Introduction to Python

T5 Bootcamp by SDAIA

Threading

Outline
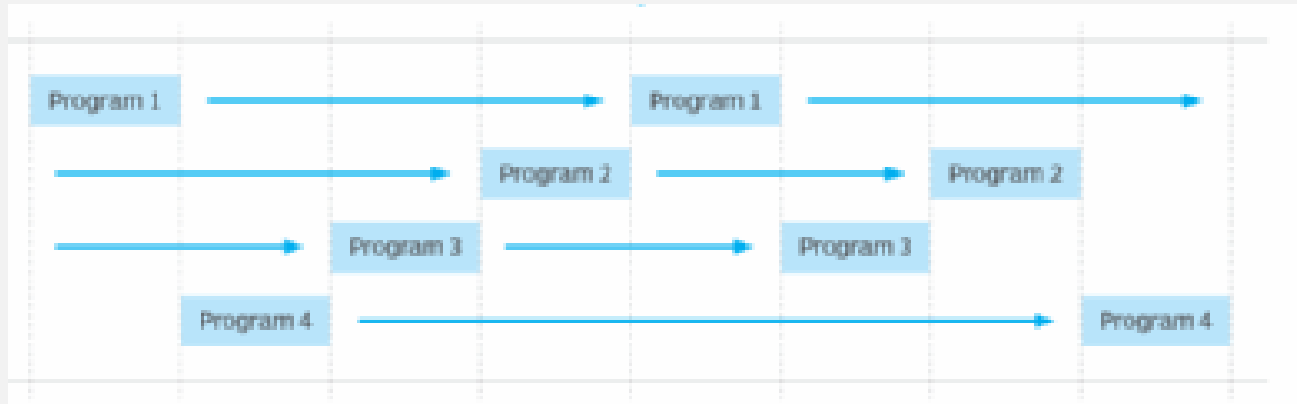
- Single Processor, multiple programs

- Hyper threads

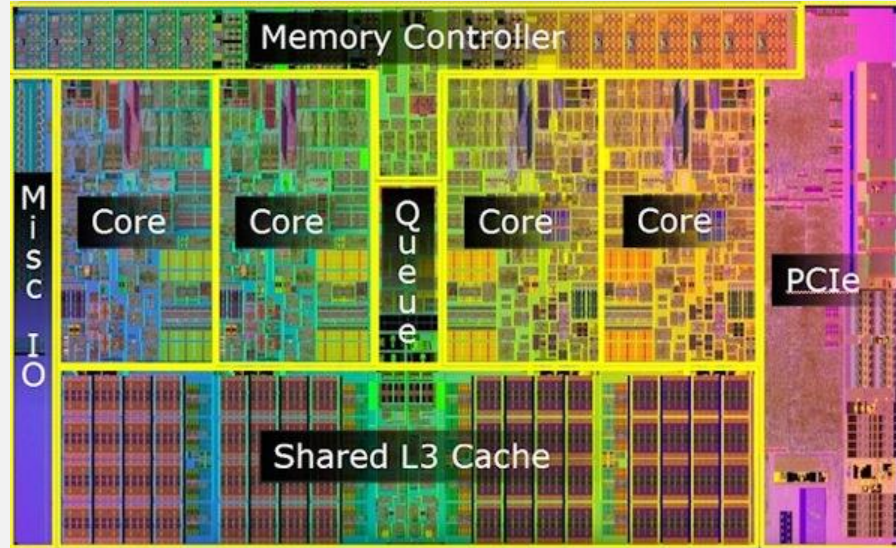- Threading example in Python

- Multi-threading and Multi-processing
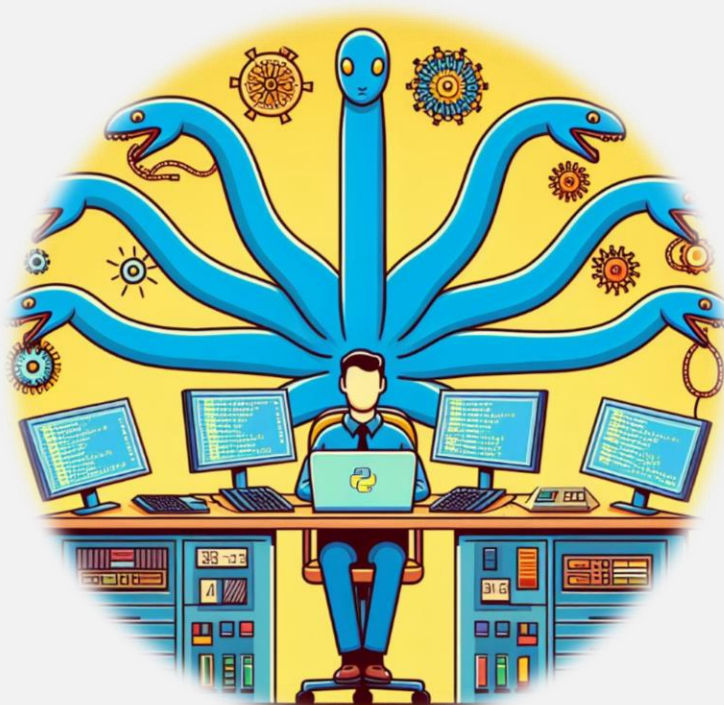
Single processor, multiple programs

- A processor switches context between programs so fast that gives the illusion that it is being done at the same time
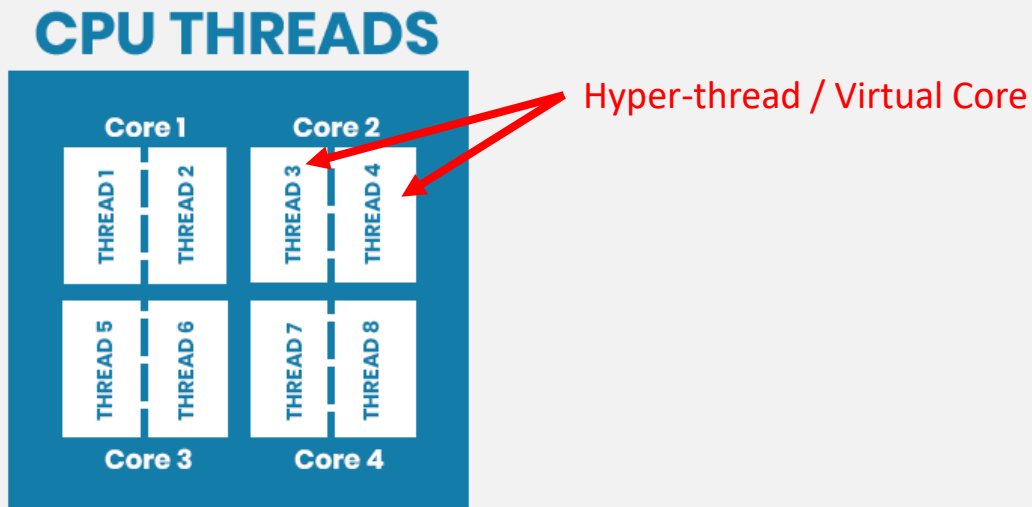
Intel Core i5 CPU

https://arstechnica.com/gadgets/2009/09/intel-launches-all-new-pc-architecture-with-core-i5i7-cpus/
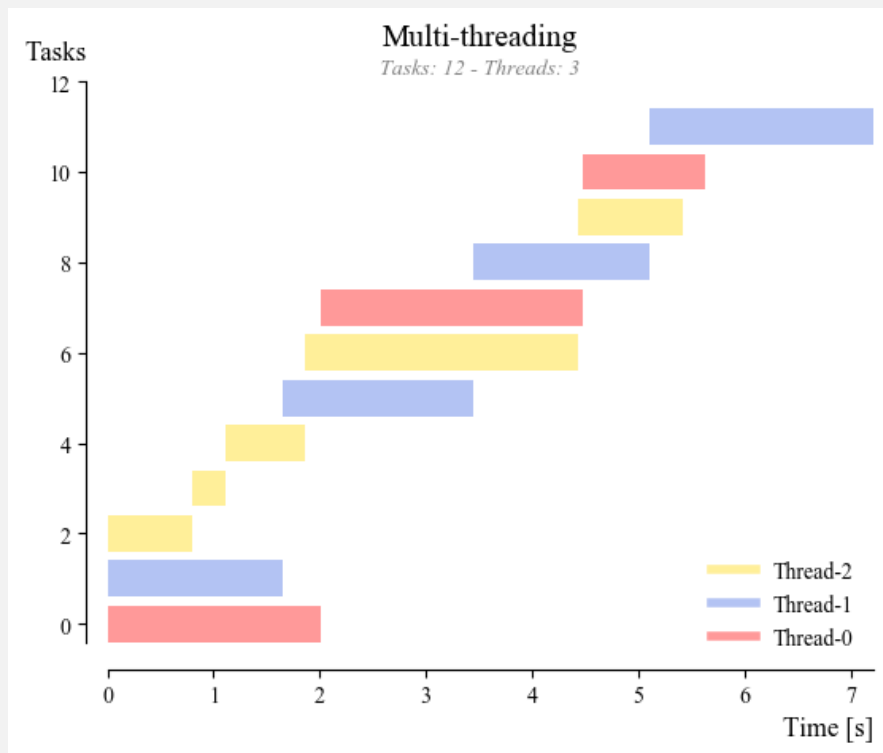
Threads within Single Quad Core CPU

- This CPU consists of 4 cores containing 8 virtual cores in total

CPU THREADS

Core 1		Core 2	
THREAD 1	THREAD 2	THREAD 3	THREAD 4
THREAD 5	THREAD 6	THREAD 7	THREAD 8
Core 3		Core 4	

Hyper-thread / Virtual Core

Threads working concurrently

https://stackoverflow.com/a/62264067

Example: create 2 threads to download files

```python
def download_file(url, filename):
    # ...
```

```python
import threading

urls = ["https://example.com/file1.txt", "https://example.com/file2.zip"]
filenames = ["file1.txt", "file2.zip"]

# Create and start download threads
threads = []
for i in range(len(urls)):
    thread = threading.Thread(target=download_file, args=(urls[i], filenames[i]))
    thread.start()
    threads.append(thread)

# Wait for all threads to finish
for thread in threads:
    thread.join()
```
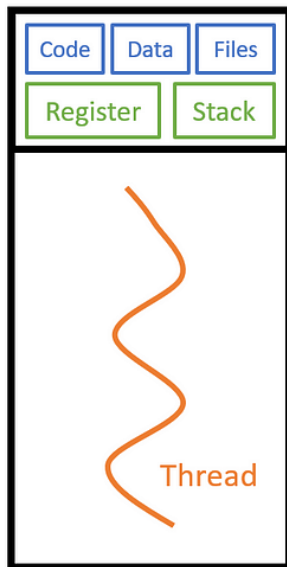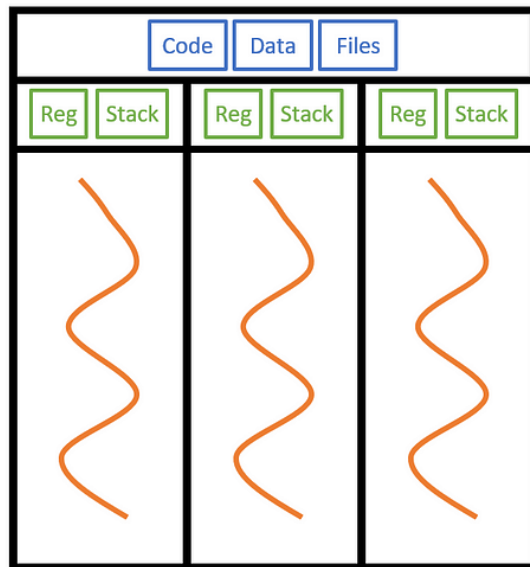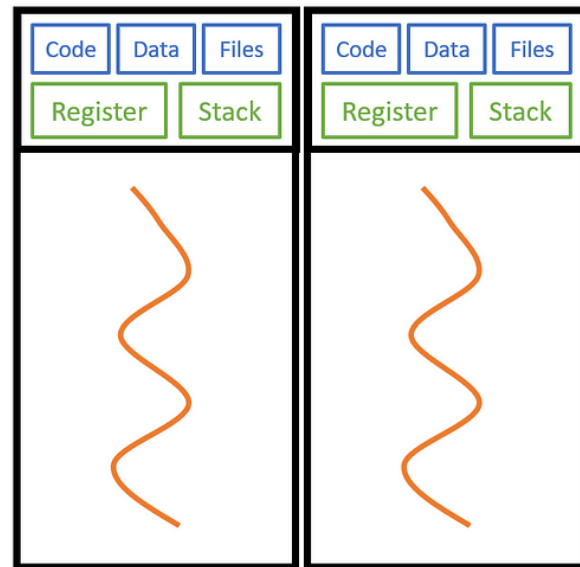
Multi-threading and Multi-processing

Single Processor Single Thread   Single Processor Multithread   Multiprocessing
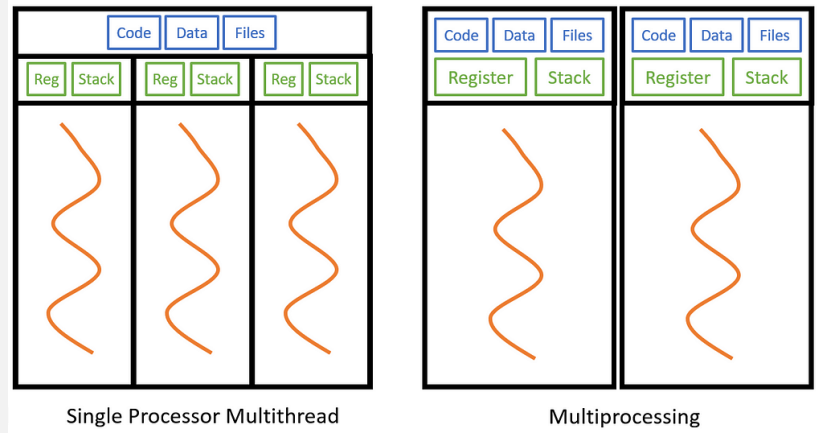
https://builtin.com/data-science/multithreading-multiprocessing

Multi-threading and Multi-processing

- **Multithreading** refers to the ability of a processor to execute multiple threads concurrently.

- **Multiprocessing** refers to the ability of a system to run multiple processors in parallel
  - each processor may run one or more threads.

Single Processor Multithread | Multiprocessing

Thank you