Design and implementation of a RPC library in python

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Introduction

Remote procedure call

RPC

- Services with methods
- Clients
- Request from a client to a service
- Reply from a service to a client

Remote procedure call

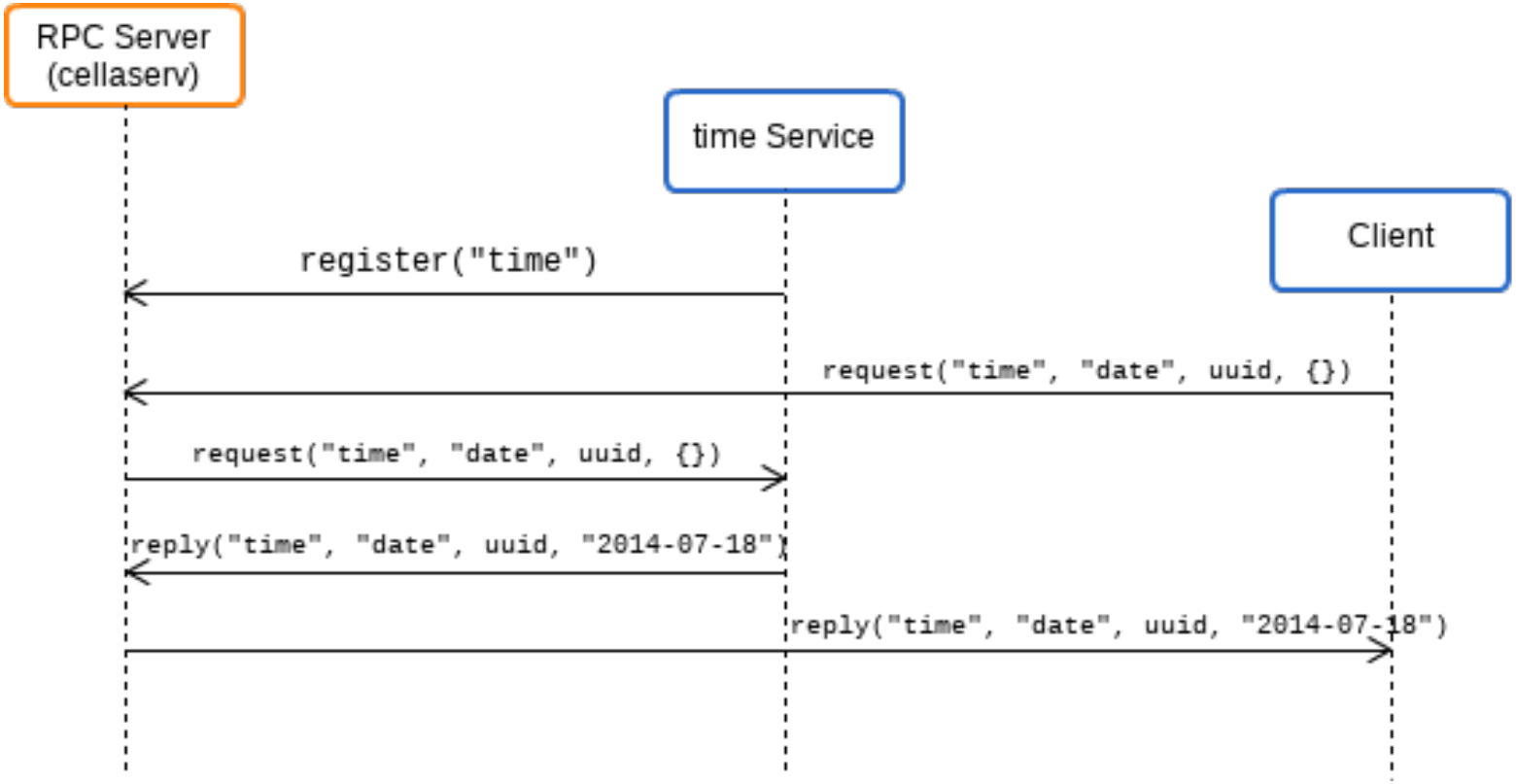
RPC

- Services with methods
- Clients
- Request from a client to a service
- Reply from a service to a client

RPC system: Cellaserv2

- Based on TCP/IP
- Centralized server
- Uses protocol buffers
- More information: https://code.evolutek.org/cellaserv2

Register + Request + Reply



The requierements of this library

Technical

- Python3
- No external libraries
- Handle Client and Service

Usage

- Easy to use
- Hard to misuse
- Fail gracefully
- Target users: mostly sleep deprived

The rush friendly requirement

Client

CellaservProxy

Code

```
from cellaserv.proxy import CellaservProxy
client = CellaservProxy()
```

Configuration

- `CellaservProxy(host="example.org", port=4242)`
- Environnment variables: `CS_HOST`, `CS_PORT`
- Configuration file: `/etc/conf.d/cellaserv`

Usage

CellaservProxy

Code

```
from cellaserv.proxy import CellaservProxy
client = CellaservProxy()
```

Configuration

- `CellaservProxy(host="example.org", port=4242)`
- Environnment variables: `CS_HOST`, `CS_PORT`
- Configuration file: `/etc/conf.d/cellaserv`

Usage

```
now = client.time.date()
```

Implementation

Usage

```
client.time.date()
```

cellaserv/proxy.py

```
class CellaservProxy(cellaserv.client.SynClient):
    ...
    def __getattr__(self, service_name):
        return ServiceProxy(self.conn,
                            service_name)
```

Implementation

Usage

```
client.time.date()
```

cellaserv/proxy.py

```
class CellaservProxy(cellaserv.client.SynClient):
    ...
    def __getattr__(self, "time"):
        return ServiceProxy(self.conn,
                            "time")
```

client.time.date()

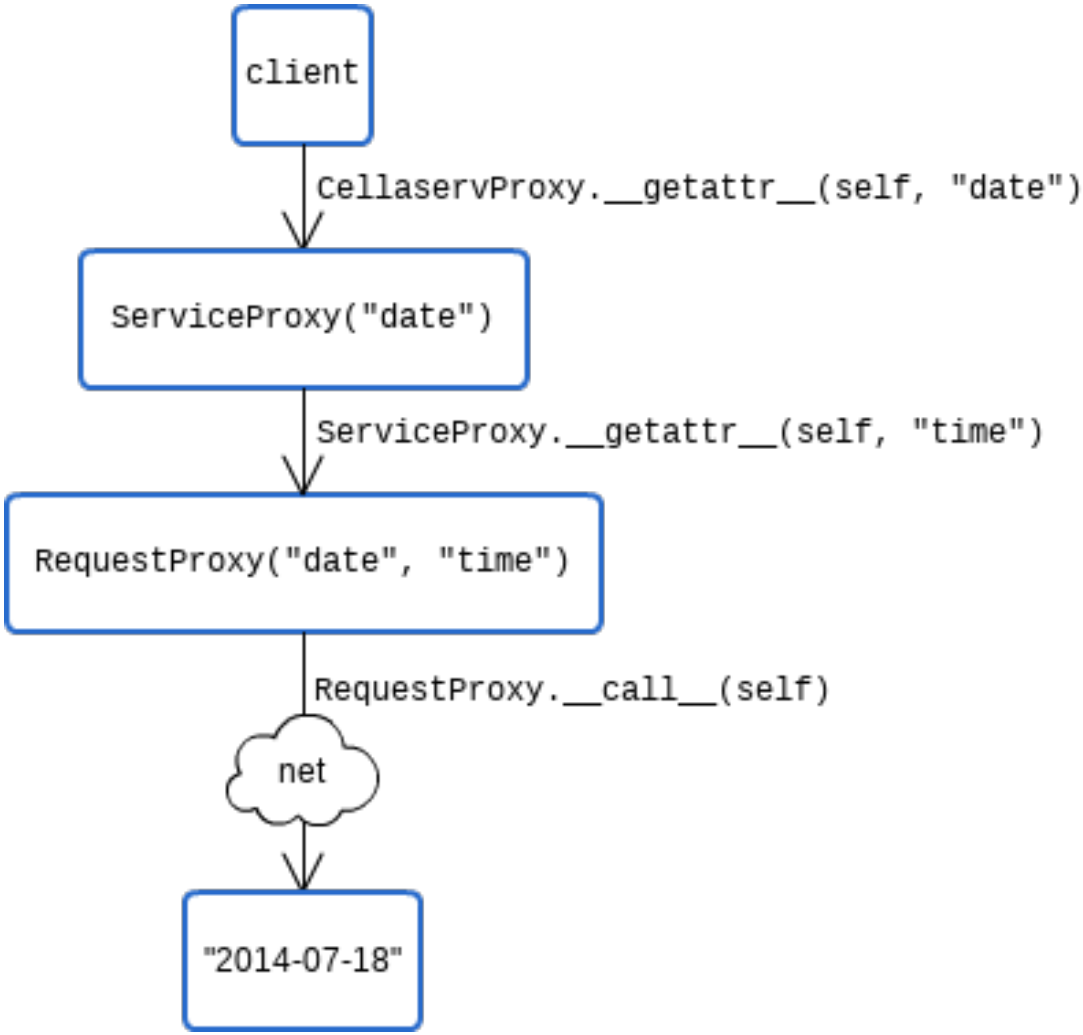


Figure 1: Execution

Service

Decorators

Service's design

Simple usage

```
import time
from cellaserv.service import Service

class Time(Service):
    @Service.action
    def date(self):
        return time.time()

Time().run()
```

Python's feature: decorators

Simple usage

```
>>> def log_usage(f):
...     def wrap(*args, **kwargs):
...         print("{} called".format(f))
...         return f(*args, **kwargs)
...     return wrap
...
>>> my_len = log_usage(len)
>>> my_len([42])
<built-in function len> called
1
```

Note: this decorator should use `@functools.wraps(f)`.

Service's design

Advanced usage

```
class Date(Service):
    @Service.action("heure")
    @Service.action("time_" + get_timezone())
    def time(self):
        return time.time()
```

Function decorator: caution

What is the difference between:

Name of the method is name of the function

```
@Service.action
def action1(self):
    pass
```

Name of the method is given by the user

```
@Service.action("action_name")
def action2(self):
    pass
```

Function decorator: caution

Name of the method is name of the function

```
action1 = Service.action(action1)
```

Name of the method is given by the user

```
action2 = Service.action("action_name")(action2)
```

Python's feature: decorators


```
class Service:
  @staticmethod
  def action(method_or_name):
    def _set_action(method, action):
      try:
        method._actions.append(action)
      except AttributeError:
        method._actions = [action]
      return method

    def _wrapper(method):
      return _set_action(method, method_or_name)

    if callable(method_or_name):
      return _set_action(method_or_name,
                         method_or_name.__name__)
    else:
      return _wrapper
```

Signatures

Dealing with TypeError

We want to emit a warning when the user send a request with bad arguments.

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Bad prototype

```
>>> def f():
...     pass
>>> f(42)
TypeError: f() takes 0 positional arguments but 1
was given
```

Dealing with TypeError

We want to emit a warning when the user send a request with bad arguments.

Bad prototype

```
>>> def f():
...     pass
>>> f(42)
TypeError: f() takes 0 positional arguments but 1
was given
```

Bad service code

```
>>> def f():
...     1 + 'a'
>>> f()
TypeError: unsupported operand type(s) for +: 'int'
and 'str'
```

Dealing with TypeError: simple solution

Report all exceptions to the user.

Checking signatures: quick and dirty solution

Hack

Use the stack size.

Bad prototype

```
>>> try:
...     f(42)
... except:
...     print(len(inspect.trace()))
1
```

Internal error

```
>>> try:
...     f()
... except:
...     print(len(inspect.trace()))
2
```

PEP-0362: Function Signature Object

The signature object

- `inspect.signature(f)` (new in python3.3)

Code

```
>>> def f(a, b):
...     pass
>>> sig = inspect.signature(f)
>>> print(sig)
(a, b)
>>> sig.parameters
mappingproxy(OrderedDict([('x', <Parameter at ...
'x'>), ('y', <Parameter at ... 'y'>)]))
```

Check signature compatibility?

Use the `bind()` method

```
>>> def f(a, b):
...     pass
>>> sig = inspect.signature(f)
>>> user_kwargs = {'a': 42, 'b': 1.2}
>>> sig.bind(**user_kwargs)
<inspect.BoundArguments object at ...>
```

Check signature compatibility?

Use the `bind()` method

```
>>> def f(a, b):
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>>> sig.bind(**user_kwargs)
<inspect.BoundArguments object at ...>
```

Bind is smart

Advanced signatures

```
>>> def f(a, *args, v=False, **kwargs):
...     pass
>>> sig = inspect.signature(f)
>>> user_args = ('x', 'y')
>>> user_kwargs = {'a': 42, 'v': True}
>>> sig.bind(*user_args, **user_kwargs)
<inspect.BoundArguments object at ...>
>>> sig.bind()
TypeError: 'a' parameter lacking default value
```

Bind is slow...

- 63 times slower than:

Code

```
try:
    f(**user_kwargs)
except TypeError as e:
    // use inspect.stack()
```

The EAFP coding style

Easier to ask for forgiveness than permission.

- Assume the user is mostly right.

More signatures

Give the user all he needs

PEP-3107: Function Annotations (python3.0)

```
>>> def is_safe(pos: '(x, y) 30mm radius') -> bool:
...     pass
>>> print(inspect.signature(is_safe))
(pos:'(x, y) 30mm radius') -> bool
```

Conclusion

More fun in this library

- Synchronous and Asynchronous clients
- Service's dependencies
- Events
- Attributes over RPC
- Descriptors
- Identification of services
- Supports down to python3.1
- Manages user's threads automatically
- Metaclass
- ...

Conclusion

This talk

- Code: `http://code.evolutek.eu/python-cellaserv2`
- Doc: `http://doc.evolutek.eu/info/cellaserv.html`
- Discuss: `#evolutek<<@irc.rezosup.org`

Contact

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