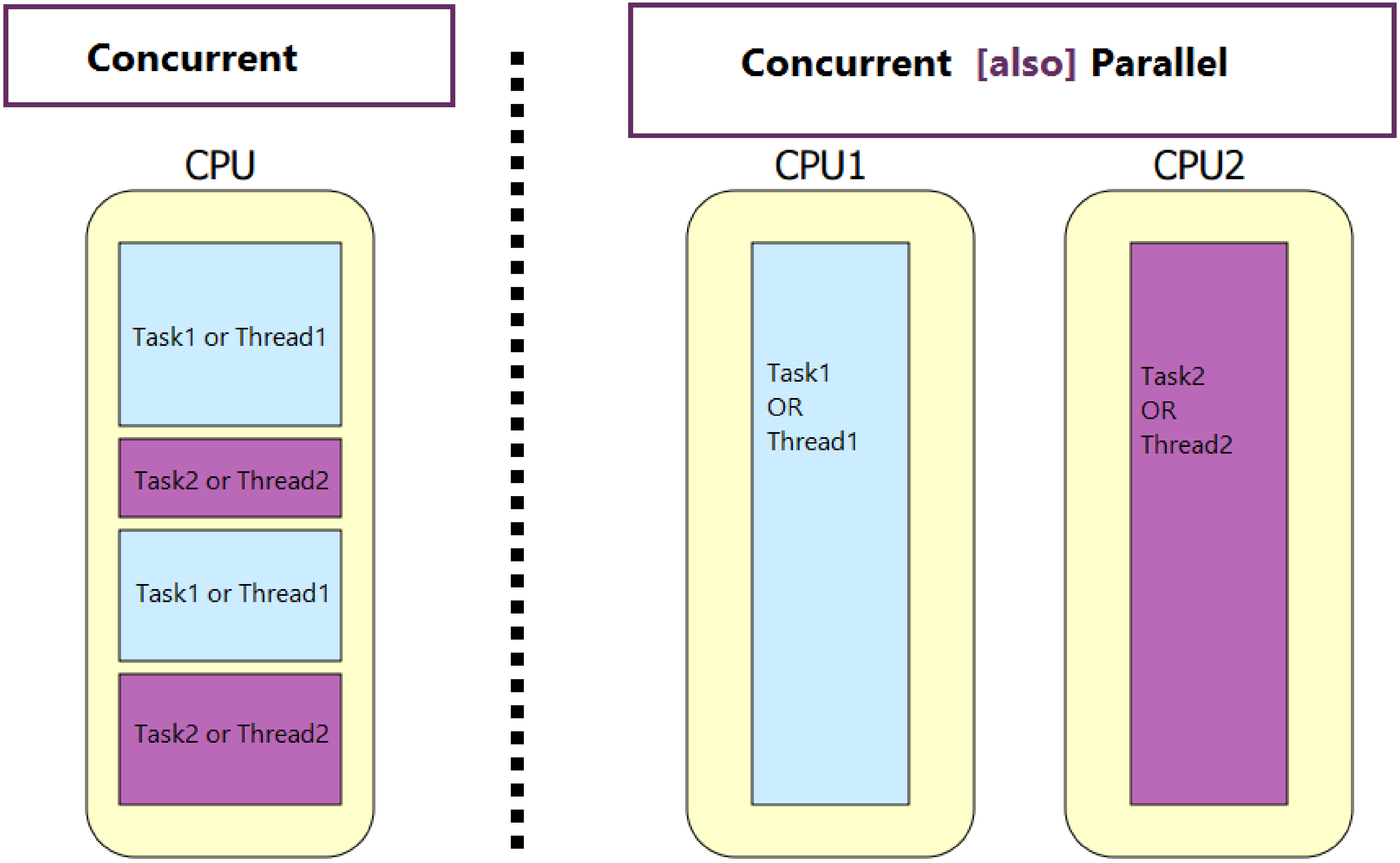
I/O Asincrono en Python

repr(self)

```
>>> from Tenerife import Sergio
>>> Sergio.full_name()
"Sergio Medina Toledo"
>>> Sergio.work()
["VoIP", "Django", "Microservices", "Scalability"]
>>> Sergio.others()
["DevOps", "Linux", "Security", "Architectures"]
>>> Sergio.languages()
["Python", "C", "C++", "js"]
>>> Sergio.job()
<backend.Developer at System73>
>>>
```

Concurrencia y Paralelismo



Concurrencia

Ejecucion de varias tareas a la vez

- Procesadores superscalares (Paralelismo)
- Multithreading (Paralelismo)
- Multiprocessing (Paralelismo)
- Pipeline (Paralelismo)
- Event loop

{"Reference": "https://jmtorres.webs.ull.es/me/2013/04/introduccion-a-la-concurrencia/"}

def blocking_io()

Una funcion o bloque de codigo es bloqueante si tiene que esperar por algo a que se complete

```python
import sys

sock = socket.socket(socket.AF_INET,socket.SOCK_STREAM)

sock.bind(('localhost', 1234))
sock.listen(5)

try:
    while True:
        conn, info = sock.accept()
        data = conn.recv(1024)
        while data:
            data = conn.recv(1024)
            print(data)

except KeyboardInterrupt:
    sock.close()
```

`def non_blocking_io()` boilerplate

```python
CONNECTION_LIST = []  # list of socket clients
server_socket = socket.socket(
        socket.AF_INET, socket.SOCK_STREAM
)
server_socket.setsockopt(
        socket.SOL_SOCKET, socket.SO_REUSEADDR, 1
)
server_socket.bind(("0.0.0.0", 1234))
server_socket.listen(5)

# Add server socket to the list of readable connections
CONNECTIONS.append(server_socket)
```

def non_blocking_io()

```python
while True:
    read_sockets, write_sockets, error_sockets = \
        select.select(CONNECTIONS, [], [], timeout=0)

    for sock in read_sockets:

        # New connection
        if sock == server_socket:
            sockfd, addr = server_socket.accept()
            CONNECTIONS.append(sockfd)

        # Some incoming message from a client
        else:
            try:
                data = sock.recv(1024)
                if data:
                    print(data)
            # client disconnected
            except:
                sock.close()
                CONNECTIONS.remove(sock)
```

`Asyncronous.io.abstractions.flavours()`

```
>>> Asyncronous.io.abstractions.flavours()
[
        "Futures",
        "Coroutines",
        "Callbacks",
        "Events",
        "Defereds",
        "stackless",
        "Awaitables"
]
```

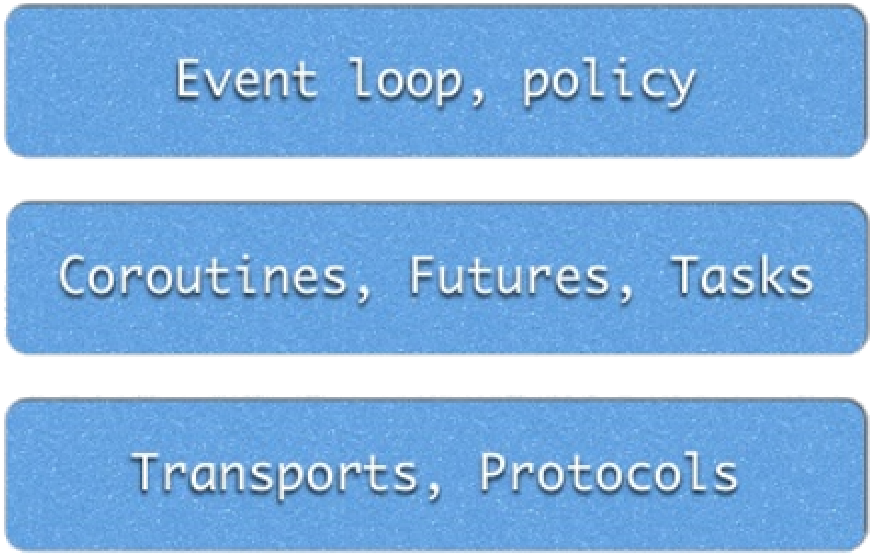
Asyncronous.io.python.flavours()

```
>>> Asyncronous.io.python.flavours()
{
"asyncore std 1.0": "Callbacks",
"stackless": "Microthreads",
"greenlet": ["Microthreads", "Spin-off of Stackless"],
"eventlet": ["libevent", "C", "Coroutines", "greenlet"],
"twisted": ["Defereds", "Callbacks"],
"tornado": ["Coroutines", "Callbacks"],
"pyuv": ["libuv", "C", "nodejs"],
"gevent": ["libev", "C", "Coroutines", "MonkeyPatching"
        "greenlet"],
"asyncio": ["std", "3.4","Futures",
            "Coroutines", "Callbacks", "Awaitables"]
"curio": "Coroutines"
}
```

Asyncio

```
>>> import asyncio
>>> dir(asyncio)
[
        "PEP-3156",
        "3.3 >=",
        ["unix", "windows"],
        ["IPv4", "IPV6"],
        ["TCP", "UDP", "Pipes"] ,
        "SSL",
        "Subprocess",
        "Signals",
]
```

Componentes de Asyncio



Async/Await

Sintaxis de py3.5 para trabajar con corrutinas

```
async def my_coroutine():
        await other_corroutine()
```

Sintaxis pre py3.5

```
@asyncio.coroutine
def my_coroutine():
        yield from other_corroutine()
```

`asyncio.apis.streams()`

```
>>> asyncio.apis.streams()
[
        "TCP wrapper",
        "UNIX Sockets wrapper",
        "Coroutine based API",
        "StreamReader",
        "StreamWriter",
        "SSL Support"
]
```

Client

```
class Client:
    def __init__(self, loop):
        self.loop = loop
        self.reader, self.writer = None, None

    async def connect(self):
        self.reader, self.writer = await \
        asyncio.open_connection(
                LISTEN_IP,
                LISTEN_PORT,
                loop=self.loop
            )

    async def send_data(self, data: bytes):
        data_len = len(data)
        data_len_in_bytes = data_len.to_bytes(
                4,
                byteorder='big'
            )
        self.writer.write(data_len_in_bytes)
        self.writer.write(data)
```

Client

```
async def read_data(self):
       data_len_in_bytes = await self.reader.read(4)
       data_len = int.from_bytes(
               data_len_in_bytes,
               byteorder='big'
           )
       data = await self.reader.read(data_len)
       return data

   def close(self):
       self.writer.close()

   def read_data_iter(self):
       return self

   async def __aiter__(self):
       return self

   async def __anext__(self):
       try:
           return await self.read_data()
       except IncompleteReadError:
           raise StopAsyncIteration
```

Client usage

```python
async def read_task_coro(client):
    async for data in client.read_data_iter():
        print(data)

async def write_task_coro(client):
    for _ in range(1, 100):
        client.send_data(b"ping")
        await asyncio.sleep(1)

async def start(loop):
    client = Client(loop)
    await client.connect()
    read_task = asyncio.ensure_future(
        read_task_coro(client)
    )
    write_task = asyncio.ensure_future(
        write_task_coro(client)
    )
    await asyncio.sleep(100)
    read_task.cancel()
    write_task.cancel()
```

Start server boilerplate

```python
def start_server():
    loop = asyncio.get_event_loop()
    server_fut = asyncio.start_server(handle_connection,
        LISTEN_IP, LISTEN_PORT, loop=loop)

    server = loop.run_until_complete(server_fut)

    # Serve requests until Ctrl+C is pressed
    print('Serving on {}'.format(
        server.sockets[0].getsockname()))
    try:
        loop.run_forever()
    except KeyboardInterrupt:
        pass

    # Close the server
    server.close()
    loop.run_until_complete(server.wait_closed())
    loop.close()

if __name__ == "__main__":
    start_server()
```

Server logic

```python
writers = []


async def handle_connection(reader, my_writer):
    writers.append(my_writer)
    try:
        while True:
            message_length_bytes = await reader.read(4)
            message_length = int.from_bytes(
                message_length_bytes, byteorder='big')
            message = await reader.read(message_length)
            for writer in writers:
                if writer != my_writer:
                    writer.write(message_length_bytes)
                    writer.write(message)
    except IncompleteReadError:
        writers.remove(my_writer)
```

Conclusiones

- Sincrono, io bloqueante
- Asincrono, io no bloqueante
- Paralelismo, en el mismo instante de tiempo (CPU Bound)
- Concurrencia, tareas ejecutadas a la vez, en el mismo o diferente instante de tiempo
- IO asincrono para tareas IO Bound
- Problema c10K, c100K, c1M

Referencias

Esta charla es una adaptacion y actualización de la charla de saghul en la pyconES 2013 actualizada

Otras referencias:

PEP 492 -- Coroutines with async and await syntax

PEP 3156 -- Asynchronous IO Support Rebooted: the "asyncio" Module

I don't understand Python's Asyncio

Some thoughts on asynchronous API design in a post-async/await world

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Agradecimientos

- A todos los asistentes
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- A mis amistades que me han echado una mano para hacer la charla y los ejercicios