Abstracting Concurrency

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Abstracting Concurrency Mechanisms

```
import threading

def sayhello():
    print("hello from {}".format(threading.current_thread().name))
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t = threading.Thread(target=sayhello)
t.start()
t.join()
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import multiprocessing, os

def sayhello():
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- **Pass to Executor**

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- Define Task
- Pass to Executor
- **Get Results**

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```

```
def sayhello(name):
    print(”hello from {}“.format(name))
    return

executor = # new threadpool or processpool instance
future_result = executor.submit(sayhello, “Tim”)
```

```
def sayhello(name):
    print(”hello from {}“.format(name))
    return

executor = # new threadpool or processpool instance
names = [“Tim”, “Sarah”, “Robert”]
results = executor.map(sayhello, names)
```

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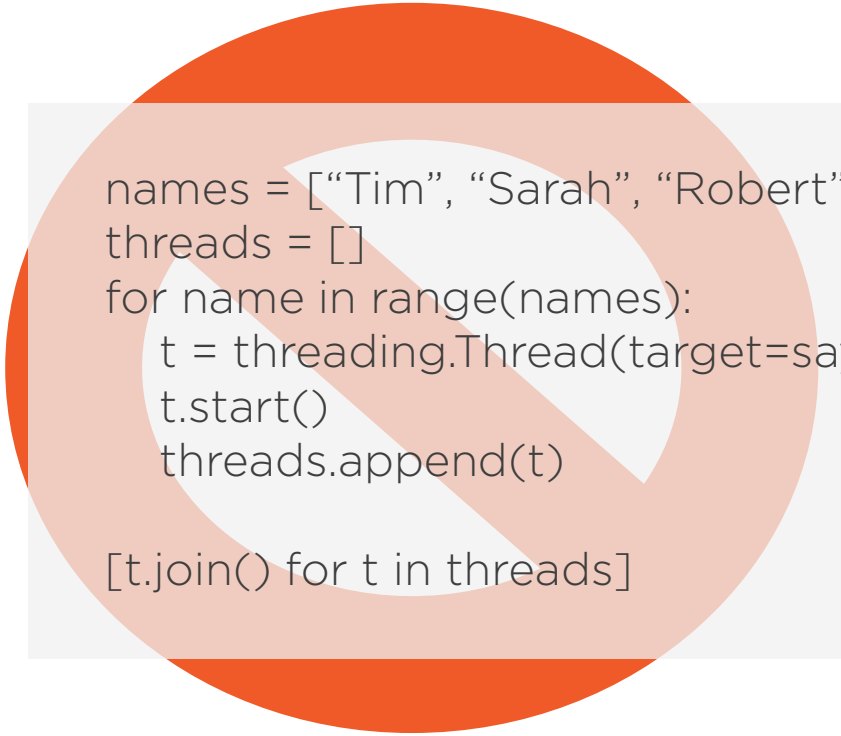

```
names = [“Tim”, “Sarah”, “Robert”]
threads = []
for name in range(names):
    t = threading.Thread(target=sayhello, arg=(name,))
    t.start()
    threads.append(t)

[t.join() for t in threads]
```

```
def sayhello(name):
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- Change of platforms

The Executor API

Executor Methods

```
submit(fn, *args, **kwargs) # schedules a function to run
```

Executor Methods

```
map(func, *iterables, timeout=None, chunksize=1)
```

Executor Methods

```
map(func,
        *iterables,
        timeout=None, # how long to wait for a task to complete
        chunksize=1)
```

Executor Methods

```
map(func,
        *iterables,
        timeout=None,
        chunksize=1) # how chop up the iterable per worker
```

Executor Methods

```
shutdown(wait=True) # stop accepting tasks and shutdown
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Executor Methods

```
with executor:
    ...use executor...
    # no need to call shutdown
```

Executor Subclass

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- ThreadPoolExecutor

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- ProcessPoolExecutor

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from concurrent.futures import ThreadPoolExecutor
from urllib.request import urlopen

def load_url(url, timeout):
    with urlopen(url, timeout=timeout) as conn:
        return conn.read()

with ThreadPoolExecutor(max_workers=2) as executor:
    url1 = "http://www.cnn.com/"
    url2 = "http://www.some-made-up-domain.com/"
    f1 = executor.submit(load_url, url1, 60)
    f2 = executor.submit(load_url, url2, 60)

    try:
        data1 = f1.result()
        print("{} page is {} bytes".format(url1, len(data1)))
        data2 = f2.result()
        print("{} page is {} bytes".format(url2, len(data2)))
    except Exception as ex:
        print("Exception downloading page " + str(ex))
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         b"the slick mountain lion ran up the tall tree"]

def generate_hash(text):
   return hashlib.sha384(text).hexdigest()

if __name__ == '__main__':
   with ProcessPoolExecutor() as executor:
      for text, hash_t in zip(texts, executor.map(generate_hash, texts)):
         print('%s hash is: %s' % (text, hash_t))
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Future Object

Future

An object that acts as a proxy for a result that is yet to be computed

Asynchronous Programming

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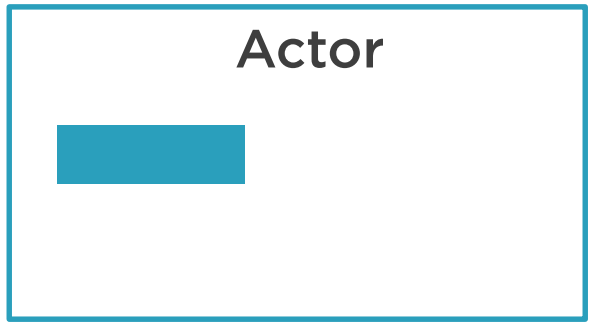

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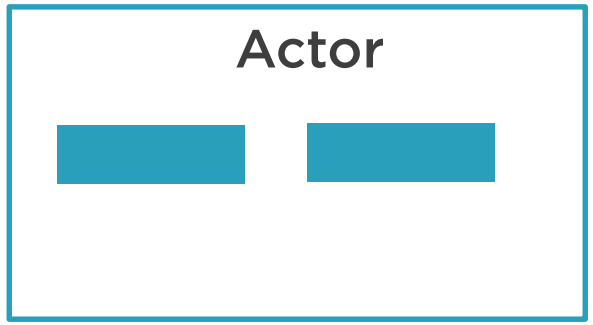

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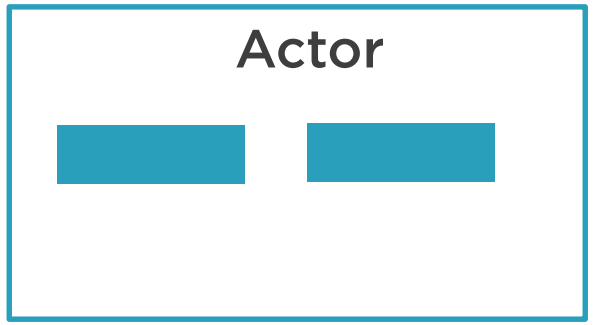

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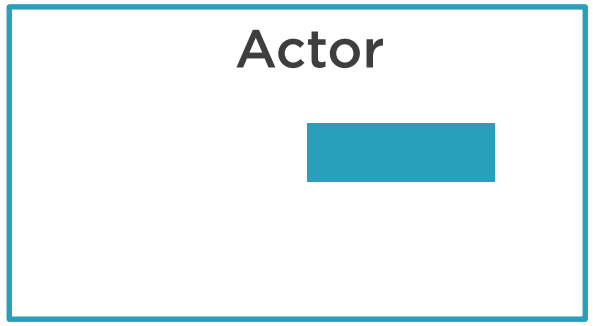

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... do other things ...
result = future.result()
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```
future = executor.submit(func, args*)
... do other things ...
result = future.result() # can throw exception
```

Future Methods

```
cancel() # attempt to cancel execution. Return True if successful
```

Future Methods

```
done() # returns True if completed or canceled
```

Future Methods

```
exception(timeout=None) # returns the exception raised, if any
```

Future Methods

```
add_done_callback(fn) # attaches function to be called on
completion or cancellation
```

Module Functions

```
concurrent.futures.wait(fs, timeout=None, return_when=ALL_COMPLETED)
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Module Functions

```
concurrent.futures.as_completed(fs, timeout=None)
```

Summary

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The Executor API

The Future Object