature is only possible since PyTango 7.1.3*

It is possible to use the print statement to log messages into the tango logging system. This is achieved by using the python's print extend form sometimes referred to as *print chevron*.

Same example as above, but now using *print chevron*:

```
1 def read_voltage(self, the_att):
2     print >>self.log_info, "read voltage attribute"
3     # ...
4     return voltage_value
```

Or using the python 3k print function:

```
1 def read_Long_attr(self, the_att):
2     print("read voltage attribute", file=self.log_info)
3     # ...
4     return voltage_value
```

### 6.13.3 Logging with decorators

This feature is only possible since PyTango 7.1.3

PyTango provides a set of decorators that place automatic log messages when you enter and when you leave a python method. For example:

```
1 @tango.DebugIt()
2 def read_Long_attr(self, the_attr):
3     the_attr.set_value(self.attr_long)
```

will generate a pair of log messages each time a client asks for the 'Long\_attr' value. Your output would look something like:

```
1282208997 [-1215965504] DEBUG test/pydsexp/1 -> read_Long_attr()
1282208997 [-1215965504] DEBUG test/pydsexp/1 <- read_Long_attr()
```

Decorators exist for all tango log levels:

- `tango.DebugIt`
- `tango.InfoIt`
- `tango.WarnIt`
- `tango.ErrorIt`
- `tango.FatalIt`

The decorators receive three optional arguments:

- `show_args` - shows method arguments in log message (defaults to False)
- `show_kwargs` shows keyword method arguments in log message (defaults to False)
- `show_ret` - shows return value in log message (defaults to False)

Example:

```
1 @tango.DebugIt(show_args=True, show_ret=True)
2 def IOLong(self, in_data):
3     return in_data * 2
```

will output something like:

```
1282221947 [-1261438096] DEBUG test/pydsexp/1 -> IOLong(23)
1282221947 [-1261438096] DEBUG test/pydsexp/1 46 <- IOLong()
```

## 6.14 Multiple device classes (Python and C++) in a server

Within the same python interpreter, it is possible to mix several Tango classes. Let's say two of your colleagues programmed two separate Tango classes in two separated python files: A PLC class in a PLC.py:

```
1 # PLC.py
2
3 from tango.server import Device
4
5 class PLC(Device):
6
7     # bla, bla my PLC code
8
9 if __name__ == "__main__":
10     PLC.run_server()
```

... and a IRMirror in a IRMirror.py:

```

1 # IRMirror.py
2
3 from tango.server import Device
4
5 class IRMirror(Device):
6
7     # bla, bla my IRMirror code
8
9 if __name__ == "__main__":
10     IRMirror.run_server()
```

You want to create a Tango server called *PLCMirror* that is able to contain devices from both PLC and IRMirror classes. All you have to do is write a *PLCMirror.py* containing the code:

```

1 # PLCMirror.py
2
3 from tango.server import run
4 from PLC import PLC
5 from IRMirror import IRMirror
6
7 run([PLC, IRMirror])
```

It is also possible to add C++ Tango class in a Python device server as soon as:

1. The Tango class is in a shared library
2. It exist a C function to create the Tango class

For a Tango class called *MyTgClass*, the shared library has to be called *MyTgClass.so* and has to be in a directory listed in the `LD_LIBRARY_PATH` environment variable. The C function creating the Tango class has to be called `_create_MyTgClass_class()` and has to take one parameter of type "char \*" which is the Tango class name. Here is an example of the main function of the same device server than before but with one C++ Tango class called *SerialLine*:

```

1 import tango
2 import sys
3
4 if __name__ == '__main__':
5     py = tango.Util(sys.argv)
6     util.add_class('SerialLine', 'SerialLine', language="c++")
7     util.add_class(PLCClass, PLC, 'PLC')
8     util.add_class(IRMirrorClass, IRMirror, 'IRMirror')
9
10    U = tango.Util.instance()
11    U.server_init()
12    U.server_run()
```

**Line 6** The C++ class is registered in the device server

**Line 7 and 8** The two Python classes are registered in the device server

## 6.15 Create attributes dynamically

It is also possible to create dynamic attributes within a Python device server. There are several ways to create dynamic attributes. One of the way, is to create all the devices within a loop, then to create the dynamic attributes and finally to make all the devices available for the external world. In C++ device server, this is typically done within the `<Device>Class::device_factory()` method. In Python device server, this method is generic and the user does not have one. Nevertheless, this generic `device_factory`

method calls a method named `dyn_attr()` allowing the user to create his dynamic attributes. It is simply necessary to re-define this method within your `<Device>Class` and to create the dynamic attribute within this method:

```
dyn_attr(self, dev_list)
```

where `dev_list` is a list containing all the devices created by the generic `device_factory()` method.

There is another point to be noted regarding dynamic attribute within Python device server. The Tango Python device server core checks that for each attribute it exists methods named `<attribute_name>_read` and/or `<attribute_name>_write` and/or `is_<attribute_name>_allowed`. Using dynamic attribute, it is not possible to define these methods because attributes name and number are known only at run-time. To address this issue, the `Device_3Impl::add_attribute()` method has a different signature for Python device server which is:

```
add_attribute(self, attr, r_meth = None, w_meth = None,
             is_allo_meth = None)
```

`attr` is an instance of the `Attr` class, `r_meth` is the method which has to be executed with the attribute is read, `w_meth` is the method to be executed when the attribute is written and `is_allo_meth` is the method to be executed to implement the attribute state machine. The method passed here as argument as to be class method and not object method. Which argument you have to use depends on the type of the attribute (A WRITE attribute does not need a read method). Note, that depending on the number of argument you pass to this method, you may have to use Python keyword argument. The necessary methods required by the Tango Python device server core will be created automatically as a forward to the methods given as arguments.

Here is an example of a device which has a TANGO command called `createFloatAttribute`. When called, this command creates a new scalar floating point attribute with the specified name:

```

1 from tango import Util, Attr
2 from tango.server import Device, command
3
4 class MyDevice(Device):
5
6     @command(dtype_in=str)
7     def CreateFloatAttribute(self, attr_name):
8         attr = Attr(attr_name, tango.DevDouble)
9         self.add_attribute(attr, self.read_General, self.write_General)
10
11     def read_General(self, attr):
12         self.info_stream("Reading attribute %s", attr.get_name())
13         attr.set_value(99.99)
14
15     def write_General(self, attr):
16         self.info_stream("Writting attribute %s", attr.get_name())

```

## 6.16 Create/Delete devices dynamically

*This feature is only possible since PyTango 7.1.2*

Starting from PyTango 7.1.2 it is possible to create devices in a device server “en caliente”. This means that you can create a command in your “management device” of a device server that creates devices of (possibly) several other tango classes. There are two ways to create a new device which are described below.

Tango imposes a limitation: the tango class(es) of the device(s) that is(are) to be created must have been registered before the server starts. If you use the high level API, the tango class(es) must be listed in the call to `run()`. If you use the lower level server API, it must be done using individual calls to `add_class()`.

### 6.16.1 Dynamic device from a known tango class name

If you know the tango class name but you don't have access to the `tango.DeviceClass` (or you are too lazy to search how to get it ;-)) the way to do it is call `create_device()` / `delete_device()`. Here is an example of implementing a tango command on one of your devices that creates a device of some arbitrary class (the example assumes the tango commands 'CreateDevice' and 'DeleteDevice' receive a parameter of type `DevVarStringArray` with two strings. No error processing was done on the code for simplicity sake):

```

1 from tango import Util
2 from tango.server import Device, command
3
4 class MyDevice(Device):
5
6     @command(dtype_in=[str])
7     def CreateDevice(self, pars):
8         klass_name, dev_name = pars
9         util = Util.instance()
10        util.create_device(klass_name, dev_name, alias=None, cb=None)
11
12    @command(dtype_in=[str])
13    def DeleteDevice(self, pars):
14        klass_name, dev_name = pars
15        util = Util.instance()
16        util.delete_device(klass_name, dev_name)

```

An optional callback can be registered that will be executed after the device is registered in the tango database but before the actual device object is created and its `init_device` method is called. It can be used, for example, to initialize some device properties.

### 6.16.2 Dynamic device from a known tango class

If you already have access to the `DeviceClass` object that corresponds to the tango class of the device to be created you can call directly the `create_device()` / `delete_device()`. For example, if you wish to create a clone of your device, you can create a tango command called `Clone`:

```

1 class MyDevice(tango.Device_4Impl):
2
3     def fill_new_device_properties(self, dev_name):
4         prop_names = db.get_device_property_list(self.get_name(), "*")
5         prop_values = db.get_device_property(self.get_name(), prop_names.value_
↳string)
6         db.put_device_property(dev_name, prop_values)
7
8         # do the same for attributes...
9         ...
10
11    def Clone(self, dev_name):
12        klass = self.get_device_class()
13        klass.create_device(dev_name, alias=None, cb=self.fill_new_device_
↳properties)
14
15    def DeleteSibling(self, dev_name):
16        klass = self.get_device_class()
17        klass.delete_device(dev_name)

```

Note that the `cb` parameter is optional. In the example it is given for demonstration purposes only.



## 6.17 Write a server (original API)

This chapter describes how to develop a PyTango device server using the original PyTango server API. This API mimics the C++ API and is considered low level. You should write a server using this API if you are using code generated by *Pogo tool* or if for some reason the high level API helper doesn't provide a feature you need (in that case think of writing a mail to tango mailing list explaining what you cannot do).

### 6.17.1 The main part of a Python device server

The rule of this part of a Tango device server is to:

- Create the *Util* object passing it the Python interpreter command line arguments
- Add to this object the list of Tango class(es) which have to be hosted by this interpreter
- Initialize the device server
- Run the device server loop

The following is a typical code for this main function:

```

1 if __name__ == '__main__':
2     util = tango.Util(sys.argv)
3     util.add_class(PyDsExpClass, PyDsExp)
4
5     U = tango.Util.instance()
6     U.server_init()
7     U.server_run()

```

**Line 2** Create the Util object passing it the interpreter command line arguments

**Line 3** Add the Tango class *PyDsExp* to the device server. The *Util.add\_class()* method of the Util class has two arguments which are the Tango class *PyDsExpClass* instance and the Tango *PyDsExp* instance. This *Util.add\_class()* method is only available since version 7.1.2. If you are using an older version please use *Util.add\_TgClass()* instead.

**Line 7** Initialize the Tango device server

**Line 8** Run the device server loop

### 6.17.2 The PyDsExpClass class in Python

The rule of this class is to :

- Host and manage data you have only once for the Tango class whatever devices of this class will be created
- Define Tango class command(s)
- Define Tango class attribute(s)

In our example, the code of this Python class looks like:

```

1 class PyDsExpClass(tango.DeviceClass):
2
3     cmd_list = { 'IOLong' : [ [ tango.ArgType.DevLong, "Number" ],
4                             [ tango.ArgType.DevLong, "Number * 2" ] ],
5                  'IOStringArray' : [ [ tango.ArgType.DevVarStringArray, "Array of ↵
↵string" ],
6                                     [ tango.ArgType.DevVarStringArray, "This ↵
↵reversed array" ] ],
7     }

```

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```

8
9 attr_list = { 'Long_attr' : [ [ tango.ArgType.DevLong ,
10                               tango.AttrDataFormat.SCALAR ,
11                               tango.AttrWriteType.READ],
12                               { 'min alarm' : 1000, 'max alarm' : 1500 } ],
13
14                               'Short_attr_rw' : [ [ tango.ArgType.DevShort,
15                                                     tango.AttrDataFormat.SCALAR,
16                                                     tango.AttrWriteType.READ_WRITE ] ]
17 }

```

**Line 1** The `PyDsExpClass` class has to inherit from the `DeviceClass` class

**Line 3 to 7** Definition of the `cmd_list` dict defining commands. The `IOLong` command is defined at lines 3 and 4. The `IOStringArray` command is defined in lines 5 and 6

**Line 9 to 17** Definition of the `attr_list` dict defining attributes. The `Long_attr` attribute is defined at lines 9 to 12 and the `Short_attr_rw` attribute is defined at lines 14 to 16

If you have something specific to do in the class constructor like initializing some specific data member, you will have to code a class constructor. An example of such a constructor is

```

1 def __init__(self, name):
2     tango.DeviceClass.__init__(self, name)
3     self.set_type("TestDevice")

```

The device type is set at line 3.

### 6.17.3 Defining commands

As shown in the previous example, commands have to be defined in a dict called `cmd_list` as a data member of the `xxxClass` class of the Tango class. This dict has one element per command. The element key is the command name. The element value is a python list which defines the command. The generic form of a command definition is:

```
'cmd_name' : [ [in_type, <"In desc">], [out_type, <"Out desc">],
<{opt parameters}>]
```

The first element of the value list is itself a list with the command input data type (one of the `tango.ArgType` pseudo enumeration value) and optionally a string describing this input argument. The second element of the value list is also a list with the command output data type (one of the `tango.ArgType` pseudo enumeration value) and optionally a string describing it. These two elements are mandatory. The third list element is optional and allows additional command definition. The authorized element for this dict are summarized in the following array:

key	Value	Definition
"display level"	DispLevel enum value	The command display level
"polling period"	Any number	The command polling period (mS)
"default command"	True or False	To define that it is the default command

### 6.17.4 Defining attributes

As shown in the previous example, attributes have to be defined in a dict called `attr_list` as a data member of the `xxxClass` class of the Tango class. This dict has one element per attribute. The element key is the attribute name. The element value is a python list which defines the attribute. The generic form of an attribute definition is:

```
'attr_name' : [ [mandatory parameters], <{opt parameters}>]
```

For any kind of attributes, the mandatory parameters are:

```
[attr data type, attr data format, attr data R/W type]
```

The attribute data type is one of the possible value for attributes of the `tango.ArgType` pseudo enumeration. The attribute data format is one of the possible value of the `tango.AttrDataFormat` pseudo enumeration and the attribute R/W type is one of the possible value of the `tango.AttrWriteType` pseudo enumeration. For spectrum attribute, you have to add the maximum X size (a number). For image attribute, you have to add the maximum X and Y dimension (two numbers). The authorized elements for the `dict` defining optional parameters are summarized in the following array:

key	value	definition
"display level"	tango.DispLevel enum value	The attribute display level
"polling period"	Any number	The attribute polling period (mS)
"memorized"	"true" or "true_without_hard_applied"	Define if and how the att. is memorized
"label"	A string	The attribute label
"description"	A string	The attribute description
"unit"	A string	The attribute unit
"standard unit"	A number	The attribute standard unit
"display unit"	A string	The attribute display unit
"format"	A string	The attribute display format
"max value"	A number	The attribute max value
"min value"	A number	The attribute min value
"max alarm"	A number	The attribute max alarm
"min alarm"	A number	The attribute min alarm
"min warning"	A number	The attribute min warning
"max warning"	A number	The attribute max warning
"delta time"	A number	The attribute RDS alarm delta time
"delta val"	A number	The attribute RDS alarm delta val

### 6.17.5 The PyDsExp class in Python

The rule of this class is to implement methods executed by commands and attributes. In our example, the code of this class looks like:

```

1 class PyDsExp(tango.Device_4Impl):
2
3     def __init__(self, cl, name):
4         tango.Device_4Impl.__init__(self, cl, name)
5         self.info_stream('In PyDsExp.__init__')
6         PyDsExp.init_device(self)
7
8     def init_device(self):
9         self.info_stream('In Python init_device method')
10        self.set_state(tango.DevState.ON)
11        self.attr_short_rw = 66
12        self.attr_long = 1246
13
14        #-----
15
```

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```

16 def delete_device(self):
17     self.info_stream('PyDsExp.delete_device')
18
19     #-----
20     # COMMANDS
21     #-----
22
23 def is_IOLong_allowed(self):
24     return self.get_state() == tango.DevState.ON
25
26 def IOLong(self, in_data):
27     self.info_stream('IOLong', in_data)
28     in_data = in_data * 2
29     self.info_stream('IOLong returns', in_data)
30     return in_data
31
32     #-----
33
34 def is_IOStringArray_allowed(self):
35     return self.get_state() == tango.DevState.ON
36
37 def IOStringArray(self, in_data):
38     l = range(len(in_data)-1, -1, -1)
39     out_index=0
40     out_data=[]
41     for i in l:
42         self.info_stream('IOStringArray <-', in_data[out_index])
43         out_data.append(in_data[i])
44         self.info_stream('IOStringArray ->',out_data[out_index])
45         out_index += 1
46     self.y = out_data
47     return out_data
48
49     #-----
50     # ATTRIBUTES
51     #-----
52
53 def read_attr_hardware(self, data):
54     self.info_stream('In read_attr_hardware')
55
56 def read_Long_attr(self, the_att):
57     self.info_stream("read_Long_attr")
58
59     the_att.set_value(self.attr_long)
60
61 def is_Long_attr_allowed(self, req_type):
62     return self.get_state() in (tango.DevState.ON,)
63
64 def read_Short_attr_rw(self, the_att):
65     self.info_stream("read_Short_attr_rw")
66
67     the_att.set_value(self.attr_short_rw)
68
69 def write_Short_attr_rw(self, the_att):
70     self.info_stream("write_Short_attr_rw")
71
72     self.attr_short_rw = the_att.get_write_value()
73
74 def is_Short_attr_rw_allowed(self, req_type):
75     return self.get_state() in (tango.DevState.ON,)

```

Line 1 The PyDsExp class has to inherit from the tango.Device\_4Impl

**Line 3 to 6** PyDsExp class constructor. Note that at line 6, it calls the `init_device()` method

**Line 8 to 12** The `init_device()` method. It sets the device state (line 9) and initialises some data members

**Line 16 to 17** The `delete_device()` method. This method is not mandatory. You define it only if you have to do something specific before the device is destroyed

**Line 23 to 30** The two methods for the `IOLong` command. The first method is called `is_IOLong_allowed()` and it is the command `is_allowed` method (line 23 to 24). The second method has the same name than the command name. It is the method which executes the command. The command input data type is a Tango long and therefore, this method receives a python integer.

**Line 34 to 47** The two methods for the `IOStringArray` command. The first method is its `is_allowed` method (Line 34 to 35). The second one is the command execution method (Line 37 to 47). The command input data type is a string array. Therefore, the method receives the array in a python list of python strings.

**Line 53 to 54** The `read_attr_hardware()` method. Its argument is a Python sequence of Python integer.

**Line 56 to 59** The method executed when the `Long_attr` attribute is read. Note that before PyTango 7 it sets the attribute value with the `tango.set_attribute_value` function. Now the same can be done using the `set_value` of the attribute object

**Line 61 to 62** The `is_allowed` method for the `Long_attr` attribute. This is an optional method that is called when the attribute is read or written. Not defining it has the same effect as always returning True. The parameter `req_type` is of type `AttrReqType` which tells if the method is called due to a read or write request. Since this is a read-only attribute, the method will only be called for read requests, obviously.

**Line 64 to 67** The method executed when the `Short_attr_rw` attribute is read.

**Line 69 to 72** The method executed when the `Short_attr_rw` attribute is written. Note that before PyTango 7 it gets the attribute value with a call to the Attribute method `get_write_value` with a list as argument. Now the write value can be obtained as the return value of the `get_write_value` call. And in case it is a scalar there is no more the need to extract it from the list.

**Line 74 to 75** The `is_allowed` method for the `Short_attr_rw` attribute. This is an optional method that is called when the attribute is read or written. Not defining it has the same effect as always returning True. The parameter `req_type` is of type `AttrReqType` which tells if the method is called due to a read or write request.

## General methods

The following array summarizes how the general methods we have in a Tango device server are implemented in Python.

Name	Input par (with "self")	return value	mandatory
<code>init_device</code>	None	None	Yes
<code>delete_device</code>	None	None	No
<code>always_executed_hook</code>	None	None	No
<code>signal_handler</code>	<code>int</code>	None	No
<code>read_attr_hardware</code>	<code>sequence&lt;int&gt;</code>	None	No

## Implementing a command

Commands are defined as described above. Nevertheless, some methods implementing them have to be written. These methods names are fixed and depend on command name. They have to be called:

- `is_<Cmd_name>_allowed(self)`
- `<Cmd_name>(self, arg)`

For instance, with a command called *MyCmd*, its `is_allowed` method has to be called `is_MyCmd_allowed` and its execution method has to be called simply *MyCmd*. The following array gives some more info on these methods.

Name	Input par (with "self")	return value	mandatory
<code>is_&lt;Cmd_name&gt;_allowed</code>	None	Python boolean	No
<code>Cmd_name</code>	Depends on cmd type	Depends on cmd type	Yes

Please check *Data types* chapter to understand the data types that can be used in command parameters and return values.

The following code is an example of how you write code executed when a client calls a command named `IOLong`:

```

1 def is_IOLong_allowed(self):
2     self.debug_stream("in is_IOLong_allowed")
3     return self.get_state() == tango.DevState.ON
4
5 def IOLong(self, in_data):
6     self.info_stream('IOLong', in_data)
7     in_data = in_data * 2
8     self.info_stream('IOLong returns', in_data)
9     return in_data

```

**Line 1-3** the `is_IOLong_allowed` method determines in which conditions the command 'IOLong' can be executed. In this case, the command can only be executed if the device is in 'ON' state.

**Line 6** write a log message to the tango INFO stream (click [here](#) for more information about PyTango log system).

**Line 7** does something with the input parameter

**Line 8** write another log message to the tango INFO stream (click [here](#) for more information about PyTango log system).

**Line 9** return the output of executing the tango command

### Implementing an attribute

Attributes are defined as described in chapter 5.3.2. Nevertheless, some methods implementing them have to be written. These methods names are fixed and depend on attribute name. They have to be called:

- `is_<Attr_name>_allowed(self, req_type)`
- `read_<Attr_name>(self, attr)`
- `write_<Attr_name>(self, attr)`

For instance, with an attribute called *MyAttr*, its `is_allowed` method has to be called `is_MyAttr_allowed`, its `read` method has to be called `read_MyAttr` and its `write` method has to be called `write_MyAttr`. The `attr` parameter is an instance of *Attr*. Unlike the commands, the `is_allowed` method for attributes receives a parameter of type `AttrReqtype`.

Please check *Data types* chapter to understand the data types that can be used in attribute.

The following code is an example of how you write code executed when a client read an attribute which is called `Long_attr`:

```

1 def read_Long_attr(self, the_attr):
2     self.info_stream("read attribute name Long_attr")
3     the_attr.set_value(self.attr_long)

```

**Line 1** Method declaration with “the\_att” being an instance of the Attribute class representing the Long\_attr attribute

**Line 2** write a log message to the tango INFO stream (click [here](#) for more information about PyTango log system).

**Line 3** Set the attribute value using the method set\_value() with the attribute value as parameter.

The following code is an example of how you write code executed when a client write the Short\_attr\_rw attribute:

```
1 def write_Short_attr_rw(self,the_att):
2     self.info_stream("In write_Short_attr_rw for attribute ",the_att.get_name())
3     self.attr_short_rw = the_att.get_write_value(data)
```

**Line 1** Method declaration with “the\_att” being an instance of the Attribute class representing the Short\_attr\_rw attribute

**Line 2** write a log message to the tango INFO stream (click [here](#) for more information about PyTango log system).

**Line 3** Get the value sent by the client using the method get\_write\_value() and store the value written in the device object. Our attribute is a scalar short attribute so the return value is an int





Everyone is welcome to contribute to PyTango project. If you don't feel comfortable with writing core PyTango we are looking for contributors to documentation or/and tests.

### 7.1 Workflow

A normal Git workflow is used. You can find how to automate your git branching workflow [example](#). Good practices:

- There is no special policy regarding commit messages. They should be short (50 chars or less) and contain summary of all changes,
- A CONTRIBUTING file is required,
- Pull requests should be ALWAYS made to develop branch, not to a master branch.

### 7.2 reStructuredText and Sphinx

Documentation is written in [reStructuredText](#) and built with [Sphinx](#) - it's easy to contribute. It also uses [autodoc](#) importing docstrings from tango package. Theme is not important, a theme prepared for Tango Community can be also used.

### 7.3 Source code standard

All code should be [PEP8](#) compatible. We have set up checking code quality with [Codacy](#) which uses [PyLint](#) under the hood. You can see how well your code is rated on your PR's page.

---

**Note:** The accepted policy is that your code **cannot** introduce more issues than it solves!

---

You can also use other tools for checking [PEP8](#) compliance for your personal use. One good example of such a tool is [Flake8](#) which combines [PEP8](#) and [PyFlakes](#). There are [plugins](#) for various IDEs so that you can use your favourite tool easily.

## 7.4 Releasing a new version

From time to time a new version should be released. Anyone who wishes to see some features of the development branch released is free to make a new release. The basic steps required are as follows:

### Pick a version number

- Semantic version numbering is used: <major>.<minor>.<patch>
- The major and minor version fields (9.2) track the TANGO C++ core version.
- Small changes are done as patch releases. For these the version number should correspond the current development number since each release process finishes with a version bump.
- **Patch release example:**
  - 9.2.5.devN or 9.2.5aN or 9.2.5bN (current development branch)
  - changes to 9.2.5 (the actual release)
  - changes to 9.2.6.dev0 (bump the patch version at the end of the release process)

### Create an issue in Github

- This is to inform the community that a release is planned.
- Use a checklist similar to the one below:

Task list:

- Read steps in the how-to-contribute docs for making a release
- Edit the changelog
- Bump the version
- Merge develop into stable
- Make sure Travis is OK on stable branch
- Make sure the documentation is updated (readthedocs)
- Create a release tag on GitHub, from stable branch
- Upload the new version to PyPI
- Bump the version with “-dev” in the develop branch
- Fill the release description on GitHub
- Build conda packages
- Advertise the release on the mailing list
- Close this issue

- A check list in this form on github can be ticked off as the work progresses.

### Make a branch from develop to prepare the release

- Example branch name: `prepare-v9.2.5`.
- Edit the changelog (in `docs/revision.rst`). Include *all* pull requests since the previous release.
- Bump the versions in (in `tango/release.py`). E.g. `version_info` to (9, 2, 5)
- Create a pull request to get these changes reviewed before proceeding.

### Merge stable into develop

- Wait until the preparation branch pull request has been merged.

- Merge `stable` into the latest `develop`. It is recommended to do a fast-forward merge in order to avoid a confusing merge commit. This can be done by simply pushing `develop` to `stable` using this command:

```
$ git push origin develop:stable
```

This way the release tag corresponds to the actual release commit both on the `stable` and `develop` branches.

- In general, the `stable` branch should point to the latest release.

#### Make sure Travis is OK on `stable` branch

- All tests, on all versions of Python must be passing. If not, bad luck - you'll have to fix it first, and go back a few steps...

#### Make sure the documentation is updated

- Log in to <https://readthedocs.org>.
- Get account permissions for <https://readthedocs.org/projects/pytango> from another contributor, if necessary.
- **Readthedocs *should* automatically build the docs for each:**
  - push to `develop` (latest docs)
  - push to `stable` (stable docs)
  - new tags (e.g v9.2.x)
- ***But*, the webhooks are somehow broken, so it probably won't work automatically!**
  - Trigger the builds manually here: <https://readthedocs.org/projects/pytango/builds/>
  - Set the new version to "active" here: <https://readthedocs.org/dashboard/pytango/versions/>

#### Create a release tag on GitHub

- On the Releases page, use "Draft a new release".
- Tag must match the format of previous tags, e.g. v9.2.5.
- Target must be the `stable` branch.

#### Upload the new version to PyPI

- Log in to <https://pypi.org>.
- Get account permissions for PyTango from another contributor, if necessary.
- If necessary, pip install twine: <https://pypi.org/project/twine/>)
- **Build update and upload, from the the `stable` branch:**
  - `$ git clean -xfd # Warning - remove all non-versioned files and directories`
  - `$ python setup.py sdist`
  - `$ twine upload dist/pytango-9.2.N.tar.gz`

#### Bump the version with "-dev" in the `develop` branch

- Change all references to next version. E.g. if releasing v9.2.5, then update references to v9.2.6.
- This includes files like `README.rst`, `doc/howto.rst`, `doc/start.rst`.
- In `tango/release.py`, change `version_info`, e.g. from `(9, 2, 5)` to `(9, 2, 6, 'dev', 0)`.

**Fill in the release description on GitHub**

- Content must be the same as the details in the changelog. List all the pull requests since the previous version.

**Build conda packages**

- This is tricky, so ask a contributor from the ESRF to do it.

**Advertise the release on the mailing list**

- Post on the Python development list.
- Example of a previous post: <http://www.tango-controls.org/community/forum/c/development/python/pytango-921-release/>

**Close off release issue**

- All the items on the check list should be ticked off by now.
- Close the issue.

---

Answers to general Tango questions can be found in the [general tango tutorial](#).

Please also check the [general tango how to](#).

#### How can I report an issue?

Bug reports are very valuable for the community.

Please open a new issue on the GitHub [issues](#) page.

#### How can I contribute to PyTango and the documentation?

Contributions are always welcome!

You can open pull requests on the GitHub [PRs](#) page.

#### I got a `libboost_python` error when I try to import tango module...

For instance:

```
>>> import tango
ImportError: libboost_python.so.1.53.0: cannot open shared object file: No such_
↪file or directory
```

You must check that you have the correct boost python installed on your computer. To see which boost python file PyTango needs, type:

```
$ ldd /usr/lib64/python2.7/site-packages/tango/_tango.so
linux-vdso.so.1 => (0x00007ffea7562000)
libtango.so.9 => /lib64/libtango.so.9 (0x00007fac04011000)
libomniORB4.so.1 => /lib64/libomniORB4.so.1 (0x00007fac03c62000)
libboost_python.so.1.53.0 => not found
[...]
```

#### I have more questions, where can I ask?

The [Tango forum](#) is a good place to get some support. Meet us in the [Python section](#).



## 9.1 TEP 1 - Device Server High Level API

TEP:	1
Title:	Device Server High Level API
Version:	2.2.0
Last-Modified:	10-Sep-2014
Author:	Tiago Coutinho <tcoutinho@cells.es>
Status:	Active
Type:	Standards Track
Content-Type:	text/x-rst
Created:	17-Oct-2012

### 9.1.1 Abstract

This TEP aims to define a new high level API for writing device servers.

### 9.1.2 Rationale

The code for Tango device servers written in Python often obey a pattern. It would be nice if non tango experts could create tango device servers without having to code some obscure tango related code. It would also be nice if the tango programming interface would be more pythonic. The final goal is to make writing tango device servers as easy as:

```
class Motor(Device):
    __metaclass__ = DeviceMeta

    position = attribute()

    def read_position(self):
        return 2.3

    @command()
    def move(self, position):
```

(continues on next page)

```

    pass

if __name__ == "__main__":
    server_run((Motor,))

```

### 9.1.3 Places to simplify

After looking at most python device servers one can see some patterns:

At <Device> class level:

1. <Device> always inherits from latest available DeviceImpl from pogo version
2. **constructor always does the same:**
  1. calls super constructor
  2. debug message
  3. calls init\_device
3. all methods have debug\_stream as first instruction
4. init\_device does additionally get\_device\_properties()
5. *read attribute* methods follow the pattern:

```

def read_Attr(self, attr):
    self.debug_stream()
    value = get_value_from_hardware()
    attr.set_value(value)

```

6. *write attribute* methods follow the pattern:

```

def write_Attr(self, attr):
    self.debug_stream()
    w_value = attr.get_write_value()
    apply_value_to_hardware(w_value)

```

At <Device>Class class level:

1. A <Device>Class class exists for every <DeviceName> class
2. The <Device>Class class only contains attributes, commands and properties descriptions (no logic)
3. The attr\_list description always follows the same (non explicit) pattern (and so does cmd\_list, class\_property\_list, device\_property\_list)
4. the syntax for attr\_list, cmd\_list, etc is far from understandable

At *main()* level:

1. **The main() method always does the same:**
  1. create *Util*
  2. register tango class
  3. when registering a python class to become a tango class, 99.9% of times the python class name is the same as the tango class name (example: Motor is registered as tango class "Motor")
  4. call *server\_init()*
  5. call *server\_run()*



## 9.1.4 High level API

The goals of the high level API are:

### Maintain all features of low-level API available from high-level API

Everything that was done with the low-level API must also be possible to do with the new API.

All tango features should be available by direct usage of the new simplified, cleaner high-level API and through direct access to the low-level API.

### Automatic inheritance from the latest\*\* DeviceImpl

Currently Devices need to inherit from a direct Tango device implementation (`DeviceImpl`, or `Device_2Impl`, `Device_3Impl`, `Device_4Impl`, etc) according to the tango version being used during the development.

In order to keep the code up to date with tango, every time a new Tango IDL is released, the code of **every** device server needs to be manually updated to inherit from the newest tango version.

By inheriting from a new high-level `Device` (which itself automatically *decides* from which `DeviceImpl` version it should inherit), the device servers are always up to date with the latest tango release without need for manual intervention (see `tango.server`).

Low-level way:

```
class Motor(PyTango.Device_4Impl):
    pass
```

High-level way:

```
class Motor(PyTango.server.Device):
    pass
```

### Default implementation of Device constructor

99% of the different device classes which inherit from low level `DeviceImpl` only implement `__init__` to call their `init_device` (see `tango.server`).

`Device` already calls `init_device`.

Low-level way:

```
class Motor(PyTango.Device_4Impl):

    def __init__(self, dev_class, name):
        PyTango.Device_4Impl.__init__(self, dev_class, name)
        self.init_device()
```

High-level way:

```
class Motor(PyTango.server.Device):

    # Nothing to be done!

    pass
```

### Default implementation of `init_device()`

99% of different device classes which inherit from low level `DeviceImpl` have an implementation of `init_device` which *at least* calls `get_device_properties()` (see `tango.server`).

`init_device()` already calls `get_device_properties()`.

Low-level way:

```
class Motor(PyTango.Device_4Impl):  
  
    def init_device(self):  
        self.get_device_properties()
```

High-level way:

```
class Motor(PyTango.server.Device):  
    # Nothing to be done!  
    pass
```

### Remove the need to code `DeviceClass`

99% of different device servers only need to implement their own subclass of `DeviceClass` to register the attribute, commands, device and class properties by using the corresponding `attr_list`, `cmd_list`, `device_property_list` and `class_property_list`.

With the high-level API we completely remove the need to code the `DeviceClass` by registering attribute, commands, device and class properties in the `Device` with a more pythonic API (see `tango.server`)

1. Hide `<Device>Class` class completely
2. simplify `main()`

Low-level way:

```
class Motor(PyTango.Device_4Impl):  
  
    def read_Position(self, attr):  
        pass  
  
class MotorClass(PyTango.DeviceClass):  
  
    class_property_list = { }  
    device_property_list = { }  
    cmd_list = { }  
  
    attr_list = {  
        'Position':  
            [[PyTango.DevDouble,  
             PyTango.SCALAR,  
             PyTango.READ]],  
    }  
  
    def __init__(self, name):  
        PyTango.DeviceClass.__init__(self, name)  
        self.set_type(name)
```

High-level way:

```
class Motor(PyTango.server.Device):
```

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```

position = PyTango.server.attribute(dtype=float, )

def read_position(self):
    pass

```

### Pythonic read/write attribute

With the low level API, it feels strange for a non tango programmer to have to write:

```

def read_Position(self, attr):
    # ...
    attr.set_value(new_position)

def read_Position(self, attr):
    # ...
    attr.set_value_date_quality(new_position, time.time(), AttrQuality.CHANGING)

```

A more pythonic way would be:

```

def read_position(self):
    # ...
    self.position = new_position

def read_position(self):
    # ...
    self.position = new_position, time.time(), AttrQuality.CHANGING

```

Or even:

```

def read_position(self):
    # ...
    return new_position

def read_position(self):
    # ...
    return new_position, time.time(), AttrQuality.CHANGING

```

### Simplify *main()*

the typical *main()* method could be greatly simplified. initializing tango, registering tango classes, initializing and running the server loop and managing errors could all be done with the single function call to `server_run()`

Low-level way:

```

def main():
    try:
        py = PyTango.Util(sys.argv)
        py.add_class(MotorClass, Motor, 'Motor')

        U = PyTango.Util.instance()
        U.server_init()
        U.server_run()

    except PyTango.DevFailed, e:
        print '-----> Received a DevFailed exception:', e
    except Exception, e:
        print '-----> An unforeseen exception occured...', e

```

High-level way:

```
def main():
    classes = Motor,
    PyTango.server_run(classes)
```

### 9.1.5 In practice

Currently, a pogo generated device server code for a Motor having a double attribute *position* would look like this:

```
#!/usr/bin/env python
# -*- coding:utf-8 -*-

#####
## license :
##-----
##
## File :      Motor.py
##
## Project :
##
## $Author :   t$
##
## $Revision : $
##
## $Date :     $
##
## $HeadUrl :  $
##-----
##          This file is generated by POGO
##    (Program Obviously used to Generate tango Object)
##
##          (c) - Software Engineering Group - ESRF
#####

"""

__all__ = ["Motor", "MotorClass", "main"]

__docformat__ = 'restructuredtext'

import PyTango
import sys
# Add additional import
#----- PROTECTED REGION ID(Motor.additionnal_import) ENABLED START -----#

#----- PROTECTED REGION END -----# //      Motor.additionnal_import

#####
## Device States Description
##
## No states for this device
#####

class Motor (PyTango.Device_4Impl):

#----- Add you global variables here -----
#----- PROTECTED REGION ID(Motor.global_variables) ENABLED START -----#
```

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```

#----- PROTECTED REGION END -----# //      Motor.global_variables
#-----
#      Device constructor
#-----
def __init__(self,cl, name):
    PyTango.Device_4Impl.__init__(self,cl,name)
    self.debug_stream("In " + self.get_name() + ".__init__()")
    Motor.init_device(self)

#-----
#      Device destructor
#-----
def delete_device(self):
    self.debug_stream("In " + self.get_name() + ".delete_device()")
    #----- PROTECTED REGION ID(Motor.delete_device) ENABLED START -----#

    #----- PROTECTED REGION END -----# //      Motor.delete_device

#-----
#      Device initialization
#-----
def init_device(self):
    self.debug_stream("In " + self.get_name() + ".init_device()")
    self.get_device_properties(self.get_device_class())
    self.attr_Position_read = 0.0
    #----- PROTECTED REGION ID(Motor.init_device) ENABLED START -----#

    #----- PROTECTED REGION END -----# //      Motor.init_device

#-----
#      Always excuted hook method
#-----
def always_executed_hook(self):
    self.debug_stream("In " + self.get_name() + ".always_excuted_hook()")
    #----- PROTECTED REGION ID(Motor.always_executed_hook) ENABLED START -----#

    #----- PROTECTED REGION END -----# //      Motor.always_executed_hook

#=====
#
#      Motor read/write attribute methods
#
#=====

#-----
#      Read Position attribute
#-----
def read_Position(self, attr):
    self.debug_stream("In " + self.get_name() + ".read_Position()")
    #----- PROTECTED REGION ID(Motor.Position_read) ENABLED START -----#
    self.attr_Position_read = 1.0
    #----- PROTECTED REGION END -----# //      Motor.Position_read
    attr.set_value(self.attr_Position_read)

#-----
#      Read Attribute Hardware
#-----
def read_attr_hardware(self, data):
    self.debug_stream("In " + self.get_name() + ".read_attr_hardware()")
    #----- PROTECTED REGION ID(Motor.read_attr_hardware) ENABLED START -----#

```

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```

#----- PROTECTED REGION END -----# //      Motor.read_attr_hardware

#-----
#
#      Motor command methods
#
#-----

#-----
#
#      MotorClass class definition
#
#-----
class MotorClass(PyTango.DeviceClass):

    #      Class Properties
    class_property_list = {
        }

    #      Device Properties
    device_property_list = {
        }

    #      Command definitions
    cmd_list = {
        }

    #      Attribute definitions
    attr_list = {
        'Position':
            [[PyTango.DevDouble,
              PyTango.SCALAR,
              PyTango.READ]],
        }

#-----
#      MotorClass Constructor
#-----
def __init__(self, name):
    PyTango.DeviceClass.__init__(self, name)
    self.set_type(name);
    print "In Motor Class constructor"

#-----
#
#      Motor class main method
#
#-----
def main():
    try:
        py = PyTango.Util(sys.argv)
        py.add_class(MotorClass, Motor, 'Motor')

        U = PyTango.Util.instance()
        U.server_init()

```

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```

        U.server_run()

    except PyTango.DevFailed,e:
        print '-----> Received a DevFailed exception:',e
    except Exception,e:
        print '-----> An unforeseen exception occured....',e

if __name__ == '__main__':
    main()

```

To make things more fair, let's analyse the stripped version of the code instead:

```

import PyTango
import sys

class Motor (PyTango.Device_4Impl):

    def __init__(self,cl, name):
        PyTango.Device_4Impl.__init__(self,cl,name)
        self.debug_stream("In " + self.get_name() + ".__init__()")
        Motor.init_device(self)

    def delete_device(self):
        self.debug_stream("In " + self.get_name() + ".delete_device()")

    def init_device(self):
        self.debug_stream("In " + self.get_name() + ".init_device()")
        self.get_device_properties(self.get_device_class())
        self.attr_Position_read = 0.0

    def always_executed_hook(self):
        self.debug_stream("In " + self.get_name() + ".always_excuted_hook()")

    def read_Position(self, attr):
        self.debug_stream("In " + self.get_name() + ".read_Position()")
        self.attr_Position_read = 1.0
        attr.set_value(self.attr_Position_read)

    def read_attr_hardware(self, data):
        self.debug_stream("In " + self.get_name() + ".read_attr_hardware()")

class MotorClass(PyTango.DeviceClass):

    class_property_list = {
    }

    device_property_list = {
    }

    cmd_list = {
    }

    attr_list = {
        'Position':
            [[PyTango.DevDouble,
              PyTango.SCALAR,
              PyTango.READ]],
    }

```

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```

    }

    def __init__(self, name):
        PyTango.DeviceClass.__init__(self, name)
        self.set_type(name);
        print "In Motor Class constructor"

def main():
    try:
        py = PyTango.Util(sys.argv)
        py.add_class(MotorClass, Motor, 'Motor')

        U = PyTango.Util.instance()
        U.server_init()
        U.server_run()

    except PyTango.DevFailed,e:
        print '-----> Received a DevFailed exception:',e
    except Exception,e:
        print '-----> An unforeseen exception occured...',e

if __name__ == '__main__':
    main()

```

And the equivalent HLAPI version of the code would be:

```

#!/usr/bin/env python

from PyTango import DebugIt, server_run
from PyTango.server import Device, DeviceMeta, attribute

class Motor(Device):
    __metaclass__ = DeviceMeta

    position = attribute()

    @DebugIt()
    def read_position(self):
        return 1.0

def main():
    server_run((Motor,))

if __name__ == "__main__":
    main()

```

## 9.1.6 References

*tango.server*

## 9.1.7 Changes

### from 2.1.0 to 2.2.0

Changed module name from *hlapi* to *server*



### from 2.0.0 to 2.1.0

Changed module name from *api2* to *hlapi* (High Level API)

### From 1.0.0 to 2.0.0

- **API Changes**
  - changed Attr to attribute
  - changed Cmd to command
  - changed Prop to device\_property
  - changed ClassProp to class\_property
- Included command and properties in the example
- Added references to API documentation

## 9.1.8 Copyright

This document has been placed in the public domain.

## 9.2 TEP 2 - Tango database serverless

TEP:	2
Title:	Tango database serverless
Version:	1.0.0
Last-Modified:	17-Oct-2012
Author:	Tiago Coutinho < <a href="mailto:tcoutinho@cells.es">tcoutinho@cells.es</a> >
Status:	Active
Type:	Standards Track
Content-Type:	text/x-rst
Created:	17-Oct-2012
Post-History:	17-Oct-2012

### 9.2.1 Abstract

This TEP aims to define a python DataBases which doesn't need a database server behind. It would make tango easier to try out by anyone and it could greatly simplify tango installation on small environments (like small, independent laboratories).

### 9.2.2 Motivation

I was given a openSUSE laptop so that I could do the presentation for the tango meeting held in FRMII on October 2012. Since I planned to do a demonstration as part of the presentation I installed all mysql libraries, omniorb, tango and pytango on this laptop.

During the flight to Munich I realized tango was not working because of a strange mysql server configuration done by the openSUSE distribution. I am not a mysql expert and I couldn't google for a solution. Also it made me angry to have to install all the mysql crap (libmysqlclient, mysqld, mysql-administrator, bla, bla) just to have a demo running.

At the time of writing the first version of this TEP I still didn't solve the problem! Shame on me!

Also at the same tango meeting during the tango archiving discussions I heard fake whispers or changing the tango archiving from MySQL/Oracle to NoSQL.

I started thinking if it could be possible to have an alternative implementation of DataBases without the need for a mysql server.

### 9.2.3 Requisites

- no dependencies on external packages
- no need for a separate database server process (at least, by default)
- no need to execute post install scripts to fill database

### 9.2.4 Step 1 - Gather database information

It turns out that python has a Database API specification ([PEP 249](#)). Python distribution comes natively ( $\geq 2.6$ ) with not one but several persistency options ([Data Persistence](#)):

module	Native	Platforms	API	Database	Description
<b>Native python 2.x</b>					
<code>pickle</code>	Yes	all	dump/load	file	python serialization/marshalling module
<code>shelve</code>	Yes	all	dict	file	high level persistent, dictionary-like object
<code>marshal</code>	Yes	all	dump/load	file	Internal Python object serialization
<code>anydbm</code>	Yes	all	dict	file	Generic access to DBM-style databases. Wrapper for <code>dbhash</code> , <code>gdbm</code> , <code>dbm</code> or <code>dumbdbm</code>
<code>dbm</code>	Yes	all	dict	file	Simple "database" interface
<code>gdbm</code>	Yes	unix	dict	file	GNU's reinterpretation of <code>dbm</code>
<code>dbhash</code>	Yes	unix?	dict	file	DBM-style interface to the BSD database library (needs <code>bsddb</code> ). <b>Removed in python 3</b>
<code>bsddb</code>	Yes	unix?	dict	file	Interface to Berkeley DB library. <b>Removed in python 3</b>
<code>dumbdbm</code>	Yes	all	dict	file	Portable DBM implementation
<code>sqlite3</code>	Yes	all	DBAPI2	file, memory	DB-API 2.0 interface for SQLite databases
<b>Native Python 3.x</b>					
<code>pickle</code>	Yes	all	dump/load	file	python serialization/marshalling module
<code>shelve</code>	Yes	all	dict	file	high level persistent, dictionary-like object
<code>marshal</code>	Yes	all	dump/load	file	Internal Python object serialization
<code>dbm</code>	Yes	all	dict	file	Interfaces to Unix "databases". Wrapper for <code>dbm.gnu</code> , <code>dbm.ndbm</code> , <code>dbm.dumb</code>
<code>dbm.gnu</code>	Yes	unix	dict	file	GNU's reinterpretation of <code>dbm</code>
<code>dbm.ndbm</code>	Yes	unix	dict	file	Interface based on <code>ndbm</code>
<code>dbm.dumb</code>	Yes	all	dict	file	Portable DBM implementation
<code>sqlite3</code>	Yes	all	DBAPI2	file, memory	DB-API 2.0 interface for SQLite databases

#### third-party DBAPI2

- `pyodbc`
- `mxODBC`

- kinterbasdb
- mxODBC Connect
- MySQLdb
- psycopg
- pyPgSQL
- PySQLite
- adodbapi
- pymssql
- sapdbapi
- ibm\_db
- InformixDB

### third-party NOSQL

(these may or not have python DBAPI2 interface)

- CouchDB - `couchdb.client`
- MongoDB - `pymongo` - NoSQL database
- Cassandra - `ycassa`

### third-party database abstraction layer

- SQLAlchemy - `sqlalchemy` - Python SQL toolkit and Object Relational Mapper

## 9.2.5 Step 2 - Which module to use?

*hrrrr... wrong question!*

The first decision I thought it should made is which python module better suites the needs of this TEP. Then I realized I would fall into the same trap as the C++ DataBases: hard link the server to a specific database implementation (in their case MySQL).

I took a closer look at the tables above and I noticed that python persistent modules come in two flavors: dict and DBAPI2. So naturally the decision I thought it had to be made was: *which flavor to use?*

But then I realized both flavors could be used if we properly design the python DataBases.

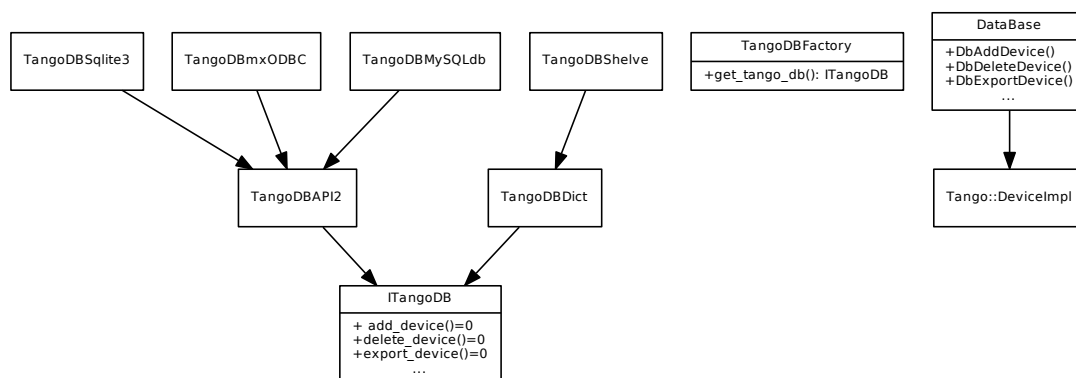
## 9.2.6 Step 3 - Architecture

If you step back for a moment and look at the big picture you will see that what we need is really just a mapping between the Tango DataBase set of attributes and commands (I will call this *Tango Device DataBase API*) and the python database API oriented to tango (I will call this TDB interface).

The TDB interface should be represented by the `ITangoDB`. Concrete databases should implement this interface (example, DBAPI2 interface should be represented by a class `TangoDBAPI2` implementing `ITangoDB`).

Connection to a concrete `ITangoDB` should be done through a factory: `TangoDBFactory`

The Tango DataBase device should have no logic. Through basic configuration it should be able to ask the `TangoDBFactory` for a concrete `ITangoDB`. The code of every command and attribute should be simple forward to the `ITangoDB` object (a part of some parameter translation and error handling).



## 9.2.7 Step 4 - The python DataBases

If we can make a python device server which has the same set of attributes and commands as the existing C++ DataBase (and of course the same semantic behavior), the tango DS and tango clients will never know the difference (BTW, that's one of the beauties of tango).

The C++ DataBase consists of around 80 commands and 1 mandatory attribute (the others are used for profiling) so making a python Tango DataBase device from scratch is out of the question.

Fortunately, C++ DataBase is one of the few device servers that were developed since the beginning with pogo and were successfully adapted to pogo 8. This means there is a precious `DataBase.xmi` available which can be loaded to pogo and saved as a python version. The result of doing this can be found [here](#) (this file was generated with a beta version of the pogo 8.1 python code generator so it may contain errors).

## 9.2.8 Step 5 - Default database implementation

The decision to which database implementation should be used should obey the following rules:

1. should not require an extra database server process
2. should be a native python module
3. should implement python DBAPI2

It came to my attention the `sqlite3` module would be perfect as a default database implementation. This module comes with python since version 2.5 and is available in all platforms. It implements the DBAPI2 interface and can store persistently in a common OS file or even in memory.

There are many free scripts on the web to translate a mysql database to sqlite3 so one can use an existing mysql tango database and directly use it with the python DataBases with sqlite3 implementation.

## 9.2.9 Development

The development is being done in PyTango SVN trunk in the `tango.databases` module.

You can checkout with:

```
$ svn co https://tango-cs.svn.sourceforge.net/svnroot/tango-cs/bindings/PyTango/
↪trunk PyTango-trunk
```

### 9.2.10 Disadvantages

A serverless, file based, database has some disadvantages when compared to the mysql solution:

- Not possible to distribute load between Tango DataBase DS and database server (example: run the Tango DS in one machine and the database server in another)
- Not possible to have two Tango DataBase DS pointing to the same database
- Harder to upgrade to newer version of sql tables (specially if using dict based database)

Bare in mind the purpose of this TED is to simplify the process of trying tango and to ease installation and configuration on small environments (like small, independent laboratories).

### 9.2.11 References

- <http://wiki.python.org/moin/DbApiCheatSheet>
- <http://wiki.python.org/moin/DbApiModuleComparison>
- <http://wiki.python.org/moin/DatabaseProgramming>
- <http://wiki.python.org/moin/DbApiFaq>
- **PEP 249**
- <http://wiki.python.org/moin/ExtendingTheDbApi>
- <http://wiki.python.org/moin/DbApi3>



# CHAPTER 10

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## History of changes

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**Contributors** T. Coutinho

**Last Update** Nov 28, 2018

### 10.1 Document revisions

Date	Revision	Description	Author
18/07/03	1.0	Initial Version	M. Ounsy
06/10/03	2.0	Extension of the "Getting Started" paragraph	A. Buteau/M. Ounsy
14/10/03	3.0	Added Exception Handling paragraph	M. Ounsy
13/06/05	4.0	Ported to Latex, added events, AttributeProxy and ApiUtil	V. Forchì
13/06/05	4.1	fixed bug with python 2.5 and and state events new Database constructor	V. Forchì
15/01/06	5.0	Added Device Server classes	E.Taurel
15/03/07	6.0	Added AttrInfoEx, AttributeConfig events, 64bits, write_attribute	T. Coutinho
21/03/07	6.1	Added groups	T. Coutinho
15/06/07	6.2	Added dynamic attributes doc	E. Taurel
06/05/08	7.0	Update to Tango 6.1. Added DB methods, version info	T. Coutinho
10/07/09	8.0	Update to Tango 7. Major refactoring. Migrated doc	T. Coutinho/R. S
24/07/09	8.1	Added migration info, added missing API doc	T. Coutinho/R. S
21/09/09	8.2	Added migration info, release of 7.0.0beta2	T. Coutinho/R. S
12/11/09	8.3	Update to Tango 7.1.	T. Coutinho/R. S
??/12/09	8.4	Update to PyTango 7.1.0 rc1	T. Coutinho/R. S
19/02/10	8.5	Update to PyTango 7.1.1	T. Coutinho/R. S
06/08/10	8.6	Update to PyTango 7.1.2	T. Coutinho
05/11/10	8.7	Update to PyTango 7.1.3	T. Coutinho
08/04/11	8.8	Update to PyTango 7.1.4	T. Coutinho
13/04/11	8.9	Update to PyTango 7.1.5	T. Coutinho
14/04/11	8.10	Update to PyTango 7.1.6	T. Coutinho
15/04/11	8.11	Update to PyTango 7.2.0	T. Coutinho
12/12/11	8.12	Update to PyTango 7.2.2	T. Coutinho
24/04/12	8.13	Update to PyTango 7.2.3	T. Coutinho
21/09/12	8.14	Update to PyTango 8.0.0	T. Coutinho
10/10/12	8.15	Update to PyTango 8.0.2	T. Coutinho

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Table 1 – continued from previous page

Date	Revision	Description	Author
20/05/13	8.16	Update to PyTango 8.0.3	T. Coutinho
28/08/13	8.13	Update to PyTango 7.2.4	T. Coutinho
27/11/13	8.18	Update to PyTango 8.1.1	T. Coutinho
16/05/14	8.19	Update to PyTango 8.1.2	T. Coutinho
30/09/14	8.20	Update to PyTango 8.1.4	T. Coutinho
01/10/14	8.21	Update to PyTango 8.1.5	T. Coutinho
05/02/15	8.22	Update to PyTango 8.1.6	T. Coutinho
03/02/16	8.23	Update to PyTango 8.1.8	T. Coutinho
12/08/16	8.24	Update to PyTango 8.1.9	V. Michel
26/02/16	9.2.0a	Update to PyTango 9.2.0a	T. Coutinho
15/08/16	9.2.0	9.2.0 Release	V. Michel
23/01/17	9.2.1	9.2.1 Release	V. Michel
27/09/17	9.2.2	9.2.2 Release	G. Cuni/V. Michel
30/05/18	9.2.3	9.2.3 Release	V. Michel
30/07/18	9.2.4	9.2.4 Release	V. Michel
28/11/18	9.2.5	9.2.5 Release	A. Joubert

## 10.2 Version history



Version	Changes
9.2.5	<p>9.2.5 release.</p> <p><b>Changes:</b></p> <ul style="list-style-type: none"> <li>• Pull Request #212: Skip databaseds backends in PyTango compatibility module</li> <li>• Pull Request #221: DevEnum attributes can now be directly assigned labels</li> <li>• Pull Request #236: Cleanup db_access module</li> <li>• Pull Request #237: Add info about how to release a new version</li> </ul> <p><b>Bug fixes:</b></p> <ul style="list-style-type: none"> <li>• Pull Request #209 (issue #207): Fix documentation warnings</li> <li>• Pull Request #211: Yet another fix to the gevent threadpool error wrapping</li> <li>• Pull Request #214 (issue #213): DevEncoded attribute should produce a bytes object in python 3</li> <li>• Pull Request #219: Fixing icons in documentation</li> <li>• Pull Request #220: Fix 'DevFailed' object does not support indexing</li> <li>• Pull Request #225 (issue #215): Fix exception propagation in python 3</li> <li>• Pull Request #226 (issue #216): Add missing converter from python bytes to char*</li> <li>• Pull Request #227: Gevent issue #1260 should be fixed by now</li> <li>• Pull Request #232: use special case-insensitive weak values dictionary for Tango nodes</li> </ul>

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Table 2 – continued from previous page

Version	Changes
9.2.4	9.2.4 release. <b>Changes:</b> <ul style="list-style-type: none"> <li>• Pull Request #194 (issue #188): Easier access to DevEnum attribute using python enum</li> <li>• Pull Request #199 (issue #195): Support python enum as dtype argument for attributes</li> <li>• Pull Request #205 (issue #202): Python 3.7 compatibility</li> </ul> <b>Bug fixes:</b> <ul style="list-style-type: none"> <li>• Pull Request #193 (issue #192): Fix a gevent green mode memory leak introduced in v9.2.3</li> </ul>
9.2.3	9.2.3 release. <b>Changes:</b> <ul style="list-style-type: none"> <li>• Pull Request #169: Use tango-controls theme for the documentation</li> <li>• Pull Request #170 (issue #171): Use a private gevent ThreadPool</li> <li>• Pull Request #180: Use same default encoding for python2 and python3 (utf-8)</li> </ul> <b>Bug fixes:</b> <ul style="list-style-type: none"> <li>• Pull Request #178 (issue #177): Make CmdDoneEvent.argout writable</li> <li>• Pull Request #178: Add GIL control for ApiUtil.get_asynch_replies</li> <li>• Pull Request #187 (issue #186): Fix and extend client green mode</li> </ul>

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Table 2 – continued from previous page

Version	Changes
9.2.2	<p>9.2.2 release.</p> <p><b>Features:</b></p> <ul style="list-style-type: none"> <li>• Pull Request #104: Pipe Events</li> <li>• Pull Request #106: Implement pipe write (client and server, issue #9)</li> <li>• Pull Request #122: Dynamic commands</li> <li>• Pull Request #124: Add forward attribute</li> <li>• Pull Request #129: Implement mandatory property (issue #30)</li> </ul> <p><b>Changes:</b></p> <ul style="list-style-type: none"> <li>• Pull Request #109: Device Interface Change Events</li> <li>• Pull Request #113: Adding asyncio green mode documentation and a how-to on contributing</li> <li>• Pull Request #114: Added PEP8-ified files in tango module.</li> <li>• Pull Request #115: Commands polling tests (client and server)</li> <li>• Pull Request #116: Attribute polling tests (client and server)</li> <li>• Pull Request #117: Use official tango-controls conda channel</li> <li>• Pull Request #125: Forward attribute example</li> <li>• Pull Request #134: Linting pytango (with pylint + flake8)</li> <li>• Pull Request #137: Codacy badge in README and code quality policy in How to Contribute</li> <li>• Pull Request #143: Added missing PipeEventData &amp; DevIntrChangeEventData</li> </ul> <p><b>Bug fixes:</b></p> <ul style="list-style-type: none"> <li>• Pull Request #85 (issue #84): Fix Gevent ThreadPool exceptions</li> <li>• Pull Request #94 (issue #93): Fix issues in setup file (GCC-7 build)</li> <li>• Pull Request #96: Filter badges from the long description</li> <li>• Pull Request #97: Fix/linker options</li> <li>• Pull Request #98: Refactor green mode for client and server APIs</li> <li>• Pull Request #101 (issue #100) check for None and return null string</li> </ul>
<b>10.2. Version history</b>	<ul style="list-style-type: none"> <li>• Pull Request #102: Update server tests</li> <li>• Pull Request #103: Cache build ob-</li> </ul>

Table 2 – continued from previous page

Version	Changes
9.2.1	<p data-bbox="810 262 959 286">9.2.1 release.</p> <p data-bbox="810 293 927 318"><b>Features:</b></p> <ul data-bbox="919 338 1390 432" style="list-style-type: none"> <li data-bbox="919 338 1390 432">• Pull Requests #70: Add test_context and test_utils modules, used for py-tango unit-testing</li> </ul> <p data-bbox="810 450 927 474"><b>Changes:</b></p> <ul data-bbox="919 495 1390 1144" style="list-style-type: none"> <li data-bbox="919 495 1390 555">• Issue #51: Refactor platform specific code in setup file</li> <li data-bbox="919 573 1390 633">• Issue #67: Comply with PEP 440 for pre-releases</li> <li data-bbox="919 651 1390 712">• Pull Request #70: Add unit-testing for the server API</li> <li data-bbox="919 730 1390 790">• Pull Request #70: Configure Travis CI for continuous integration</li> <li data-bbox="919 808 1390 869">• Pull Request #76: Add unit-testing for the client API</li> <li data-bbox="919 887 1390 947">• Pull Request #78: Update the python version classifiers</li> <li data-bbox="919 965 1390 1025">• Pull Request #80: Move tango object server to its own module</li> <li data-bbox="919 1043 1390 1144">• Pull Request #90: The metaclass definition for tango devices is no longer mandatory</li> </ul> <p data-bbox="810 1162 927 1187"><b>Bug fixes:</b></p> <ul data-bbox="919 1207 1390 2018" style="list-style-type: none"> <li data-bbox="919 1207 1390 1267">• Issue #24: Fix dev_status dangling pointer bug</li> <li data-bbox="919 1285 1390 1346">• Issue #57: Fix dev_state/status to be gevent safe</li> <li data-bbox="919 1364 1390 1424">• Issue #58: Server gevent mode internal call hangs</li> <li data-bbox="919 1442 1390 1503">• Pull Request #62: Several fixes in tango.databases</li> <li data-bbox="919 1520 1390 1581">• Pull Request #63: Follow up on issue #21 (Fix Group.get_device method)</li> <li data-bbox="919 1599 1390 1693">• Issue #64: Fix AttributeProxy.__dev_proxy to be initialized with python internals</li> <li data-bbox="919 1711 1390 1771">• Issue #74: Fix hanging with an asynchronous tango server fails to start</li> <li data-bbox="919 1789 1390 1850">• Pull Request #81: Fix DeviceImpl documentation</li> <li data-bbox="919 1868 1390 1928">• Issue #82: Fix attribute completion for device proxies with IPython &gt;= 4</li> <li data-bbox="919 1946 1390 2007">• Issue #84: Fix gevent threadpool exceptions</li> </ul>

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Table 2 – continued from previous page

Version	Changes
9.2.0	<p>9.2.0 release.</p> <p>Features:</p> <ul style="list-style-type: none"> <li>• Issue #37: Add <code>display_level</code> and <code>polling_period</code> as optional arguments to command decorator</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• Fix cache problem when using <i>DeviceProxy</i> through an <i>AttributeProxy</i></li> <li>• Fix compilation on several platforms</li> <li>• Issue #19: Defining new members in <i>DeviceProxy</i> has side effects</li> <li>• Fixed bug in <i>beacon.add_device</i></li> <li>• Fix for <i>get_device_list</i> if <i>server_name</i> is '*'</li> <li>• Fix <i>get_device_attribute_property2</i> if <i>prop_attr</i> is not <i>None</i></li> <li>• Accept <i>StdStringVector</i> in <i>put_device_property</i></li> <li>• Map 'int' to <i>DevLong64</i> and 'uint' to <i>DevULong64</i></li> <li>• Issue #22: Fix <i>push_data_ready_event()</i> deadlock</li> <li>• Issue #28: Fix compilation error for <i>constants.cpp</i></li> <li>• Issue #21: Fix <i>Group.get_device</i> method</li> <li>• Issue #33: Fix internal server documentation</li> </ul> <p>Changes:</p> <ul style="list-style-type: none"> <li>• Move <i>ITango</i> to another project</li> <li>• Use <i>setuptools</i> instead of <i>distutils</i></li> <li>• Add <i>six</i> as a requirement</li> <li>• Refactor directory structure</li> <li>• Rename <i>PyTango</i> module to <i>tango</i> (<i>import PyTango</i> still works for backward compatibility)</li> <li>• Add a ReST readme for GitHub and PyPI</li> </ul> <p><b>ITango changes (moved to another project):</b></p> <ul style="list-style-type: none"> <li>• Fix <i>itango</i> event logger for python 3</li> <li>• Avoid deprecation warning with IPython 4.x</li> <li>• Use entry points instead of scripts</li> </ul>

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Table 2 – continued from previous page

Version	Changes
9.2.0a	9.2 alpha release. Missing: <ul style="list-style-type: none"> <li>• writable pipes (client and server)</li> <li>• dynamic commands (server)</li> <li>• device interface change event (client and server)</li> <li>• pipe event (client and server)</li> </ul> Bug fixes: <ul style="list-style-type: none"> <li>• 776: [pytango][8.1.8] SyntaxError: invalid syntax</li> </ul>
8.1.9	Features: <ul style="list-style-type: none"> <li>• PR #2: asyncio support for both client and server API</li> <li>• PR #6: Expose AutoTangoMonitor and AutoTangoAllowThreads</li> </ul> Bug fixes: <ul style="list-style-type: none"> <li>• PR #31: Get -l flags from pkg-config</li> <li>• PR #15: Rename itango script to itango3 for python3</li> <li>• PR #14: Avoid deprecation warning with IPython 4.x</li> </ul>

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Table 2 – continued from previous page

Version	Changes
8.1.8	<p>Features:</p> <ul style="list-style-type: none"> <li>• PR #3: Add a <code>run_server</code> class method to Device</li> <li>• PR #4: Add device inheritance</li> <li>• 110: device property with auto update in database</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 690: Description attribute property</li> <li>• 700: [pytango] useless files in the source distribution</li> <li>• 701: Memory leak in command with list argument</li> <li>• 704: Assertion failure when calling command with string array input type</li> <li>• 705: Support <code>boost_python</code> lib name on Gentoo</li> <li>• 714: Memory leak in PyTango for direct server command calls</li> <li>• 718: OverflowErrors with float types in 8.1.6</li> <li>• 724: PyTango Device-Proxy.command_inout(&lt;str&gt;) memory leaks</li> <li>• 736: pytango FTBFS with python 3.4</li> <li>• 747: PyTango event callback in gevent mode gets called in non main thread</li> </ul>
8.1.6	<p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 698: PyTango.Util discrepancy</li> <li>• 697: PyTango.server.run does not accept old Device style classes</li> </ul>
8.1.5	<p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 687: [pytango] 8.1.4 unexpected files in the source package</li> <li>• 688: PyTango 8.1.4 new style server commands don't work</li> </ul>

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Table 2 – continued from previous page

Version	Changes
8.1.4	Features: <ul style="list-style-type: none"> <li>• 107: Nice to check Tango/PyTango version at runtime</li> </ul> Bug fixes: <ul style="list-style-type: none"> <li>• 659: segmentation fault when unsubscribing from events</li> <li>• 664: problem while installing PyTango 8.1.1 with pip (using pip 1.4.1)</li> <li>• 678: [pytango] 8.1.2 unexpected files in the source package</li> <li>• 679: PyTango.server tries to import missing <code>__builtin__</code> module on Python 3</li> <li>• 680: Cannot import PyTango.server.run</li> <li>• 686: Device property substitution for a multi-device server</li> </ul>
8.1.3	<i>SKIPPED</i>
8.1.2	Features: <ul style="list-style-type: none"> <li>• 98: PyTango.server.server_run needs additional <code>post_init_callback</code> parameter</li> <li>• 102: DevEncoded attribute should support a python buffer object</li> <li>• 103: Make creation of *EventData objects possible in PyTango</li> </ul> Bug fixes: <ul style="list-style-type: none"> <li>• 641: python3 error handling issue</li> <li>• 648: PyTango unicode method parameters fail</li> <li>• 649: <code>write_attribute</code> of <code>spectrum/image</code> fails in PyTango without numpy</li> <li>• 650: [pytango] 8.1.1 not compatible with ipyton 1.2.0-rc1</li> <li>• 651: PyTango segmentation fault when run a DS that use <code>attr_data.py</code></li> <li>• 660: <code>command_inout_async</code> (polling mode) fails</li> <li>• 666: PyTango shutdown sometimes blocks.</li> </ul>

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Table 2 – continued from previous page

Version	Changes
8.1.1	<p>Features:</p> <ul style="list-style-type: none"> <li>• Implemented tango C++ 8.1 API</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 527: set_value() for ULong64</li> <li>• 573: [pytango] python3 error with unregistered device</li> <li>• 611: URGENT fail to write attribute with PyTango 8.0.3</li> <li>• 612: [pytango][8.0.3] failed to build from source on s390</li> <li>• 615: Threading problem when setting a DevULong64 attribute</li> <li>• 622: PyTango broken when running on Ubuntu 13</li> <li>• 626: attribute_history extraction can raised an exception</li> <li>• 628: Problem in installing PyTango 8.0.3 on Scientific Linux 6</li> <li>• 635: Reading of ULong64 attributes does not work</li> <li>• 636: PyTango log messages are not filtered by level</li> <li>• 637: [pytango] segfault doing write_attribute on Group</li> </ul>
8.1.0	<i>SKIPPED</i>
8.0.3	<p>Features:</p> <ul style="list-style-type: none"> <li>• 88: Implement Util::server_set_event_loop method in python</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 3576353: [pytango] segfault on 'Restart-Server'</li> <li>• 3579062: [pytango] Attribute missing methods</li> <li>• 3586337: [pytango] Some DeviceClass methods are not python safe</li> <li>• 3598514: DeviceProxy.__setattr__ break python's descriptors</li> <li>• 3607779: [pytango] IPython 0.10 error</li> <li>• 598: Import DLL by PyTango failed on windows</li> <li>• 605: [pytango] use distutils.version module</li> </ul>

Continued on next page

Table 2 – continued from previous page

Version	Changes
8.0.2	Bug fixes: <ul style="list-style-type: none"> <li>• 3570970: [pytango] problem during the python3 building</li> <li>• 3570971: [pytango] itango does not work without qtconsole</li> <li>• 3570972: [pytango] warning/error when building 8.0.0</li> <li>• 3570975: [pytango] problem during use of python3 version</li> <li>• 3574099: [pytango] compile error with gcc &lt; 4.5</li> </ul>
8.0.1	<i>SKIPPED</i>
8.0.0	Features: <ul style="list-style-type: none"> <li>• Implemented tango C++ 8.0 API</li> <li>• Python 3k compatible</li> </ul> Bug fixes: <ul style="list-style-type: none"> <li>• 3023857: DevEncoded write attribute not supported</li> <li>• 3521545: [pytango] problem with tango profile</li> <li>• 3530535: PyTango group writting fails</li> <li>• 3564959: EncodedAttribute.encode_xxx() methods don't accept bytearray</li> </ul>
7.2.4	Bug fixes: <ul style="list-style-type: none"> <li>• 551: [pytango] Some DeviceClass methods are not python safe</li> </ul>
7.2.3	Features: <ul style="list-style-type: none"> <li>• 3495607: DeviceClass.device_name_factory is missing</li> </ul> Bug fixes: <ul style="list-style-type: none"> <li>• 3103588: documentation of PyTango.Attribute.Group</li> <li>• 3458336: Problem with pytango 7.2.2</li> <li>• 3463377: PyTango memory leak in read encoded attribute</li> <li>• 3487930: [pytango] wrong python dependency</li> <li>• 3511509: Attribute.set_value_date_quality for encoded does not work</li> <li>• 3514457: [pytango] TANGO_HOST multi-host support</li> <li>• 3520739: command_history(...) in PyTango</li> </ul>

Continued on next page

Table 2 – continued from previous page

Version	Changes
7.2.2	<p>Features:</p> <ul style="list-style-type: none"> <li>• 3305251: DS dynamic attributes discards some Attr properties</li> <li>• 3365792: DeviceProxy.&lt;cmd_name&gt; could be documented</li> <li>• 3386079: add support for ipython 0.11</li> <li>• 3437654: throw python exception as tango exception</li> <li>• 3447477: spock profile installation</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 3372371: write attribute of DevEncoded doesn't work</li> <li>• 3374026: [pytango] pyflakes warning</li> <li>• 3404771: PyTango.MultiAttribute.get_attribute_list missing</li> <li>• 3405580: PyTango.MultiClassAttribute missing</li> </ul>
7.2.1	<i>SKIPPED</i>
7.2.0	<p>Features:</p> <ul style="list-style-type: none"> <li>• 3286678: Add missing EncodedAttribute JPEG methods</li> </ul>
7.1.6	<p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 7.1.5 distribution is missing some files</li> </ul>
7.1.5	<p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 3284174: 7.1.4 does not build with gcc 4.5 and tango 7.2.6</li> <li>• 3284265: [pytango][7.1.4] a few files without licence and copyright</li> <li>• 3284318: copyleft vs copyright</li> <li>• 3284434: [pytango][doc] few ERROR during the doc generation</li> <li>• 3284435: [pytango][doc] few warning during the doc generation</li> <li>• 3284440: [pytango][spock] the profile can't be installed</li> <li>• 3285185: PyTango Device Server does not load Class Properties values</li> <li>• 3286055: PyTango 7.1.x DS using Tango C++ 7.2.x seg faults on exit</li> </ul>

Continued on next page

Table 2 – continued from previous page

Version	Changes
7.1.4	<p>Features:</p> <ul style="list-style-type: none"> <li>• 3274309: Generic Callback for events</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 3011775: Seg Faults due to removed dynamic attributes</li> <li>• 3105169: PyTango 7.1.3 does not compile with Tango 7.2.X</li> <li>• 3107243: spock profile does not work with python 2.5</li> <li>• 3124427: PyTango.WAttribute.set_max_value() changes min value</li> <li>• 3170399: Missing documentation about is_&lt;attr&gt;_allowed method</li> <li>• 3189082: Missing get_properties() for Attribute class</li> <li>• 3196068: delete_device() not called after server_admin.Kill()</li> <li>• 3257286: Binding crashes when reading a WRITE string attribute</li> <li>• 3267628: DP.read_attribute(, extract=List/tuple) write value is wrong</li> <li>• 3274262: Database.is_multi_tango_host missing</li> <li>• 3274319: EncodedAttribute is missing in PyTango (&lt;= 7.1.3)</li> <li>• 3277269: read_attribute(DevEncoded) is not numpy as expected</li> <li>• 3278946: DeviceAttribute copy constructor is not working</li> </ul> <p>Documentation:</p> <ul style="list-style-type: none"> <li>• Added <i>The Utilities API</i> chapter</li> <li>• Added <i>Encoded API</i> chapter</li> <li>• Improved <i>Write a server (original API)</i> chapter</li> </ul>

Continued on next page

Table 2 – continued from previous page

Version	Changes
7.1.3	<p>Features:</p> <ul style="list-style-type: none"> <li>• tango logging with print statement</li> <li>• tango logging with decorators</li> <li>• from sourceforge:</li> <li>• 3060380: ApiUtil should be exported to PyTango</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• added licence header to all source code files</li> <li>• spock didn't work without TANGO_HOST env. variable (it didn't recognize tangorc)</li> <li>• spock should give a proper message if it tries to be initialized outside ipython</li> <li>• 3048798: licence issue GPL != LGPL</li> <li>• 3073378: DeviceImpl.signal_handler raising exception crashes DS</li> <li>• 3088031: Python DS unable to read DevVarBooleanArray property</li> <li>• 3102776: PyTango 7.1.2 does not work with python 2.4 &amp; boost 1.33.0</li> <li>• 3102778: Fix compilation warnings in linux</li> </ul>

Continued on next page

Table 2 – continued from previous page

Version	Changes
7.1.2	<p>Features:</p> <ul style="list-style-type: none"> <li>• 2995964: Dynamic device creation</li> <li>• 3010399: The DeviceClass.get_device_list that exists in C++ is missing</li> <li>• 3023686: Missing DeviceProxy.&lt;attribute name&gt;</li> <li>• 3025396: DeviceImpl is missing some CORBA methods</li> <li>• 3032005: IPython extension for PyTango</li> <li>• 3033476: Make client objects pickable</li> <li>• 3039902: PyTango.Util.add_class would be useful</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 2975940: DS command with DevVarCharArray return type fails</li> <li>• 3000467: DeviceProxy.unlock is LOCKING instead of unlocking!</li> <li>• 3010395: Util.get_device_* methods don't work</li> <li>• 3010425: Database.dev_name does not work</li> <li>• 3016949: command_inout_asynch callback does not work</li> <li>• 3020300: PyTango does not compile with gcc 4.1.x</li> <li>• 3030399: Database put(delete)_attribute_alias generates segfault</li> </ul>
7.1.1	<p>Features:</p> <ul style="list-style-type: none"> <li>• Improved setup script</li> <li>• Interfaced with PyPI</li> <li>• Cleaned build script warnings due to unclean python C++ macro definitions</li> <li>• 2985993: PyTango numpy command support</li> <li>• 2971217: PyTango.GroupAttrReplyList slicing</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 2983299: Database.put_property() deletes the property</li> <li>• 2953689: can not write_attribute scalar/spectrum/image</li> <li>• 2953030: PyTango doc installation</li> </ul>

Continued on next page

Table 2 – continued from previous page

Version	Changes
7.1.0	<p>Features:</p> <ul style="list-style-type: none"> <li>• 2908176: <code>read_*</code>, <code>write_*</code> and <code>is_*_allowed()</code> methods can now be defined</li> <li>• 2941036: TimeVal conversion to time and datetime</li> <li>• added str representation on <code>Attr</code>, <code>Attribute</code>, <code>DeviceImpl</code> and <code>DeviceClass</code></li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• 2903755: <code>get_device_properties()</code> bug reading <code>DevString</code> properties</li> <li>• 2909927: <code>PyTango.Group.read_attribute()</code> return values</li> <li>• 2914194: <code>DevEncoded</code> does not work</li> <li>• 2916397: <code>PyTango.DeviceAttribute</code> copy constructor does not work</li> <li>• 2936173: <code>PyTango.Group.read_attributes()</code> fails</li> <li>• 2949099: Missing <code>PyTango.Except.print_error_stack</code></li> </ul>

Continued on next page

Table 2 – continued from previous page

Version	Changes
7.1.0rc1	<p>Features:</p> <ul style="list-style-type: none"> <li>• <code>v = image_attribute.get_write_value()</code> returns square sequences (arrays of arrays, or numpy objects) now instead of flat lists. Also for spectrum attributes a numpy is returned by default now instead.</li> <li>• <code>image_attribute.set_value(v)</code> accepts numpy arrays now or square sequences instead of just flat lists. So, <code>dim_x</code> and <code>dim_y</code> are useless now. Also the numpy path is faster.</li> <li>• new enum <code>AttrSerialModel</code></li> <li>• <code>Attribute</code> new methods: <code>set(get)_attr_serial_model</code>, <code>set_change_event</code>, <code>set_archive_event</code>, <code>is_change_event</code>, <code>is_check_change_event</code>, <code>is_archive_criteria</code>, <code>is_check_archive_criteria</code>, <code>remove_configuration</code></li> <li>• added support for numpy scalars in tango operations like <code>write_attribute</code> (ex: now a <code>DEV_LONG</code> attribute can receive a <code>numpy.int32</code> argument in a <code>write_attribute</code> method call)</li> </ul> <p>Bug fixes:</p> <ul style="list-style-type: none"> <li>• <code>DeviceImpl.set_value</code> for scalar attributes</li> <li>• <code>DeviceImpl.push_***_event</code></li> <li>• server commands with <code>DevVar***StringArray</code> as parameter or as return type</li> <li>• in windows, a bug in <code>PyTango.Util</code> prevented servers from starting up</li> <li>• <code>DeviceImpl.get_device_properties</code> for string properties assigns only first character of string to object member instead of entire string</li> <li>• added missing methods to <code>Util</code></li> <li>• exported <code>SubDevDiag</code> class</li> <li>• error in read/events of attributes of type <code>DevBoolean READ_WRITE</code></li> <li>• error in automatic unsubscribe events of <code>DeviceProxy</code> when the object disappears (happens only on some compilers with some optimization flags)</li> <li>• fix possible bug when comparing attribute names in <code>DeviceProxy</code></li> <li>• pretty print of <code>DevFailed</code> -&gt; fix deprecation warning in python 2.6</li> <li>• device class properties were not properly fetched when there is no property value defined</li> </ul>
260	<p><b>Chapter 10. History of changes</b></p> <ul style="list-style-type: none"> <li>• memory leak when converting <code>DevFailed</code> exceptions from C++ to python</li> <li>• python device server file without extension</li> </ul>



Table 2 – continued from previous page

Version	Changes
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# CHAPTER 11

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## Indexes

---

- modindex
- genindex

**Last update:** Nov 28, 2018



**t**

tango, 21

tango.server, 96



## A

- AccessControlType (class in tango), 93  
 add() (tango.Group method), 74  
 add\_attribute() (tango.LatestDeviceImpl method), 118  
 add\_attribute() (tango.server.Device method), 100  
 add\_class() (tango.Util method), 155  
 add\_command() (tango.LatestDeviceImpl method), 118  
 add\_command() (tango.server.Device method), 100  
 add\_Cpp\_TgClass() (tango.Util method), 155  
 add\_device() (tango.Database method), 162  
 add\_logging\_target() (tango.DeviceProxy method), 30  
 add\_server() (tango.Database method), 162  
 add\_TgClass() (tango.Util method), 155  
 add\_wiz\_class\_prop() (tango.DeviceClass method), 129  
 add\_wiz\_dev\_prop() (tango.DeviceClass method), 129  
 adm\_name() (tango.DeviceProxy method), 30  
 alias() (tango.DeviceProxy method), 30  
 always\_executed\_hook() (tango.LatestDeviceImpl method), 118  
 always\_executed\_hook() (tango.server.Device method), 100  
 ApiUtil (class in tango), 82  
 append\_status() (tango.LatestDeviceImpl method), 118  
 append\_status() (tango.server.Device method), 100  
 ArchiveEventInfo (class in tango), 89  
 asyn\_req\_type (class in tango), 93  
 AsyncCall, 198  
 AsyncReplyNotArrived, 199  
 Attr (class in tango), 135  
 AttrConfEventData (class in tango), 90  
 AttrDataFormat (class in tango), 93  
 AttrReqType (class in tango), 92  
 Attribute (class in tango), 140  
 attribute (class in tango.server), 111  
 attribute\_history() (tango.DeviceProxy method), 30  
 attribute\_list\_query() (tango.DeviceProxy method), 31  
 attribute\_list\_query\_ex() (tango.DeviceProxy method), 31  
 attribute\_query() (tango.DeviceProxy method), 31  
 AttributeAlarmInfo (class in tango), 83  
 AttributeDimension (class in tango), 84  
 AttributeEventInfo (class in tango), 89  
 AttributeInfo (class in tango), 84  
 AttributeInfoEx (class in tango), 84  
 AttributeProxy (class in tango), 61  
 AttrQuality (class in tango), 93  
 AttrReadEvent (class in tango), 88  
 AttrWriteType (class in tango), 93  
 AttrWrittenEvent (class in tango), 89

## B

- black\_box() (tango.DeviceProxy method), 31  
 build\_connection() (tango.Database method), 163

## C

- cancel\_all\_polling\_asynch\_request() (tango.DeviceProxy method), 31  
 cancel\_asynch\_request() (tango.DeviceProxy method), 31  
 cb\_sub\_model (class in tango), 93  
 ChangeEventInfo (class in tango), 89  
 check\_access\_control() (tango.Database method), 163  
 check\_alarm() (tango.Attribute method), 140  
 check\_alarm() (tango.MultiAttribute method), 148  
 check\_command\_exists() (tango.LatestDeviceImpl method), 119  
 check\_command\_exists() (tango.server.Device method), 100  
 check\_tango\_host() (tango.Database method), 163  
 class\_property (class in tango.server), 115  
 CmdArgType (class in tango), 91  
 CmdDoneEvent (class in tango), 89

- command() (in module *tango.server*), 112  
 command\_history() (*tango.DeviceProxy* method), 32  
 command\_inout() (*tango.DeviceProxy* method), 32  
 command\_inout() (*tango.Group* method), 74  
 command\_inout\_asynch() (*tango.DeviceProxy* method), 32  
 command\_inout\_asynch() (*tango.Group* method), 74  
 command\_inout\_raw() (*tango.DeviceProxy* method), 33  
 command\_inout\_reply() (*tango.DeviceProxy* method), 34  
 command\_inout\_reply() (*tango.Group* method), 75  
 command\_inout\_reply\_raw() (*tango.DeviceProxy* method), 34  
 command\_list\_query() (*tango.DeviceProxy* method), 35  
 command\_query() (*tango.DeviceProxy* method), 35  
 CommandInfo (class in *tango*), 85  
 CommunicationFailed, 197  
 connect() (*tango.DeviceProxy* method), 35  
 connect\_db() (*tango.Util* method), 155  
 ConnectionFailed, 197  
 contains() (*tango.Group* method), 75  
 create\_device() (*tango.DeviceClass* method), 130  
 create\_device() (*tango.Util* method), 155
- ## D
- Database (class in *tango*), 162  
 DataReadyEventData (class in *tango*), 90  
 DbDatum (class in *tango*), 184  
 DbDevExportInfo (class in *tango*), 184  
 DbDevImportInfo (class in *tango*), 184  
 DbDevInfo (class in *tango*), 184  
 DbHistory (class in *tango*), 185  
 DbServerInfo (class in *tango*), 185  
 debug\_stream() (*tango.LatestDeviceImpl* method), 119  
 debug\_stream() (*tango.server.Device* method), 101  
 DebugIt (class in *tango*), 133  
 decode\_gray16() (*tango.EncodedAttribute* method), 185  
 decode\_gray8() (*tango.EncodedAttribute* method), 186  
 decode\_rgb32() (*tango.EncodedAttribute* method), 187  
 delete\_attribute\_alias() (*tango.Database* method), 163  
 delete\_class\_attribute\_property() (*tango.Database* method), 164  
 delete\_class\_property() (*tango.Database* method), 164  
 delete\_device() (*tango.Database* method), 164  
 delete\_device() (*tango.DeviceClass* method), 130  
 delete\_device() (*tango.LatestDeviceImpl* method), 119  
 delete\_device() (*tango.server.Device* method), 101  
 delete\_device() (*tango.Util* method), 156  
 delete\_device\_alias() (*tango.Database* method), 164  
 delete\_device\_attribute\_property() (*tango.Database* method), 165  
 delete\_device\_property() (*tango.Database* method), 165  
 delete\_property() (*tango.AttributeProxy* method), 61  
 delete\_property() (*tango.Database* method), 165  
 delete\_property() (*tango.DeviceProxy* method), 35  
 delete\_server() (*tango.Database* method), 166  
 delete\_server\_info() (*tango.Database* method), 166  
 description() (*tango.DeviceProxy* method), 36  
 dev\_name() (*tango.DeviceProxy* method), 36  
 dev\_state() (*tango.LatestDeviceImpl* method), 119  
 dev\_status() (*tango.LatestDeviceImpl* method), 119  
 DevCommandInfo (class in *tango*), 85  
 DevError (class in *tango*), 197  
 DevFailed, 197  
 Device (class in *tango.server*), 100  
 device\_destroyer() (*tango.DeviceClass* method), 130  
 device\_factory() (*tango.DeviceClass* method), 130  
 device\_name\_factory() (*tango.DeviceClass* method), 130  
 device\_property (class in *tango.server*), 115  
 DeviceAttribute (class in *tango*), 86  
 DeviceAttributeConfig (class in *tango*), 85  
 DeviceAttributeHistory (class in *tango*), 90  
 DeviceClass (class in *tango*), 129  
 DeviceData (class in *tango*), 88  
 DeviceDataHistory (class in *tango*), 90  
 DeviceInfo (class in *tango*), 86  
 DeviceProxy (class in *tango*), 29  
 DeviceProxy() (in module *tango.futures*), 81  
 DeviceProxy() (in module *tango.gevent*), 81  
 DeviceUnlocked, 199  
 DevSource (class in *tango*), 93  
 DevState (class in *tango*), 94  
 disable() (*tango.Group* method), 76  
 DispLevel (class in *tango*), 94  
 dyn\_attr() (*tango.DeviceClass* method), 131
- ## E
- enable() (*tango.Group* method), 76



- [encode\\_gray16\(\)](#) (*tango.EncodedAttribute method*), 187  
[encode\\_gray8\(\)](#) (*tango.EncodedAttribute method*), 188  
[encode\\_jpeg\\_gray8\(\)](#) (*tango.EncodedAttribute method*), 188  
[encode\\_jpeg\\_rgb24\(\)](#) (*tango.EncodedAttribute method*), 189  
[encode\\_jpeg\\_rgb32\(\)](#) (*tango.EncodedAttribute method*), 190  
[encode\\_rgb24\(\)](#) (*tango.EncodedAttribute method*), 190  
[EncodedAttribute](#) (*class in tango*), 185  
[environment variable](#)  
[PYTANGO\\_GREEN\\_MODE](#), 13  
[TANGO\\_HOST](#), 3, 4, 201  
[error\\_stream\(\)](#) (*tango.LatestDeviceImpl method*), 120  
[error\\_stream\(\)](#) (*tango.server.Device method*), 101  
[ErrorIt](#) (*class in tango*), 135  
[ErrSeverity](#) (*class in tango*), 93  
[event\\_queue\\_size\(\)](#) (*tango.AttributeProxy method*), 62  
[event\\_queue\\_size\(\)](#) (*tango.DeviceProxy method*), 36  
[EventCallback](#) (*class in tango.utils*), 191  
[EventData](#) (*class in tango*), 90  
[EventSystemFailed](#), 199  
[EventType](#) (*class in tango*), 92  
[Except](#) (*class in tango*), 196  
[export\\_device\(\)](#) (*tango.Database method*), 166  
[export\\_device\(\)](#) (*tango.DeviceClass method*), 131  
[export\\_event\(\)](#) (*tango.Database method*), 166  
[export\\_server\(\)](#) (*tango.Database method*), 167  
[extract\(\)](#) (*tango.DeviceData method*), 88  
[ExtractAs](#) (*tango.DeviceAttribute attribute*), 87
- ## F
- [fatal\\_stream\(\)](#) (*tango.LatestDeviceImpl method*), 120  
[fatal\\_stream\(\)](#) (*tango.server.Device method*), 101  
[FatalIt](#) (*class in tango*), 135
- ## G
- [get\\_access\\_control\(\)](#) (*tango.DeviceProxy method*), 36  
[get\\_access\\_except\\_errors\(\)](#) (*tango.Database method*), 167  
[get\\_access\\_right\(\)](#) (*tango.DeviceProxy method*), 37  
[get\\_alias\(\)](#) (*tango.Database method*), 167  
[get\\_alias\\_from\\_attribute\(\)](#) (*tango.Database method*), 167  
[get\\_alias\\_from\\_device\(\)](#) (*tango.Database method*), 167  
[get\\_assoc\(\)](#) (*tango.Attr method*), 135  
[get\\_assoc\\_ind\(\)](#) (*tango.Attribute method*), 140  
[get\\_assoc\\_name\(\)](#) (*tango.Attribute method*), 140  
[get\\_asynch\\_cb\\_sub\\_model\(\)](#) (*tango.ApiUtil method*), 82  
[get\\_asynch\\_replies\(\)](#) (*tango.ApiUtil method*), 82  
[get\\_asynch\\_replies\(\)](#) (*tango.DeviceProxy method*), 37  
[get\\_attr\\_by\\_ind\(\)](#) (*tango.MultiAttribute method*), 148  
[get\\_attr\\_by\\_name\(\)](#) (*tango.MultiAttribute method*), 149  
[get\\_attr\\_ind\\_by\\_name\(\)](#) (*tango.MultiAttribute method*), 149  
[get\\_attr\\_min\\_poll\\_period\(\)](#) (*tango.LatestDeviceImpl method*), 120  
[get\\_attr\\_min\\_poll\\_period\(\)](#) (*tango.server.Device method*), 101  
[get\\_attr\\_nb\(\)](#) (*tango.MultiAttribute method*), 149  
[get\\_attr\\_poll\\_ring\\_depth\(\)](#) (*tango.LatestDeviceImpl method*), 120  
[get\\_attr\\_poll\\_ring\\_depth\(\)](#) (*tango.server.Device method*), 102  
[get\\_attr\\_serial\\_model\(\)](#) (*tango.Attribute method*), 140  
[get\\_attribute\\_alias\(\)](#) (*tango.Database method*), 168  
[get\\_attribute\\_alias\\_list\(\)](#) (*tango.Database method*), 168  
[get\\_attribute\\_config\(\)](#) (*tango.DeviceProxy method*), 37  
[get\\_attribute\\_config\\_ex\(\)](#) (*tango.DeviceProxy method*), 37  
[get\\_attribute\\_from\\_alias\(\)](#) (*tango.Database method*), 168  
[get\\_attribute\\_list\(\)](#) (*tango.DeviceProxy method*), 38  
[get\\_attribute\\_list\(\)](#) (*tango.MultiAttribute method*), 149  
[get\\_attribute\\_name\(\)](#) (*tango.DbHistory method*), 185  
[get\\_attribute\\_poll\\_period\(\)](#) (*tango.DeviceProxy method*), 38  
[get\\_attribute\\_poll\\_period\(\)](#) (*tango.LatestDeviceImpl method*), 120  
[get\\_attribute\\_poll\\_period\(\)](#) (*tango.server.Device method*), 102  
[get\\_cl\\_name\(\)](#) (*tango.Attr method*), 135  
[get\\_class\\_attribute\\_list\(\)](#) (*tango.Database method*), 168  
[get\\_class\\_attribute\\_property\(\)](#) (*tango.Database method*), 169  
[get\\_class\\_attribute\\_property\\_history\(\)](#) (*tango.Database method*), 169  
[get\\_class\\_for\\_device\(\)](#) (*tango.Database method*), 169

`get_class_inheritance_for_device()` (*tango.Database method*), 169

`get_class_list()` (*tango.Database method*), 170

`get_class_list()` (*tango.Util method*), 156

`get_class_properties()` (*tango.Attr method*), 136

`get_class_property()` (*tango.Database method*), 170

`get_class_property_history()` (*tango.Database method*), 170

`get_class_property_list()` (*tango.Database method*), 171

`get_cmd_by_name()` (*tango.DeviceClass method*), 131

`get_cmd_min_poll_period()` (*tango.LatestDeviceImpl method*), 120

`get_cmd_min_poll_period()` (*tango.server.Device method*), 102

`get_cmd_poll_ring_depth()` (*tango.LatestDeviceImpl method*), 121

`get_cmd_poll_ring_depth()` (*tango.server.Device method*), 102

`get_command_config()` (*tango.DeviceProxy method*), 38

`get_command_list()` (*tango.DeviceClass method*), 131

`get_command_list()` (*tango.DeviceProxy method*), 39

`get_command_poll_period()` (*tango.DeviceProxy method*), 39

`get_command_poll_period()` (*tango.LatestDeviceImpl method*), 121

`get_command_poll_period()` (*tango.server.Device method*), 102

`get_config()` (*tango.AttributeProxy method*), 62

`get_cvs_location()` (*tango.DeviceClass method*), 131

`get_cvs_tag()` (*tango.DeviceClass method*), 131

`get_data()` (*tango.GroupAttrReply method*), 80

`get_data()` (*tango.GroupCmdReply method*), 80

`get_data_format()` (*tango.Attribute method*), 140

`get_data_raw()` (*tango.GroupCmdReply method*), 80

`get_data_size()` (*tango.Attribute method*), 140

`get_data_type()` (*tango.Attribute method*), 140

`get_database()` (*tango.Util method*), 156

`get_date()` (*tango.Attribute method*), 140

`get_date()` (*tango.DbHistory method*), 185

`get_date()` (*tango.DeviceAttribute method*), 87

`get_db_host()` (*tango.DeviceProxy method*), 39

`get_db_port()` (*tango.DeviceProxy method*), 39

`get_db_port_num()` (*tango.DeviceProxy method*), 39

`get_dev_host()` (*tango.DeviceProxy method*), 39

`get_dev_idl_version()` (*tango.LatestDeviceImpl method*), 121

`get_dev_idl_version()` (*tango.server.Device method*), 102

`get_dev_port()` (*tango.DeviceProxy method*), 40

`get_device_alias()` (*tango.Database method*), 171

`get_device_alias_list()` (*tango.Database method*), 171

`get_device_attr()` (*tango.LatestDeviceImpl method*), 121

`get_device_attr()` (*tango.server.Device method*), 103

`get_device_attribute_property()` (*tango.Database method*), 171

`get_device_attribute_property_history()` (*tango.Database method*), 172

`get_device_by_name()` (*tango.Util method*), 156

`get_device_class_list()` (*tango.Database method*), 172

`get_device_db()` (*tango.DeviceProxy method*), 40

`get_device_domain()` (*tango.Database method*), 172

`get_device_exported()` (*tango.Database method*), 172

`get_device_exported_for_class()` (*tango.Database method*), 173

`get_device_family()` (*tango.Database method*), 173

`get_device_from_alias()` (*tango.Database method*), 173

`get_device_info()` (*tango.Database method*), 173

`get_device_list()` (*tango.DeviceClass method*), 131

`get_device_list()` (*tango.Group method*), 76

`get_device_list()` (*tango.Util method*), 157

`get_device_list_by_class()` (*tango.Util method*), 157

`get_device_member()` (*tango.Database method*), 173

`get_device_name()` (*tango.Database method*), 174

`get_device_properties()` (*tango.LatestDeviceImpl method*), 121

`get_device_properties()` (*tango.server.Device method*), 103

`get_device_property()` (*tango.Database method*), 174

`get_device_property_history()` (*tango.Database method*), 174

`get_device_property_list()` (*tango.Database method*), 175

`get_device_proxy()` (*tango.AttributeProxy method*), 63

`get_device_service_list()` (*tango.Database method*), 175

`get_disp_level()` (*tango.Attr method*), 136

`get_doc_url()` (*tango.DeviceClass method*), 132

`get_ds_exec_name()` (*tango.Util method*), 157

`get_ds_inst_name()` (*tango.Util method*), 157

- [get\\_ds\\_name\(\)](#) (*tango.Util method*), 157  
[get\\_dserver\\_device\(\)](#) (*tango.Util method*), 157  
[get\\_enum\\_labels\(\)](#) (*in module tango.utils*), 191  
[get\\_err\\_stack\(\)](#) (*tango.DeviceAttribute method*), 87  
[get\\_events\(\)](#) (*tango.AttributeProxy method*), 63  
[get\\_events\(\)](#) (*tango.DeviceProxy method*), 40  
[get\\_events\(\)](#) (*tango.utils.EventCallback method*), 191  
[get\\_exported\\_flag\(\)](#) (*tango.LatestDeviceImpl method*), 121  
[get\\_exported\\_flag\(\)](#) (*tango.server.Device method*), 103  
[get\\_file\\_name\(\)](#) (*tango.Database method*), 175  
[get\\_format\(\)](#) (*tango.Attr method*), 136  
[get\\_fqdn\(\)](#) (*tango.DeviceProxy method*), 40  
[get\\_from\\_env\\_var\(\)](#) (*tango.DeviceProxy method*), 40  
[get\\_fully\\_qualified\\_name\(\)](#) (*tango.Group method*), 77  
[get\\_green\\_mode\(\)](#) (*in module tango*), 81  
[get\\_green\\_mode\(\)](#) (*tango.DeviceProxy method*), 41  
[get\\_home\(\)](#) (*in module tango.utils*), 194  
[get\\_host\\_list\(\)](#) (*tango.Database method*), 175  
[get\\_host\\_name\(\)](#) (*tango.Util method*), 158  
[get\\_host\\_server\\_list\(\)](#) (*tango.Database method*), 175  
[get\\_idl\\_version\(\)](#) (*tango.DeviceProxy method*), 41  
[get\\_info\(\)](#) (*tango.Database method*), 176  
[get\\_instance\\_name\\_list\(\)](#) (*tango.Database method*), 176  
[get\\_label\(\)](#) (*tango.Attribute method*), 141  
[get\\_last\\_event\\_date\(\)](#) (*tango.AttributeProxy method*), 63  
[get\\_last\\_event\\_date\(\)](#) (*tango.DeviceProxy method*), 41  
[get\\_locker\(\)](#) (*tango.DeviceProxy method*), 41  
[get\\_logger\(\)](#) (*tango.LatestDeviceImpl method*), 122  
[get\\_logger\(\)](#) (*tango.server.Device method*), 103  
[get\\_logging\\_level\(\)](#) (*tango.DeviceProxy method*), 41  
[get\\_logging\\_target\(\)](#) (*tango.DeviceProxy method*), 42  
[get\\_max\\_dim\\_x\(\)](#) (*tango.Attribute method*), 141  
[get\\_max\\_dim\\_y\(\)](#) (*tango.Attribute method*), 141  
[get\\_max\\_value\(\)](#) (*tango.WAttribute method*), 147  
[get\\_memorized\(\)](#) (*tango.Attr method*), 136  
[get\\_memorized\\_init\(\)](#) (*tango.Attr method*), 136  
[get\\_min\\_poll\\_period\(\)](#) (*tango.LatestDeviceImpl method*), 122  
[get\\_min\\_poll\\_period\(\)](#) (*tango.server.Device method*), 103  
[get\\_min\\_value\(\)](#) (*tango.WAttribute method*), 147  
[get\\_name\(\)](#) (*tango.Attr method*), 136  
[get\\_name\(\)](#) (*tango.Attribute method*), 141  
[get\\_name\(\)](#) (*tango.DbHistory method*), 185  
[get\\_name\(\)](#) (*tango.DeviceClass method*), 132  
[get\\_name\(\)](#) (*tango.Group method*), 77  
[get\\_name\(\)](#) (*tango.LatestDeviceImpl method*), 122  
[get\\_name\(\)](#) (*tango.server.Device method*), 103  
[get\\_non\\_auto\\_polled\\_attr\(\)](#) (*tango.LatestDeviceImpl method*), 122  
[get\\_non\\_auto\\_polled\\_attr\(\)](#) (*tango.server.Device method*), 103  
[get\\_non\\_auto\\_polled\\_cmd\(\)](#) (*tango.LatestDeviceImpl method*), 122  
[get\\_non\\_auto\\_polled\\_cmd\(\)](#) (*tango.server.Device method*), 104  
[get\\_object\\_list\(\)](#) (*tango.Database method*), 176  
[get\\_object\\_property\\_list\(\)](#) (*tango.Database method*), 176  
[get\\_pid\(\)](#) (*tango.Util method*), 158  
[get\\_pid\\_str\(\)](#) (*tango.Util method*), 158  
[get\\_pipe\\_config\(\)](#) (*tango.DeviceProxy method*), 42  
[get\\_poll\\_old\\_factor\(\)](#) (*tango.LatestDeviceImpl method*), 122  
[get\\_poll\\_old\\_factor\(\)](#) (*tango.server.Device method*), 104  
[get\\_poll\\_period\(\)](#) (*tango.AttributeProxy method*), 64  
[get\\_poll\\_ring\\_depth\(\)](#) (*tango.LatestDeviceImpl method*), 122  
[get\\_poll\\_ring\\_depth\(\)](#) (*tango.server.Device method*), 104  
[get\\_polled\\_attr\(\)](#) (*tango.LatestDeviceImpl method*), 123  
[get\\_polled\\_attr\(\)](#) (*tango.server.Device method*), 104  
[get\\_polled\\_cmd\(\)](#) (*tango.LatestDeviceImpl method*), 123  
[get\\_polled\\_cmd\(\)](#) (*tango.server.Device method*), 104  
[get\\_polling\\_period\(\)](#) (*tango.Attr method*), 136  
[get\\_polling\\_period\(\)](#) (*tango.Attribute method*), 141  
[get\\_polling\\_threads\\_pool\\_size\(\)](#) (*tango.Util method*), 158  
[get\\_prev\\_state\(\)](#) (*tango.LatestDeviceImpl method*), 123  
[get\\_prev\\_state\(\)](#) (*tango.server.Device method*), 104  
[get\\_properties\(\)](#) (*tango.Attribute method*), 141  
[get\\_property\(\)](#) (*tango.AttributeProxy method*), 64  
[get\\_property\(\)](#) (*tango.Database method*), 176  
[get\\_property\(\)](#) (*tango.DeviceProxy method*), 42  
[get\\_property\\_forced\(\)](#) (*tango.Database method*), 177  
[get\\_property\\_history\(\)](#) (*tango.Database*

method), 177

get\_property\_list() (*tango.DeviceProxy method*), 43

get\_quality() (*tango.Attribute method*), 141

get\_serial\_model() (*tango.Util method*), 158

get\_server\_class\_list() (*tango.Database method*), 178

get\_server\_info() (*tango.Database method*), 178

get\_server\_list() (*tango.Database method*), 178

get\_server\_name\_list() (*tango.Database method*), 178

get\_server\_version() (*tango.Util method*), 158

get\_services() (*tango.Database method*), 179

get\_size() (*tango.Group method*), 77

get\_source() (*tango.DeviceProxy method*), 43

get\_state() (*tango.LatestDeviceImpl method*), 123

get\_state() (*tango.server.Device method*), 104

get\_status() (*tango.LatestDeviceImpl method*), 123

get\_status() (*tango.server.Device method*), 105

get\_sub\_dev\_diag() (*tango.Util method*), 158

get\_tango\_lib\_release() (*tango.Util method*), 158

get\_tango\_lib\_version() (*tango.DeviceProxy method*), 43

get\_timeout\_millis() (*tango.DeviceProxy method*), 44

get\_trace\_level() (*tango.Util method*), 159

get\_transparency\_reconnection() (*tango.AttributeProxy method*), 64

get\_transparency\_reconnection() (*tango.DeviceProxy method*), 44

get\_type() (*tango.Attr method*), 136

get\_type() (*tango.DeviceClass method*), 132

get\_type() (*tango.DeviceData method*), 88

get\_user\_default\_properties() (*tango.Attr method*), 137

get\_value() (*tango.DbHistory method*), 185

get\_version\_str() (*tango.Util method*), 159

get\_w\_attr\_by\_ind() (*tango.MultiAttribute method*), 149

get\_w\_attr\_by\_name() (*tango.MultiAttribute method*), 149

get\_writable() (*tango.Attr method*), 137

get\_writable() (*tango.Attribute method*), 142

get\_write\_value() (*tango.WAttribute method*), 147

get\_write\_value\_length() (*tango.WAttribute method*), 147

get\_x() (*tango.Attribute method*), 142

get\_y() (*tango.Attribute method*), 142

GreenMode (*class in tango*), 94

Group (*class in tango*), 74

GroupAttrReply (*class in tango*), 80

GroupCmdReply (*class in tango*), 80

GroupReply (*class in tango*), 80

## H

history() (*tango.AttributeProxy method*), 65

## I

import\_device() (*tango.Database method*), 179

import\_info() (*tango.DeviceProxy method*), 44

info() (*tango.DeviceProxy method*), 44

info\_stream() (*tango.LatestDeviceImpl method*), 123

info\_stream() (*tango.server.Device method*), 105

InfoIt (*class in tango*), 134

init\_device() (*tango.LatestDeviceImpl method*), 123

init\_device() (*tango.server.Device method*), 105

initialize\_dynamic\_attributes() (*tango.server.Device method*), 105

insert() (*tango.DeviceData method*), 88

is\_archive\_event() (*tango.Attr method*), 137

is\_archive\_event() (*tango.Attribute method*), 142

is\_array\_type() (*in module tango.utils*), 193

is\_assoc() (*tango.Attr method*), 137

is\_attribute\_polled() (*tango.DeviceProxy method*), 44

is\_binary\_type() (*in module tango.utils*), 193

is\_bool() (*in module tango.utils*), 192

is\_bool\_type() (*in module tango.utils*), 193

is\_change\_event() (*tango.Attr method*), 137

is\_change\_event() (*tango.Attribute method*), 142

is\_check\_archive\_criteria() (*tango.Attr method*), 137

is\_check\_archive\_criteria() (*tango.Attribute method*), 142

is\_check\_change\_criteria() (*tango.Attr method*), 137

is\_check\_change\_criteria() (*tango.Attribute method*), 142

is\_command\_polled() (*tango.DeviceProxy method*), 44

is\_control\_access\_checked() (*tango.Database method*), 179

is\_data\_ready\_event() (*tango.Attr method*), 137

is\_data\_ready\_event() (*tango.Attribute method*), 143

is\_dbase\_used() (*tango.DeviceProxy method*), 45

is\_deleted() (*tango.DbHistory method*), 185

is\_device\_locked() (*tango.LatestDeviceImpl method*), 123

is\_device\_locked() (*tango.server.Device method*), 105

is\_device\_restarting() (*tango.Util method*), 159

is\_empty() (*tango.DbDatum method*), 184

is\_empty() (*tango.DeviceData method*), 88

is\_enabled() (*tango.Group method*), 77

is\_event\_queue\_empty() (*tango.AttributeProxy method*), 65  
 is\_event\_queue\_empty() (*tango.DeviceProxy method*), 45  
 is\_float\_type() (*in module tango.utils*), 193  
 is\_int\_type() (*in module tango.utils*), 193  
 is\_integer() (*in module tango.utils*), 192  
 is\_locked() (*tango.DeviceProxy method*), 45  
 is\_locked\_by\_me() (*tango.DeviceProxy method*), 45  
 is\_max\_alarm() (*tango.Attribute method*), 143  
 is\_max\_value() (*tango.WAttribute method*), 147  
 is\_max\_warning() (*tango.Attribute method*), 143  
 is\_min\_alarm() (*tango.Attribute method*), 143  
 is\_min\_value() (*tango.WAttribute method*), 148  
 is\_min\_warning() (*tango.Attribute method*), 143  
 is\_multi\_tango\_host() (*tango.Database method*), 179  
 is\_non\_str\_seq() (*in module tango.utils*), 192  
 is\_number() (*in module tango.utils*), 192  
 is\_numerical\_type() (*in module tango.utils*), 193  
 is\_polled() (*tango.Attribute method*), 143  
 is\_polled() (*tango.AttributeProxy method*), 65  
 is\_polled() (*tango.LatestDeviceImpl method*), 124  
 is\_polled() (*tango.server.Device method*), 105  
 is\_pure\_str() (*in module tango.utils*), 192  
 is\_rds\_alarm() (*tango.Attribute method*), 143  
 is\_scalar\_type() (*in module tango.utils*), 192  
 is\_seq() (*in module tango.utils*), 192  
 is\_str\_type() (*in module tango.utils*), 194  
 is\_svr\_shutting\_down() (*tango.Util method*), 159  
 is\_svr\_starting() (*tango.Util method*), 159  
 is\_there\_subscriber() (*tango.LatestDeviceImpl method*), 124  
 is\_there\_subscriber() (*tango.server.Device method*), 105  
 is\_write\_associated() (*tango.Attribute method*), 144  
 isoformat() (*tango.TimeVal method*), 95

## K

KeepAliveCmdCode (*class in tango*), 93

## L

LatestDeviceImpl (*class in tango*), 118  
 lock() (*tango.DeviceProxy method*), 45  
 LockCmdCode (*class in tango*), 92  
 LockerInfo (*class in tango*), 86  
 LockerLanguage (*class in tango*), 91  
 locking\_status() (*tango.DeviceProxy method*), 46  
 LogIt (*class in tango*), 133  
 LogLevel (*class in tango*), 92  
 LogTarget (*class in tango*), 92

## M

MessageBoxType (*class in tango*), 91  
 MultiAttribute (*class in tango*), 148

## N

name() (*tango.AttributeProxy method*), 65  
 name() (*tango.DeviceProxy method*), 46  
 name\_equals() (*tango.Group method*), 77  
 name\_matches() (*tango.Group method*), 77  
 NamedDevFailedList, 199  
 NonDbDevice, 198  
 NonSupportedFeature, 198  
 NotAllowed, 199

## O

obj\_2\_str() (*in module tango.utils*), 194

## P

pending\_asynch\_call() (*tango.ApiUtil method*), 83  
 pending\_asynch\_call() (*tango.DeviceProxy method*), 46  
 PeriodicEventInfo (*class in tango*), 89  
 ping() (*tango.AttributeProxy method*), 66  
 ping() (*tango.DeviceProxy method*), 46  
 ping() (*tango.Group method*), 77  
 pipe (*class in tango.server*), 113  
 PipeWriteType (*class in tango*), 93  
 poll() (*tango.AttributeProxy method*), 66  
 poll\_attribute() (*tango.DeviceProxy method*), 46  
 poll\_command() (*tango.DeviceProxy method*), 47  
 PollCmdCode (*class in tango*), 91  
 PollDevice (*class in tango*), 86  
 polling\_status() (*tango.DeviceProxy method*), 47  
 PollObjType (*class in tango*), 91  
 push\_archive\_event() (*tango.LatestDeviceImpl method*), 124  
 push\_archive\_event() (*tango.server.Device method*), 106  
 push\_att\_conf\_event() (*tango.LatestDeviceImpl method*), 125  
 push\_att\_conf\_event() (*tango.server.Device method*), 106  
 push\_change\_event() (*tango.LatestDeviceImpl method*), 125  
 push\_change\_event() (*tango.server.Device method*), 106  
 push\_data\_ready\_event() (*tango.LatestDeviceImpl method*), 125  
 push\_data\_ready\_event() (*tango.server.Device method*), 107  
 push\_event() (*tango.LatestDeviceImpl method*), 126  
 push\_event() (*tango.server.Device method*), 107  
 push\_event() (*tango.utils.EventCallback method*), 191

- push\_pipe\_event() (*tango.LatestDeviceImpl method*), 126  
 push\_pipe\_event() (*tango.server.Device method*), 108  
 put\_attribute\_alias() (*tango.Database method*), 179  
 put\_class\_attribute\_property() (*tango.Database method*), 180  
 put\_class\_property() (*tango.Database method*), 180  
 put\_device\_alias() (*tango.Database method*), 180  
 put\_device\_attribute\_property() (*tango.Database method*), 180  
 put\_device\_property() (*tango.Database method*), 181  
 put\_property() (*tango.AttributeProxy method*), 66  
 put\_property() (*tango.Database method*), 181  
 put\_property() (*tango.DeviceProxy method*), 47  
 put\_server\_info() (*tango.Database method*), 182  
 PYTANGO\_GREEN\_MODE, 13  
 Python Enhancement Proposals  
     PEP 249, 238, 241
- ## R
- read() (*tango.AttributeProxy method*), 66  
 read\_alarm() (*tango.MultiAttribute method*), 150  
 read\_async() (*tango.AttributeProxy method*), 67  
 read\_attr\_hardware() (*tango.LatestDeviceImpl method*), 126  
 read\_attribute() (*tango.DeviceProxy method*), 48  
 read\_attribute() (*tango.Group method*), 77  
 read\_attribute\_async() (*tango.DeviceProxy method*), 48  
 read\_attribute\_async() (*tango.Group method*), 77  
 read\_attribute\_reply() (*tango.DeviceProxy method*), 48  
 read\_attribute\_reply() (*tango.Group method*), 77  
 read\_attributes() (*tango.DeviceProxy method*), 48  
 read\_attributes() (*tango.Group method*), 78  
 read\_attributes\_async() (*tango.DeviceProxy method*), 49  
 read\_attributes\_async() (*tango.Group method*), 78  
 read\_attributes\_reply() (*tango.DeviceProxy method*), 50  
 read\_attributes\_reply() (*tango.Group method*), 78  
 read\_pipe() (*tango.DeviceProxy method*), 50  
 read\_reply() (*tango.AttributeProxy method*), 68  
 reconnect() (*tango.DeviceProxy method*), 51  
 register\_service() (*tango.Database method*), 182  
 register\_signal() (*tango.DeviceClass method*), 132  
 register\_signal() (*tango.LatestDeviceImpl method*), 127  
 register\_signal() (*tango.server.Device method*), 108  
 Release (class in *tango*), 94  
 remove\_all() (*tango.Group method*), 78  
 remove\_attribute() (*tango.LatestDeviceImpl method*), 127  
 remove\_attribute() (*tango.server.Device method*), 108  
 remove\_command() (*tango.LatestDeviceImpl method*), 127  
 remove\_command() (*tango.server.Device method*), 108  
 remove\_configuration() (*tango.Attribute method*), 144  
 remove\_logging\_target() (*tango.DeviceProxy method*), 51  
 rename\_server() (*tango.Database method*), 182  
 requires\_py Tango() (in module *tango.utils*), 194  
 requires\_tango() (in module *tango.utils*), 195  
 reread\_filedatabase() (*tango.Database method*), 182  
 reset\_filedatabase() (*tango.Util method*), 159  
 run() (in module *tango.server*), 116  
 run\_server() (*tango.server.Device class method*), 108
- ## S
- scalar\_to\_array\_type() (in module *tango.utils*), 194  
 seqStr\_2\_obj() (in module *tango.utils*), 194  
 SerialModel (class in *tango*), 92  
 server\_init() (*tango.Util method*), 159  
 server\_run() (in module *tango.server*), 117  
 server\_run() (*tango.Util method*), 160  
 server\_set\_event\_loop() (*tango.Util method*), 160  
 set\_abs\_change() (*tango.UserDefaultAttrProp method*), 150  
 set\_access\_checked() (*tango.Database method*), 182  
 set\_access\_control() (*tango.DeviceProxy method*), 51  
 set\_archive\_abs\_change() (*tango.UserDefaultAttrProp method*), 150  
 set\_archive\_event() (*tango.Attr method*), 138  
 set\_archive\_event() (*tango.Attribute method*), 144  
 set\_archive\_event() (*tango.LatestDeviceImpl method*), 127  
 set\_archive\_event() (*tango.server.Device method*), 109

`set_archive_event_abs_change()` (*tango.UserDefaultAttrProp method*), 150  
`set_archive_event_period()` (*tango.UserDefaultAttrProp method*), 151  
`set_archive_event_rel_change()` (*tango.UserDefaultAttrProp method*), 151  
`set_archive_period()` (*tango.UserDefaultAttrProp method*), 151  
`set_archive_rel_change()` (*tango.UserDefaultAttrProp method*), 151  
`set_assoc_ind()` (*tango.Attribute method*), 144  
`set_asynch_cb_sub_model()` (*tango.ApiUtil method*), 83  
`set_attr_serial_model()` (*tango.Attribute method*), 144  
`set_attribute_config()` (*tango.DeviceProxy method*), 52  
`set_change_event()` (*tango.Attr method*), 138  
`set_change_event()` (*tango.Attribute method*), 145  
`set_change_event()` (*tango.LatestDeviceImpl method*), 127  
`set_change_event()` (*tango.server.Device method*), 109  
`set_cl_name()` (*tango.Attr method*), 138  
`set_class_properties()` (*tango.Attr method*), 138  
`set_config()` (*tango.AttributeProxy method*), 68  
`set_data_ready_event()` (*tango.Attr method*), 138  
`set_data_ready_event()` (*tango.Attribute method*), 145  
`set_date()` (*tango.Attribute method*), 145  
`set_default_properties()` (*tango.Attr method*), 139  
`set_delta_t()` (*tango.UserDefaultAttrProp method*), 151  
`set_delta_val()` (*tango.UserDefaultAttrProp method*), 151  
`set_description()` (*tango.UserDefaultAttrProp method*), 152  
`set_disp_level()` (*tango.Attr method*), 139  
`set_display_unit()` (*tango.UserDefaultAttrProp method*), 152  
`set_enum_labels()` (*tango.UserDefaultAttrProp method*), 152  
`set_event_abs_change()` (*tango.UserDefaultAttrProp method*), 152  
`set_event_period()` (*tango.UserDefaultAttrProp method*), 152  
`set_event_rel_change()` (*tango.UserDefaultAttrProp method*), 152  
`set_format()` (*tango.UserDefaultAttrProp method*), 153  
`set_green_mode()` (*in module tango*), 81  
`set_green_mode()` (*tango.DeviceProxy method*), 52  
`set_label()` (*tango.UserDefaultAttrProp method*), 153  
`set_logging_level()` (*tango.DeviceProxy method*), 52  
`set_max_alarm()` (*tango.UserDefaultAttrProp method*), 153  
`set_max_value()` (*tango.UserDefaultAttrProp method*), 153  
`set_max_value()` (*tango.WAttribute method*), 148  
`set_max_warning()` (*tango.UserDefaultAttrProp method*), 153  
`set_memorized()` (*tango.Attr method*), 139  
`set_memorized_init()` (*tango.Attr method*), 139  
`set_min_alarm()` (*tango.UserDefaultAttrProp method*), 153  
`set_min_value()` (*tango.UserDefaultAttrProp method*), 153  
`set_min_value()` (*tango.WAttribute method*), 148  
`set_min_warning()` (*tango.UserDefaultAttrProp method*), 154  
`set_period()` (*tango.UserDefaultAttrProp method*), 154  
`set_pipe_config()` (*tango.DeviceProxy method*), 53  
`set_polling_period()` (*tango.Attr method*), 139  
`set_polling_threads_pool_size()` (*tango.Util method*), 160  
`set_properties()` (*tango.Attribute method*), 145  
`set_quality()` (*tango.Attribute method*), 145  
`set_rel_change()` (*tango.UserDefaultAttrProp method*), 154  
`set_serial_model()` (*tango.Util method*), 160  
`set_server_version()` (*tango.Util method*), 161  
`set_source()` (*tango.DeviceProxy method*), 53  
`set_standard_unit()` (*tango.UserDefaultAttrProp method*), 154  
`set_state()` (*tango.LatestDeviceImpl method*), 128  
`set_state()` (*tango.server.Device method*), 109  
`set_status()` (*tango.LatestDeviceImpl method*), 128  
`set_status()` (*tango.server.Device method*), 109  
`set_timeout_millis()` (*tango.DeviceProxy method*), 53  
`set_timeout_millis()` (*tango.Group method*), 78  
`set_trace_level()` (*tango.Util method*), 161  
`set_transparency_reconnection()`

(*tango.AttributeProxy method*), 69  
 set\_transparency\_reconnection() (*tango.DeviceProxy method*), 54  
 set\_type() (*tango.DeviceClass method*), 132  
 set\_unit() (*tango.UserDefaultAttrProp method*), 154  
 set\_value() (*tango.Attribute method*), 146  
 set\_value\_date\_quality() (*tango.Attribute method*), 146  
 set\_w\_dim\_x() (*tango.DeviceAttribute method*), 87  
 set\_w\_dim\_y() (*tango.DeviceAttribute method*), 87  
 signal\_handler() (*tango.DeviceClass method*), 132  
 signal\_handler() (*tango.LatestDeviceImpl method*), 128  
 signal\_handler() (*tango.server.Device method*), 110  
 size() (*tango.DbDatum method*), 184  
 state() (*tango.AttributeProxy method*), 69  
 state() (*tango.DeviceProxy method*), 54  
 status() (*tango.AttributeProxy method*), 69  
 status() (*tango.DeviceProxy method*), 54  
 stop\_poll() (*tango.AttributeProxy method*), 69  
 stop\_poll\_attribute() (*tango.DeviceProxy method*), 54  
 stop\_poll\_command() (*tango.DeviceProxy method*), 54  
 stop\_polling() (*tango.LatestDeviceImpl method*), 128  
 stop\_polling() (*tango.server.Device method*), 110  
 strftime() (*tango.TimeVal method*), 95  
 subscribe\_event() (*tango.AttributeProxy method*), 69  
 subscribe\_event() (*tango.DeviceProxy method*), 54

## T

tango (*module*), 21  
 tango.server (*module*), 96  
 TANGO\_HOST, 3, 4, 201  
 TimeVal (*class in tango*), 95  
 todatetime() (*tango.TimeVal method*), 95  
 totime() (*tango.TimeVal method*), 95  
 trigger\_attr\_polling() (*tango.Util method*), 161  
 trigger\_cmd\_polling() (*tango.Util method*), 161

## U

unexport\_device() (*tango.Database method*), 183  
 unexport\_event() (*tango.Database method*), 183  
 unexport\_server() (*tango.Database method*), 183  
 unlock() (*tango.DeviceProxy method*), 56

unregister\_server() (*tango.Util method*), 161  
 unregister\_service() (*tango.Database method*), 183  
 unregister\_signal() (*tango.DeviceClass method*), 133  
 unregister\_signal() (*tango.LatestDeviceImpl method*), 129  
 unregister\_signal() (*tango.server.Device method*), 110  
 unsubscribe\_event() (*tango.AttributeProxy method*), 71  
 unsubscribe\_event() (*tango.DeviceProxy method*), 56  
 UserDefaultAttrProp (*class in tango*), 150  
 Util (*class in tango*), 155

## W

warn\_stream() (*tango.LatestDeviceImpl method*), 129  
 warn\_stream() (*tango.server.Device method*), 110  
 WarnIt (*class in tango*), 134  
 WAttribute (*class in tango*), 147  
 write() (*tango.AttributeProxy method*), 72  
 write\_async() (*tango.AttributeProxy method*), 72  
 write\_attr\_hardware() (*tango.LatestDeviceImpl method*), 129  
 write\_attr\_hardware() (*tango.server.Device method*), 110  
 write\_attribute() (*tango.DeviceProxy method*), 56  
 write\_attribute() (*tango.Group method*), 79  
 write\_attribute\_async() (*tango.DeviceProxy method*), 57  
 write\_attribute\_async() (*tango.Group method*), 79  
 write\_attribute\_reply() (*tango.DeviceProxy method*), 57  
 write\_attribute\_reply() (*tango.Group method*), 79  
 write\_attributes() (*tango.DeviceProxy method*), 58  
 write\_attributes\_async() (*tango.DeviceProxy method*), 58  
 write\_attributes\_reply() (*tango.DeviceProxy method*), 59  
 write\_filedatabase() (*tango.Database method*), 183  
 write\_pipe() (*tango.DeviceProxy method*), 59  
 write\_read() (*tango.AttributeProxy method*), 73  
 write\_read\_attribute() (*tango.DeviceProxy method*), 60  
 write\_read\_attributes() (*tango.DeviceProxy method*), 60  
 write\_reply() (*tango.AttributeProxy method*), 73  
 WrongData, 198  
 WrongNameSyntax, 197