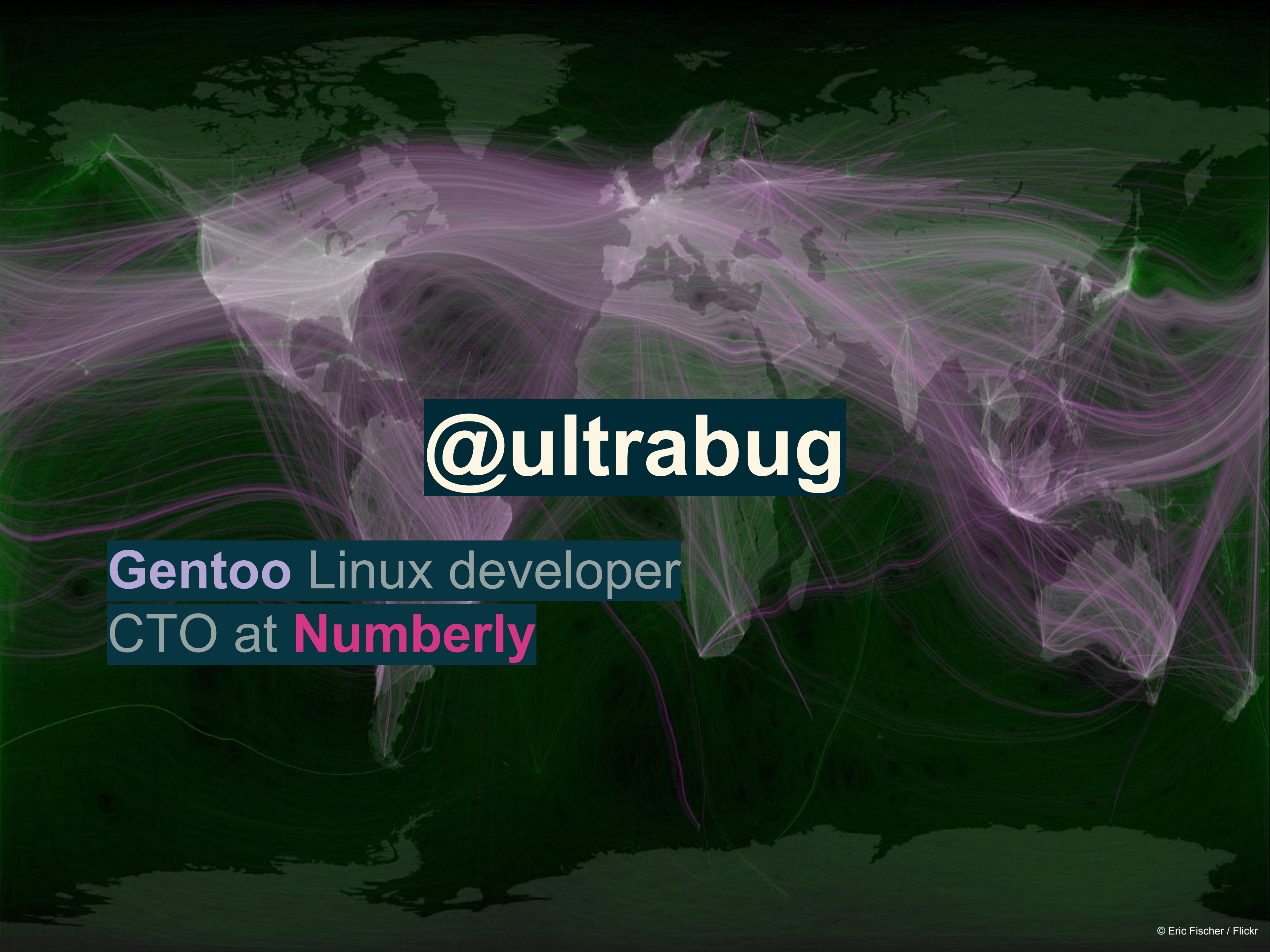
Using **Service Discovery** to build dynamic python applications

EuroPython 2016



@ultrabug

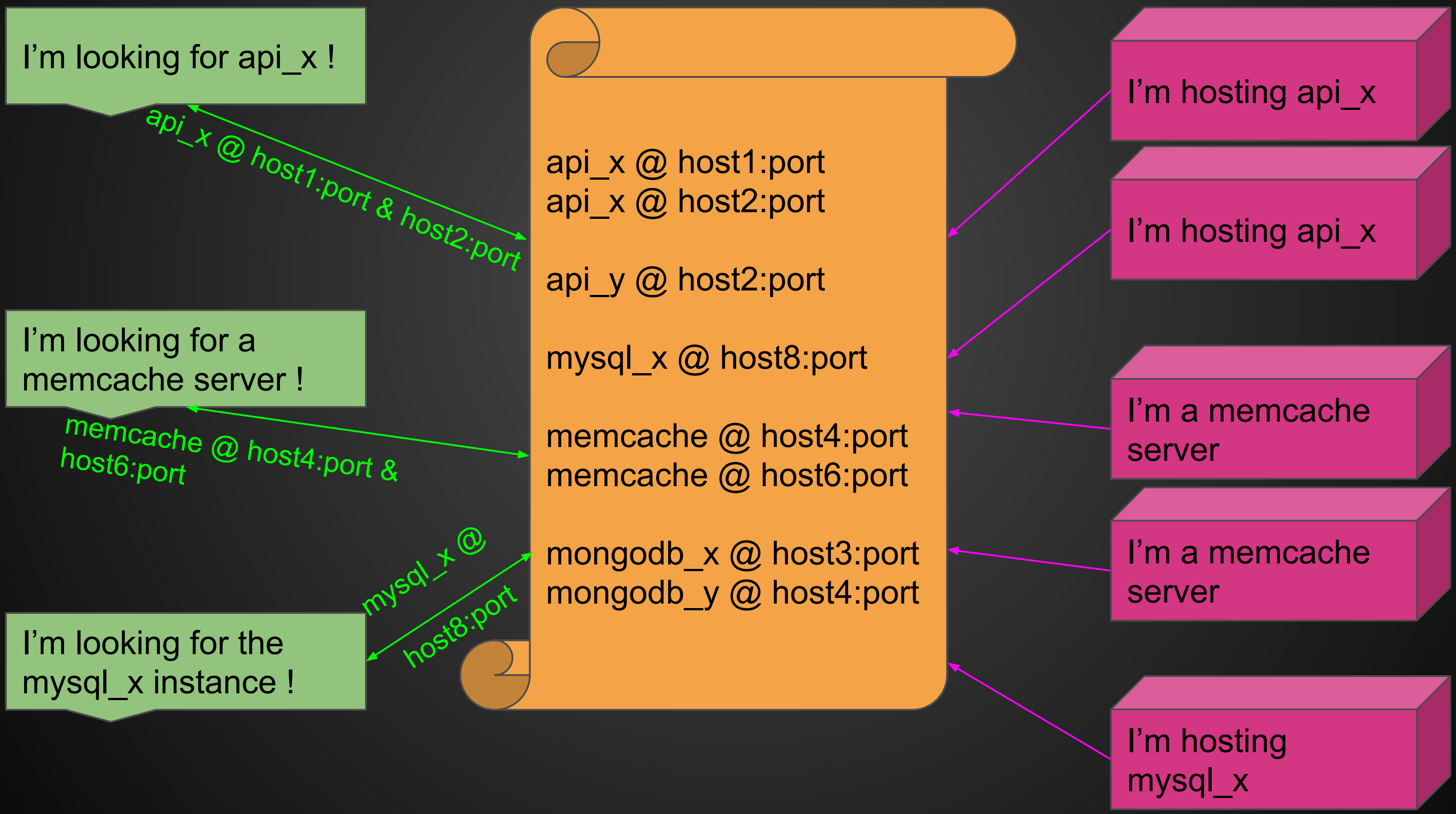
Gentoo Linux developer

CTO at **Numberly**

Service discovery

query a distributed catalog for a given service

Service discovery register & query



Zookeeper (Apache)

Facts

- since 2007
- Java
- ZAB “consensus”

+ Mature

+ Features

+ Hadoop

- Service discovery

- Maintenance

- Python C binding

- Not datacenter aware

etcd (CoreOS)

Facts

- since 2013
- Go
- Raft consensus

+ Adoption
+ Fast
+ Simple
+ HTTP API

- Health checking
- Service discovery
- Not datacenter aware

Consul (HashiCorp)

Facts

- since 2013
- Go
- Raft consensus

+ Health checking
+ Service discovery
+ Datacenter aware
+ Web UI
+ HTTP API
+ DNS API

Notes on Zookeeper & etcd

Service discovery = abusing the K/V store !

K/V store is like a filesystem where you can store data.

- /
  - api_x
    - providers
      - host1:port
      - host2:port
  - memcache
    - providers
      - host4:port
      - host6:port

Python client libraries

Zookeeper	kazoo zc.zk pookeeper
etcd	python-etcd aioetcd
Consul	python-consul consulate

Python clients reliability

can you trust your engine ?

© David Monniaux / wikipedia

zc.zk client reliability (kazoo)

```
>>> import zc.zk

>>> zk = zc.zk.ZooKeeper('yazd:2181,dunno:2181', wait=False)

>>> zk.state
'CONNECTED'

# zookeeper server up
>>> zk.properties('/ep2016/color')
zc.zk.Properties(/ep2016/color)

# zookeeper server down
>>> zk.properties('/ep2016/color')
SessionExpiredError:
```

+ Multiple hosts
+ Autoreconnect
+ Connection state
+ Rich exceptions
− Don’t fail on connect

etcd client reliability

```
>>> import etcd

>>> etc = etcd.Client(host='localhost', port=4001,
                      allow_reconnect=True)

# etcd server up
>>> etc.leader
{u'clientURLs': [u'http://localhost:2379', u'http://localhost:4001'], ...}

# etcd server down
>>> etc.leader
EtcdException: Cannot get leader data: Connection to etcd failed due to
MaxRetryError ("HTTPConnectionPool(host='127.0.0.1', port=4001):
Max retries exceeded with url: /v2/stats/self (Caused by
NewConnectionError('<urllib3.connection.HTTPConnection object at
0x7f9beaac3cd0>: Failed to establish a new connection: [Errno 111]
Connection refused',))",)
```

− Multiple hosts
+ Autoreconnect
− Connection state
+ Rich exceptions
− Don’t fail on connect

python-consul client reliability

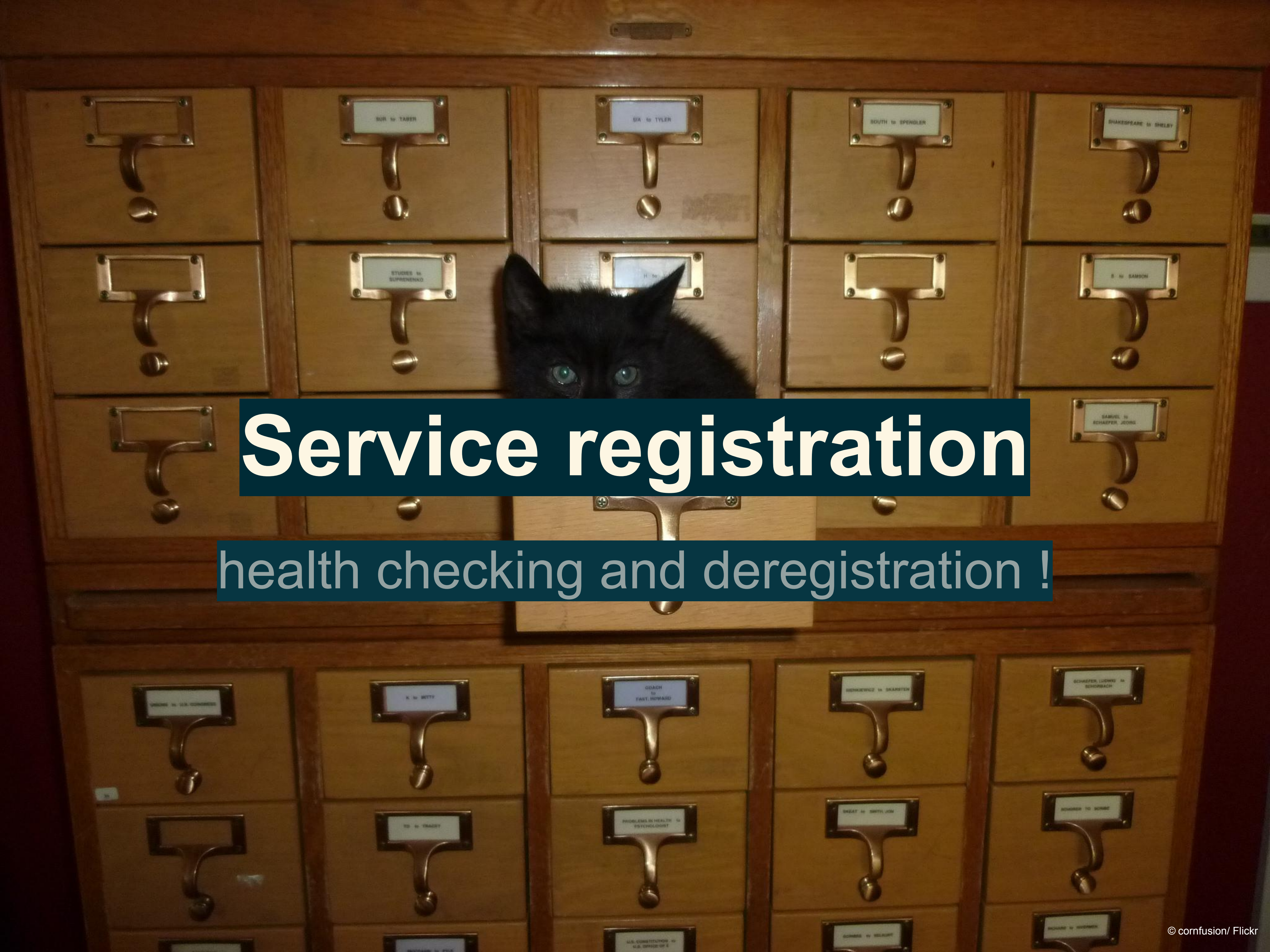
```
>>> import consul

>>> cons = consul.Consul(host='localhost', port=8500)

# consul server up
>>> cons.status.leader()
u'172.17.15.2:8300'

# consul server down
>>> cons.status.leader()
ConnectionError: HTTPConnectionPool(host='127.0.0.1', port=8500):
Max retries exceeded with url: /v1/status/leader (Caused by
NewConnectionError('<requests.packages.urllib3.connection.HTTPConn
ection object at 0x7f9beaafa290>: Failed to establish a new connection:
[Errno 111] Connection refused',))
```

- − Multiple hosts
- + Autoreconnect
- − Connection state
- + Rich exceptions
- + Don’t fail on connect



Service registration

health checking and deregistration !

zc.zk service registration

```
def register(client):
    while True:
        if client.state == 'CONNECTED':
            try:
                client.create('/ep2016/providers', ephemeral=False, makepath=True)
            except NodeExistsError:
                pass
            try:
                client.register('/ep2016/providers', ('yazd', 5000))
                break
            except NodeExistsError:
                print('waiting for registration...')
                sleep(0.5)
        else:
            print('zookeeper host is down, reconnecting...')
            sleep(0.5)

>>> zk = zc.zk.ZooKeeper('yazd:2181,dunno:2181', session_timeout=5, wait=True)
>>> register(zk)
```

zc.zk health checking

```
def register(client):
    while True:
        if client.state == 'CONNECTED':
            try:
                client.create('/ep2016/providers', ephemeral=False, makepath=True)
            except NodeExistsError:
                pass
            try:
                client.register('/ep2016/providers', ('yazd', 5000))    # implicit ephemeral znode
                break
            except NodeExistsError:
                print('waiting for registration...')
                sleep(0.5)
        else:
            print('zookeeper host is down, reconnecting...')
            sleep(0.5)
# session_timeout = failure detection latency
>>> zk = zc.zk.ZooKeeper('yazd:2181,dunno:2181', session_timeout=5, wait=True)
>>> register(zk)
```

etcd service registration

```
def register(client):
    while True:
        try:
           client.read('/ep2016/providers')
        except (etcd.EtcdKeyNotFound, KeyError):
           client.write('/ep2016/providers', None, dir=True)
        except etcd.EtcdException:
            print('etcd host is down, reconnecting...')
            continue
        try:
           client.write('/ep2016/providers/yazd:5000', 'yazd:5000', dir=False, ttl=5)
        except etcd.EtcdAlreadyExist:
            pass
        except etcd.EtcdException:
            print('etcd host is down, reconnecting...')
            return

>>> etc = etcd.Client(host='localhost', port=4001, allow_reconnect=True)
>>> register(etc)
```

etcd health checking

```
class HealthPinger(threading.Thread):
    stop = False
    def __init__(self):
        threading.Thread.__init__(self)
        self.client = etcd.Client(host='localhost', port=4001, allow_reconnect=True)
    def run(self):
        while HealthPinger.stop is False:   # infinite loop registration before TTL expires
            self.register()
            sleep(TTL - 1)
    def register(self):
        try:
            self.client.read('/ep2016/providers')
        except (etcd.EtcdKeyNotFound, KeyError):
            self.client.write('/ep2016/providers', None, dir=True)
        except etcd.EtcdException:
            print('etcd host is down, reconnecting...')
            return
        try:
            self.client.write('/ep2016/providers/yazd:5000', 'yazd:5000', dir=False, ttl=5)   # ttl = failure detection latency
        except etcd.EtcdAlreadyExist:
            pass
        except etcd.EtcdException:
            print('etcd host is down, reconnecting...')
            return

>>> register_thread = HealthPinger().start()
```

python-consul service registration

```
def register(client):
    while True:
        try:
            client.agent.service.register('ep2016', address='yazd', port=5002)    # integrated service registration <3
            break
        except (ConnectionError, consul.ConsulException):
            print('consul host is down, reconnecting...')
            sleep(0.5)

>>> cons = consul.Consul(host='localhost', port=8500)
>>> register(cons)
```

python-consul health checking

```
def register(client):
    # create a HTTP health check for our web service which the consul server will run every 2 seconds
    check_http = consul.Check.http('http://yazd:5002', interval='2s')    # interval = failure detection latency

    while True:
        try:
            client.agent.service.register('ep2016', address='yazd', port=5002, check=check_http)
            break
        except (ConnectionError, consul.ConsulException):
            print('consul host is down, reconnecting...')
            sleep(0.5)

>>> cons = consul.Consul(host='localhost', port=8500)
>>> register(cons)
```

Discover all the things !

Querying the catalog for a service

```
# Zookeeper
addresses = zk.children('/ep2016/providers')
for address in sorted(addresses):
    host, port = address.split(':')
```

```
# etcd
children = etc.read('/ep2016/providers', recursive=True).children
for child in children:
    host, port = child.value.split(':')
```

```
# Consul
index, services = cons.health.service('ep2016', passing=True)
for service_info in services:
    service = service_info['Service']
```

Live demo !

(hopefully)

Thanks

source code : github.com/ultrabug/ep2016

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