

## Lab 2: Processes & Threads

```
DS [~/DS] - .../threaded_downloader.py - PyCharm
File Edit View Navigate Code Refactor Run Tools VCS Window Help
DS > threaded_downloader.py threaded_downloader
1: Project DS ~/DS
  venv
    bin
    include
    lib
    lib64
    pyenv.cfg
  f1040.pdf
  f1040a.pdf
  f1040es.pdf
  f1040ez.pdf
  f1040sb.pdf
  threaded_downloader.py
  External Libraries
  Scratches and Consoles
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URLS = ["http://www.irs.gov/pub/irs-pdf/f1040.pdf",
        "http://www.irs.gov/pub/irs-pdf/f1040a.pdf",
        "http://www.irs.gov/pub/irs-pdf/f1040ez.pdf",
        "http://www.irs.gov/pub/irs-pdf/f1040es.pdf",
        "http://www.irs.gov/pub/irs-pdf/f1040sb.pdf"]

def download_and_save(url, filename):
    r = requests.get(url)
    with open(filename, 'wb') as f:
        f.write(r.content)

# First variant
print(" Spawn threads after previous finished. So they will work one after another:")
start = timeit.timeit()
for url in URLS:
    filename = url.split('/')[-1]
    t = threading.Thread(target=download_and_save, args=(url, filename))
    t.start()
    t.join()
end = timeit.timeit()
print(end - start)
start = timeit.timeit()
print("Spawn all threads at once.")
threads = []

Run: threaded_downloader
/home/banana_and_bread/DS/venv/bin/python /home/banana_and_bread/DS/threaded_downloader.py
Spawn threads after previous finished. So they will work one after another:
0.016871341998921707
Spawn all threads at once.
0.006397471996024251
Spawn processes after previous finished. So they will work one after another:
0.014371916011441499
Spawn all processes at once.
0.008721224992768839

Process finished with exit code 0
Python Console Terminal 4: Run 6: TODO Event Log
IDE and Plugin Updates: The following plugin is ready (43 minutes ago) 12:11 1.5 UTF-8 4 spaces Python 3.7 (DS) 2
```

Parallel processes and threads in this case are faster than sequential ones, because due to the GIL, only parallelization of CPU-bound tasks is blocked. For io-bound tasks this is not so important, because most of the time the threads are sleeping and do not compete for the processor.