

Tugas 3

1. Buatlah program client untuk Tugas 2 dengan mengimplementasikan ketentuan di tugas 2 dengan metode
 - Thread
 - Threadpool
 - Process
2. Jalankan server pada tugas 2, lalu, untuk setiap metode pada nomor 1, jalankan tugas 3 nomor 1 dan amatilah jumlah maksimum thread yang dapat dijalankan di lingkungan eksekusi anda.
3. Jalankan di lab environment
 - Tuliskan semua dalam satu file PDF dengan nama TUGAS3.PDF
 - Link menuju source code anda di github (masing-masing harus punya repository di github)
 - Jalankan program client (tugas 3 nomor 2) dan server (pada tugas 2), capturelah interaksi antara client dan server. Berikan deskripsi tentang interaksi ini terutama dengan jumlah thread di masing-masing sisi (client / server)

Untuk tugas 3, server akan tetap menggunakan kode yang sama dengan tugas 2, namun dengan penambahan pengeditan pada log server untuk menampilkan total klien yang diterima oleh server.

Penambahan code pada server berupa

```
self.my_socket.setsockopt(socket.SOL_SOCKET, socket.SO_REUSEADDR, 1)
```

Supaya server dapat menerima koneksi yang sama secara

Selain itu, akan dibuat tiga jenis klien, yaitu menggunakan thread, threadpool, dan process.

THREAD

Pengujian pertama akan dilakukan menggunakan klien dengan nama "client_thread". Jumlah thread dalam pengujian pertama dimulai dari 50 thread yang dikirim ke server. Dan bisa dilihat dari hasil screenshot bahwa client_thread bisa melakukan thread sampai 50 thread. Saya akan mencoba melakukan eksplorasi dengan menambahkan banyak thread.

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```
WARNING:root:total koneksi 4953
WARNING:root:total koneksi 4954
WARNING:root:total koneksi 4955
WARNING:root:total koneksi 4956
WARNING:root:total koneksi 4957
WARNING:root:total koneksi 4958
WARNING:root:total koneksi 4959
WARNING:root:total koneksi 4960
WARNING:root:total koneksi 4961
WARNING:root:total koneksi 4962
WARNING:root:total koneksi 4963
WARNING:root:total koneksi 4964
WARNING:root:total koneksi 4965
WARNING:root:total koneksi 4966
WARNING:root:total koneksi 4967
WARNING:root:total koneksi 4968
WARNING:root:total koneksi 4969
WARNING:root:total koneksi 4970
WARNING:root:total koneksi 4971
WARNING:root:total koneksi 4972
WARNING:root:total koneksi 4973
WARNING:root:total koneksi 4974
WARNING:root:total koneksi 4975
WARNING:root:total koneksi 4976
WARNING:root:total koneksi 4977
WARNING:root:total koneksi 4978
WARNING:root:total koneksi 4979
WARNING:root:total koneksi 4980
WARNING:root:total koneksi 4981
WARNING:root:total koneksi 4982
WARNING:root:total koneksi 4983
WARNING:root:total koneksi 4984
WARNING:root:total koneksi 4985
WARNING:root:total koneksi 4986
WARNING:root:total koneksi 4987
WARNING:root:total koneksi 4988
[]

WARNING:root:[CLIENT 2126] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 2134] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 2123] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 2154] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 2132] sending b'TIME\r\n\r\n'
Exception in thread Thread-2458 ( kirim_data):
Exception in thread Thread-2535 ( kirim_data):
Traceback (most recent call last):
Exception in thread Thread-2581 ( kirim_data):
Traceback (most recent call last):
Exception in thread Thread-2548 ( kirim_data):
Traceback (most recent call last):
Exception in thread Thread-2514 ( kirim_data):
Traceback (most recent call last):
Exception in thread Thread-2530 ( kirim_data):
Exception in thread Thread-2483 ( kirim_data):
File "/opt/conda/lib/python3.10/threading.py", line 1016, in _bootstrap_inner
File "/opt/conda/lib/python3.10/threading.py", line 1016, in _bootstrap_inner
File "/opt/conda/lib/python3.10/threading.py", line 1016, in _bootstrap_inner
Traceback (most recent call last):
File "/opt/conda/lib/python3.10/threading.py", line 1016, in _bootstrap_inner
Exception in thread Thread-2627 ( kirim_data):
Traceback (most recent call last):
File "/opt/conda/lib/python3.10/threading.py", line 1016, in _bootstrap_inner
self.run()
File "/opt/conda/lib/python3.10/threading.py", line 953, in run
self.run()
File "/opt/conda/lib/python3.10/threading.py", line 953, in run
self.run()
File "/opt/conda/lib/python3.10/threading.py", line 953, in run
Exception in thread Thread-2562 ( kirim_data):
self._target(*self._args, **self._kwargs)
File "/home/jovyan/work/progjar/progjar3/client/client_thread.py", line 24, in kirim_data
Traceback (most recent call last):
self.run()
File "/opt/conda/lib/python3.10/threading.py", line 953, in run
self._target(*self._args, **self._kwargs)
```

Disini bisa dilihat untuk thread sebanyak 5000 server tidak bisa melakukan proses lagi, dan pada bagian client juga terdapat error. Sehingga saya mencoba melakukan percobaan sebanyak 4500 thread, supaya mengetahui batas proses yang bisa dilakukan dengan client_thread tanpa mengalami error.

```
WARNING:root:total koneksi 4498
WARNING:root:total koneksi 4499
WARNING:root:total koneksi 4500
[]

WARNING:root:[CLIENT 3356] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 3498] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 3501] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 3512] sending b'TIME\r\n\r\n'
(base) jovyan@248c9e3fbd59:~/work/progjar/progjar3/client$
```

THREADPOOL

Pengujian selanjutnya dilakukan pada threadpool. Jumlah thread dalam pengujian cobaan client_thread_pool dimulai dari 100 threads client yang mencoba terhubung ke server. Dan dari hasil yang saya dapat saya langsung mencoba ke jumlah thread yang lebih tinggi yaitu 5000. Ini hasil yang saya dapatkan.

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```
WARNING:root:total koneksi 4965
WARNING:root:total koneksi 4966
WARNING:root:total koneksi 4967
WARNING:root:total koneksi 4968
WARNING:root:total koneksi 4969
WARNING:root:total koneksi 4970
WARNING:root:total koneksi 4971
WARNING:root:total koneksi 4972
WARNING:root:total koneksi 4973
WARNING:root:total koneksi 4974
WARNING:root:total koneksi 4975
WARNING:root:total koneksi 4976
WARNING:root:total koneksi 4977
WARNING:root:total koneksi 4978
WARNING:root:total koneksi 4979
WARNING:root:total koneksi 4980
WARNING:root:total koneksi 4981
WARNING:root:total koneksi 4982
WARNING:root:total koneksi 4983
WARNING:root:total koneksi 4984
WARNING:root:total koneksi 4985
WARNING:root:total koneksi 4986
WARNING:root:total koneksi 4987
WARNING:root:total koneksi 4988
WARNING:root:total koneksi 4989
WARNING:root:total koneksi 4990
WARNING:root:total koneksi 4991
WARNING:root:total koneksi 4992
WARNING:root:total koneksi 4993
WARNING:root:total koneksi 4994
WARNING:root:total koneksi 4995
WARNING:root:total koneksi 4996
WARNING:root:total koneksi 4997
WARNING:root:total koneksi 4998
WARNING:root:total koneksi 4999
WARNING:root:total koneksi 5000

WARNING:root:[CLIENT 4975] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4976] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4977] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4978] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4979] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4980] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4981] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4982] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4983] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4984] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4985] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4986] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4987] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4988] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4989] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4990] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4991] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4992] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4993] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4994] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4995] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4996] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4997] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4998] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 4999] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 5000] sending b'TIME\r\n\r\n'
(base) jovyan@248c9e3fbd59:~/work/progjar/progjar3/client$
```

Bisa dilihat untuk thread sebanyak 5000 tidak ada kendala dan lebih cepat dibanding client_thread. Disini saya akan mencoba dengan thread yang lebih besar yaitu 500000 thread. Ini merupakan hasil dari percobaan saya

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```
WARNING:root:total koneksi 499965
WARNING:root:total koneksi 499966
WARNING:root:total koneksi 499967
WARNING:root:total koneksi 499968
WARNING:root:total koneksi 499969
WARNING:root:total koneksi 499970
WARNING:root:total koneksi 499971
WARNING:root:total koneksi 499972
WARNING:root:total koneksi 499973
WARNING:root:total koneksi 499974
WARNING:root:total koneksi 499975
WARNING:root:total koneksi 499976
WARNING:root:total koneksi 499977
WARNING:root:total koneksi 499978
WARNING:root:total koneksi 499979
WARNING:root:total koneksi 499980
WARNING:root:total koneksi 499981
WARNING:root:total koneksi 499982
WARNING:root:total koneksi 499983
WARNING:root:total koneksi 499984
WARNING:root:total koneksi 499985
WARNING:root:total koneksi 499986
WARNING:root:total koneksi 499987
WARNING:root:total koneksi 499988
WARNING:root:total koneksi 499989
WARNING:root:total koneksi 499990
WARNING:root:total koneksi 499991
WARNING:root:total koneksi 499992
WARNING:root:total koneksi 499993
WARNING:root:total koneksi 499994
WARNING:root:total koneksi 499995
WARNING:root:total koneksi 499996
WARNING:root:total koneksi 499997
WARNING:root:total koneksi 499998
WARNING:root:total koneksi 499999
WARNING:root:total koneksi 500000

WARNING:root:[CLIENT 499975] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499976] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499977] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499978] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 498384] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499979] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499980] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499981] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499982] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499983] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499984] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499985] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499987] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499988] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499989] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499990] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499991] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499992] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499993] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499994] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499995] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499996] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499997] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499998] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499999] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 500000] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 498497] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 498986] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499123] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 496323] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499358] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 493090] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499736] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499874] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 499985] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 495328] sending b'TIME\r\n\r\n'
(base) jovyan@248c9e3fbd59:~/work/progjar/progjar3/client$
```

Bisa dilihat bahwa untuk banyak thread tidak ada error. Dapat disimpulkan bahwa client_thread_pool memiliki kemampuan untuk menjalankan banyak thread sesuai dengan kapabilitas perangkat yang digunakan. Perbedaan antara thread dan threadpool terletak pada penggunaan thread-nya. Pada kelas thread, setiap thread yang dibuat tidak dapat digunakan kembali, sehingga thread yang sudah selesai akan dihentikan. Proses penghentian thread ini membutuhkan waktu, yang mengakibatkan kelas thread mengalami keterlambatan saat eksekusi selesai. Sementara itu, pada kelas threadpool, thread tetap aktif dan siap menjalankan tugas baru sampai pool tersebut dimatikan.

PROCESS

untuk percobaan pada process saya akan mencoba dengan melakukan 100 thread.

```
WARNING:root:total koneksi 81
WARNING:root:total koneksi 82
WARNING:root:total koneksi 83
WARNING:root:total koneksi 84
WARNING:root:total koneksi 85
WARNING:root:total koneksi 86
WARNING:root:total koneksi 87
WARNING:root:total koneksi 88
WARNING:root:total koneksi 89
WARNING:root:total koneksi 90
WARNING:root:total koneksi 91
WARNING:root:total koneksi 92
WARNING:root:total koneksi 93
WARNING:root:total koneksi 94
WARNING:root:total koneksi 95
WARNING:root:total koneksi 96
WARNING:root:total koneksi 97
WARNING:root:total koneksi 98
WARNING:root:total koneksi 99
WARNING:root:total koneksi 100

WARNING:root:[CLIENT 83] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 85] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 86] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 84] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 87] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 88] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 89] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 90] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 91] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 92] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 93] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 94] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 95] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 96] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 98] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 99] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 97] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 100] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 26] sending b'TIME\r\n\r\n'
(base) jovyan@248c9e3fbd59:~/work/progjar/progjar3/client$
```


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Pada percobaan client_process untuk melakukan proses 100 thread sangat cepat dilakuakn. Saat mencoba melakukan percobaan di labtop saya, waktu yang dibutuhkan hanya dibawah 1 detik untuk proses tersebut. Saya akan mencoba untuk 5000 thread

```
WARNING:root:total koneksi 2027
WARNING:root:total koneksi 2028
WARNING:root:total koneksi 2029
WARNING:root:total koneksi 2030
WARNING:root:total koneksi 2031
WARNING:root:total koneksi 2032
WARNING:root:total koneksi 2033
WARNING:root:total koneksi 2034
WARNING:root:total koneksi 2035
WARNING:root:total koneksi 2036
WARNING:root:total koneksi 2037
WARNING:root:total koneksi 2038
WARNING:root:total koneksi 2039
WARNING:root:total koneksi 2040
WARNING:root:total koneksi 2041
WARNING:root:total koneksi 2042
WARNING:root:total koneksi 2043
WARNING:root:total koneksi 2044

WARNING:root:[CLIENT 2043] sending b'TIME\r\n\r\n'
Traceback (most recent call last):
  File "/home/jovyan/work/progjar/progjar3/client/client_process.py", line 49, in <module>
  File "/opt/conda/lib/python3.10/multiprocessing/process.py", line 121, in start
  File "/opt/conda/lib/python3.10/multiprocessing/context.py", line 224, in _Popen
  File "/opt/conda/lib/python3.10/multiprocessing/context.py", line 281, in _Popen
  File "/opt/conda/lib/python3.10/multiprocessing/popen_fork.py", line 19, in __init__
Process Process-2045:
  File "/opt/conda/lib/python3.10/multiprocessing/popen_fork.py", line 65, in _launch
OSError: [Errno 24] Too many open files
WARNING:root:[CLIENT 2044] sending b'TIME\r\n\r\n'
Traceback (most recent call last):
  File "/opt/conda/lib/python3.10/multiprocessing/process.py", line 314, in _bootstrap
  File "/opt/conda/lib/python3.10/multiprocessing/process.py", line 108, in run
  File "/home/jovyan/work/progjar/progjar3/client/client_process.py", line 12, in kirim_data
OSError: [Errno 24] Too many open files
WARNING:root:[CLIENT 1657] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 1692] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 952] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 950] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 1783] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 1874] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 1893] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 1895] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 1140] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 1961] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 2004] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 2006] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 1979] sending b'TIME\r\n\r\n'
WARNING:root:[CLIENT 2038] sending b'TIME\r\n\r\n'
(base) jovyan@248c9e3fbd59:~/work/progjar/progjar3/client$
```

Proses berlangsung dengan cepat sama seperti percobaan pertama. Namun pada proses yang ke 2044 server tidak melakukan proses dan pada client terjadi error. Disini saya mengambil kesimpulan bahwa untuk client_process dapat melakukan proses thread dengan cepat, tetapi terbatas hanya sampai 2044 proses saja.

Link github : <https://github.com/bosbonta/Tugas-Progjar/tree/main/Tugas%203>