

PEMROGRAMAN JARINGAN E
TUGAS IMPLEMENTASI KASUS MENGGUNAKAN CONCURENCY



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Praktikum

1. Buatlah program yang mengimplementasikan
 - a. multi process
 - b. multi thread
 - c. multi process asynchronous
 - d. multi thread asynchronous

dengan menggunakan protokol transport UDP. kasus dapat didefinisikan sendiri. dan Buatlah arsitektur jaringan anda sendiri di simulator GNS3

2. buatlah laporan dalam bentuk PDF yang berisikan screenshot dari
 - a. deskripsi kasus yang dibuat
 - b. gambar arsitektur jaringan (dalam simulator GNS3)
 - c. program yang dibuat (1-4)
 - d. hasil outputnya

Studi Kasus :

Terdapat 1 client yaitu alpine-1 dan 2 server yaitu alpine-2 dan alpine-3, nantinya client akan men-download satu gambar lalu akan mem-broadcast atau mengirim file image tersebut ke kedua server dengan protokol transport UDP. Pengiriman atau broadcast dari client ke 2 server akan dilakukan dengan 4 berbeda yaitu multi process, multi thread, multi process asynchronous dan multi thread asynchronous sesuai perintah pada soal.

Github : https://github.com/Asmophel/Pemrograman_Jaringan_E/tree/Tugas-3-Implementasi-Kasus-Concurrency/progjar3/jawaban

Program yang digunakan :

1. library.py

```
64 lines (54 sloc) | 2.32 KB
1 import logging
2 import socket
3 import requests
4 import os
5 import time
6 import datetime
7
8
9 def get_url_list():
10     url = dict()
11     # url['kompas'] = 'https://asset.kompas.com/crops/qz_3jya2g6boomdCEXsfhSpec-/0x0:998x665/740x500/data/photo/2020/03/01/5e5b52f4d8896.jpg'
12     url['its'] = 'https://www.its.ac.id/wp-content/uploads/2017/10/logo-its-1.png'
13     url['detik'] = 'https://akcdn.detik.net.id/community/media/visual/2021/04/22/detikcon-ranadan-desktop-1.gif?d=1'
14     # url['file1'] = 'https://file-examples-com.github.io/uploads/2018/04/file_example_MOV_480_700x8.mov'
15     url['file2'] = 'https://file-examples-com.github.io/uploads/2018/04/file_example_MOV_1280_1_400x8.mov'
16     url['file3'] = 'https://file-examples-com.github.io/uploads/2017/02/zip_200.zip'
17     return url
18
19
20 def download_bc_gambar(url=None, tuliskefile=False, target_ip=None, target_port=None):
21     waktu_mulai = datetime.datetime.now()
22     if url is None:
23         return False
24     ff = requests.get(url)
25     # tipe = dict()
26     # tipe['image/png'] = 'png'
27     # tipe['image/jpg'] = 'jpg'
28     # tipe['image/gif'] = 'gif'
29     # tipe['image/jpeg'] = 'jpg'
30     # tipe['application/zip'] = 'zip'
31     # tipe['video/quicktime'] = 'mov'
32     time.sleep(2) #untuk simulasi, diberi tambahan delay 2 detik
33
34     # content_type = ff.headers['Content-Type']
35     # logging.warning(content_type)
36     namafile = os.path.basename(url)
37     # ekstensi = tipe[content_type]
38
39     #download gambar
40     if (tuliskefile):
41         fp = open(f"{namafile}", "wb")
42         fp.write(ff.content)
43         fp.close()
44
45     #broadcast gambar
46     sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
47     sock.setsockopt(socket.SOL_SOCKET, socket.SO_REUSEPORT, 1)
48     sock.setsockopt(socket.SOL_SOCKET, socket.SO_BROADCAST, 1)
49
50     print(f"broadcast file {namafile}")
51     image_file = open(f"{namafile}", "rb")
52     image_bytes = image_file.read()
53     sock.sendto(image_bytes, (target_ip, target_port))
54
55     #waktu
56     waktu_process = datetime.datetime.now() - waktu_mulai
57     waktu_akhir = datetime.datetime.now()
58     logging.warning(f"writing {namafile} dalam waktu {waktu_process} {waktu_mulai} s/d {waktu_akhir}")
59     return waktu_process
60
61 # if __name__ == '__main__':
62 #     #check fungsi
63 #     k = download_bc_gambar('https://asset.kompas.com/crops/qz_3jya2g6boomdCEXsfhSpec-/0x0:998x665/740x500/data/photo/2020/03/01/5e5b52f4d8896.jpg')
64 #     print(k)
```

2. udpserver_broadcast.py

```
Asmophel codingan Latest commit baz2d7e 3 minutes ago History
Rx 1 contributor
29 lines (20 sloc) | 595 Bytes
Raw Blame
1 import socket
2 import threading
3
4 SERVER_IP = '192.168.122.98'
5 SERVER_PORT = 5005
6
7
8 sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
9 sock.setsockopt(socket.SOL_SOCKET, socket.SO_REUSEPORT, 1)
10 sock.setsockopt(socket.SOL_SOCKET, socket.SO_BROADCAST, 1)
11
12 sock.bind(("", SERVER_PORT))
13
14 count = 1
15
16 while True:
17     data, addr = sock.recvfrom(54272)
18     #buffer size 1024 * 53
19     print(addr)
20     print("diterima ", data)
21     print("dikirim oleh " , addr)
22
23     received_image = 'img' + str(count) + ".jpg"
24     count += 1
25     file = open(received_image, 'wb')
26     file.write(data)
27     file.close()
28
```

3. udpserver_broadcast2.py

```
Asmophel codingan Latest commit be2bd7e 6 minutes ago History
A1 contributor
29 lines (20 sloc) | 596 Bytes
1 import socket
2 import threading
3
4 SERVER_IP = '192.168.122.132'
5 SERVER_PORT = 5005
6
7
8 sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
9 sock.setsockopt(socket.SOL_SOCKET, socket.SO_REUSEPORT, 1)
10 sock.setsockopt(socket.SOL_SOCKET, socket.SO_BROADCAST, 1)
11
12 sock.bind(('', SERVER_PORT))
13
14 count = 1
15
16 while True:
17     data, addr = sock.recvfrom(54272)
18     #buffer size 1024 * 51
19     print(addr)
20     print("diterima ", data)
21     print("dikirim oleh ", addr)
22
23     received_image = 'img' + str(count) + ".jpg"
24     count += 1
25     file = open(received_image, 'wb')
26     file.write(data)
27     file.close()
28
```

4. multi_process_async.py

```
Asmophel codingan Latest commit be2bd7e 7 minutes ago History
A1 contributor
35 lines (27 sloc) | 1.19 KB
1 from library import download_bc_gambar, get_url_list
2 import time
3 import datetime
4 from multiprocessing import Process, Pool
5
6 TARGET_IP = '255.255.255.255'
7 TARGET_PORT = 5005
8
9
10 def download_bc_semua():
11     texec = dict()
12     url = get_url_list()
13     status_task = dict()
14     task_pool = Pool(processes=20) #2 task yang dapat dikerjakan secara simultan, dapat diset sesuai jumlah core
15     catatawal = datetime.datetime.now()
16     for k in url:
17         print(f"mendownload {url[k]}")
18         #bagian ini merupakan bagian yang menginstruksikan eksekusi fungsi download dan broadcast gambar secara multiprocess
19         texec[k] = task_pool.apply_async(func=download_bc_gambar, args=(url[k], True, TARGET_IP, TARGET_PORT))
20
21     #Setelah menyelesaikan tugasnya, dikembalikan ke main process dengan mengambil hasilnya dengan get
22     for k in url:
23         status_task[k] = texec[k].get(timeout=10)
24
25     catat_akhir = datetime.datetime.now()
26     selesai = catat_akhir - catatawal
27     print(f"Waktu TOTAL yang dibutuhkan (selesai) detik (catatawal) s/d (catat_akhir)")
28     print("status TASK")
29     print(status_task)
30
31 #fungsi download_bc_gambar akan dijalankan secara multi process
32
33
34 if __name__ == '__main__':
35     download_bc_semua()
```

5. multi_process.py

```
Asmophel codingan Latest commit be2bd7e 7 minutes ago History
A1 contributor
27 lines (25 sloc) | 1016 Bytes
1 from library import download_bc_gambar, get_url_list
2 import time
3 import datetime
4 from multiprocessing import Process
5
6 TARGET_IP = '255.255.255.255'
7 TARGET_PORT = 5005
8
9
10 def download_bc_semua():
11     texec = dict()
12     url = get_url_list()
13     catatawal = datetime.datetime.now()
14     for k in url:
15         print(f"mendownload {url[k]}")
16         waktu = time.time()
17         #bagian ini merupakan bagian yang menginstruksikan eksekusi fungsi download dan broadcast gambar secara multiprocess
18         texec[k] = Process(target=download_bc_gambar, args=(url[k], True, TARGET_IP, TARGET_PORT))
19         texec[k].start()
20
21     #Setelah menyelesaikan tugasnya, dikembalikan ke main process dengan join
22     for k in url:
23         texec[k].join()
24
25     catat_akhir = datetime.datetime.now()
26     selesai = catat_akhir - catatawal
27     print(f"Waktu TOTAL yang dibutuhkan (selesai) detik (catatawal) s/d (catat_akhir)")
28
29 #fungsi download_bc_gambar akan dijalankan secara multi process
30
31 if __name__ == '__main__':
32     download_bc_semua()
```

6. multi_thread_async.py

```
Asmophel codingan Latest commit be2bd7e 8 minutes ago History
A1 contributor

36 lines (28 sloc) 1.13 KB
Raw Blame

1 from library import download_bc_gambar, get_url_list
2 import time
3 import datetime
4 import concurrent.futures
5
6 TARGET_IP = '255.255.255.255'
7 TARGET_PORT = 5985
8
9
10 def download_bc_semua():
11     texec = dict()
12     urlis = get_url_list()
13     status_task = dict()
14     task = concurrent.futures.ThreadPoolExecutor(max_workers=4)
15     catat_awal = datetime.datetime.now()
16     for k in urlis:
17         print(f"mendownload {urlis[k]}")
18         waktu = time.time()
19         #bagian ini merupakan bagian yang menginstruksikan eksekusi fungsi download dan broadcast gambar secara multithread
20         texec[k] = task.submit(download_bc_gambar, urlis[k], True, TARGET_IP, TARGET_PORT)
21
22     #setelah menyelesaikan tugasnya, dikembalikan ke main thread dengan menaggil result
23     for k in urlis:
24         status_task[k] = texec[k].result()
25
26     catat_akhir = datetime.datetime.now()
27     selesai = catat_akhir - catat_awal
28     print(f"Waktu TOTAL yang dibutuhkan (selesai) detik {catat_awal} s/d {catat_akhir}")
29     print("hasil task yang dijalankan")
30     print(status_task)
31
32
33 #fungsi download_bc_gambar akan dijalankan secara multithreading
34
35 if __name__ == '__main__':
36     download_bc_semua()
```

7. multi_thread.py

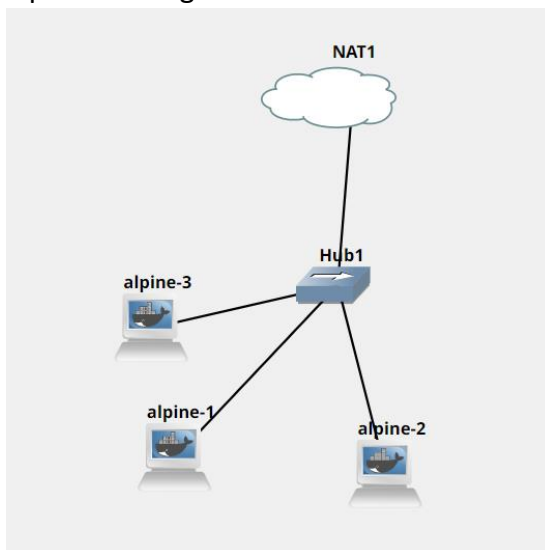
```
Asmophel codingan Latest commit be2bd7e 9 minutes ago History
A1 contributor

34 lines (25 sloc) 997 Bytes
Raw Blame

1 from library import download_bc_gambar, get_url_list
2 import time
3 import datetime
4 import threading
5
6 TARGET_IP = '255.255.255.255'
7 TARGET_PORT = 5985
8
9
10 def download_bc_semua():
11     texec = dict()
12     urlis = get_url_list()
13
14     catat_awal = datetime.datetime.now()
15     for k in urlis:
16         print(f"mendownload {urlis[k]}")
17         waktu = time.time()
18         #bagian ini merupakan bagian yang menginstruksikan eksekusi fungsi download gambar secara multithread
19         texec[k] = threading.Thread(target=download_bc_gambar, args=(urlis[k], True, TARGET_IP, TARGET_PORT))
20         texec[k].start()
21
22     #setelah menyelesaikan tugasnya, dikembalikan ke main thread dengan join
23     for k in urlis:
24         texec[k].join()
25
26     catat_akhir = datetime.datetime.now()
27     selesai = catat_akhir - catat_awal
28     print(f"Waktu TOTAL yang dibutuhkan (selesai) detik {catat_awal} s/d {catat_akhir}")
29
30
31 #fungsi download_bc_gambar akan dijalankan secara multithreading
32
33 if __name__ == '__main__':
34     download_bc_semua()
```

Dokumentasi :

1. Arsitektur Jaringan, nantinya alpine-1 akan digunakan sebagai client, alpine-2 dan alpine-3 sebagai server



2. Cek ip pada client (alpine-1) dengan command **ifconfig**

```
alpine-1 x alpine-2 x alpine-3 > - x
ifconfig
eth0 Link encap:Ethernet HWaddr 4E:A8:C7:9E:AE:6C
      inet addr:192.168.122.103 Bcast:192.168.122.255 Mask:255.255.255.0
      UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
      RX packets:29936 errors:0 dropped:0 overruns:0 frame:0
      TX packets:7548 errors:0 dropped:0 overruns:0 carrier:0
      collisions:0 txqueuelen:1000
      RX bytes:25727820 (24.5 MiB) TX bytes:1424441 (1.3 MiB)

lo Link encap:Local Loopback
   inet addr:127.0.0.1 Mask:255.0.0.0
   inet6 addr: ::1/128 Scope:Host
   UP LOOPBACK RUNNING MTU:65536 Metric:1
   RX packets:50 errors:0 dropped:0 overruns:0 frame:0
   TX packets:50 errors:0 dropped:0 overruns:0 carrier:0
   collisions:0 txqueuelen:1000
   RX bytes:645235 (630.1 KiB) TX bytes:645235 (630.1 KiB)

/home/Pemrograman_Jaringan_E/progjar3/jawaban #
```

3. Cek ip pada server1 (alpine-2) dengan command **ifconfig**

```
alpine-1 x alpine-2 x alpine-3 > - x
ifconfig
eth0 Link encap:Ethernet HWaddr 4E:71:A9:53:49:8C
      inet addr:192.168.122.90 Bcast:192.168.122.255 Mask:255.255.255.0
      UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
      RX packets:34509 errors:0 dropped:3 overruns:0 frame:0
      TX packets:2778 errors:0 dropped:0 overruns:0 carrier:0
      collisions:0 txqueuelen:1000
      RX bytes:26775633 (25.5 MiB) TX bytes:164364 (160.5 KiB)

lo Link encap:Local Loopback
   inet addr:127.0.0.1 Mask:255.0.0.0
   inet6 addr: ::1/128 Scope:Host
   UP LOOPBACK RUNNING MTU:65536 Metric:1
   RX packets:0 errors:0 dropped:0 overruns:0 frame:0
   TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
   collisions:0 txqueuelen:1000
   RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

/home/Pemrograman_Jaringan_E/progjar3/jawaban #
```

4. Cek ip pada server2 (alpine-3) dengan command **ifconfig**

```
< alpine-1 x alpine-2 x alpine-3 x > - x
ifconfig
eth0      Link encap:Ethernet  HWaddr 4A:05:F3:D7:94:FA
          inet addr:192.168.122.132  Bcast:192.168.122.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:34884 errors:0 dropped:5 overruns:0 frame:0
          TX packets:2607 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:26996917 (25.7 MiB)  TX bytes:155062 (151.4 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

/home/Pemrograman_Jaringan_E/progjar3/jawaban #
```

5. Sesuaikan IP server pada masing-masing server sesuai alpine-2 dan alpine-3

```
< alpine-1 x alpine-2 x alpine-3 x > - x
GNU nano 4.6      udpserver_broadcast.py
import socket
import threading

SERVER_IP = '192.168.122.90'
SERVER_PORT = 5005

sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
sock.setsockopt(socket.SOL_SOCKET, socket.SO_REUSEPORT, 1)
sock.setsockopt(socket.SOL_SOCKET, socket.SO_BROADCAST, 1)

sock.bind(("", SERVER_PORT))

count = 1

while True:
    data, addr = sock.recvfrom(54272)
    #buffer size 1024 * 53
    print(addr)
    print("diterima ", data)
```

6. untuk IP client gunakan "255.255.255.255", ubah coding pada program multi process, multi thread, multi process asynchronous dan multi thread asynchronous.

```
< alpine-1 x alpine-2 x alpine-3 x > - x
GNU nano 4.6      multi_process.py
from library import download_bc_gambar, get_url_list
import time
import datetime
from multiprocessing import Process

TARGET_IP = '255.255.255.255'
TARGET_PORT = 5005

def download_bc_semua():
    texec = dict()
    urls = get_url_list()
    catat_awal = datetime.datetime.now()
    for k in urls:
        print(f"mendownload {urls[k]}")
        waktu = time.time()
        #bagian ini merupakan bagian yang menginstruksikan eksekusi fungsi downl
        texec[k] = Process(target=download_bc_gambar, args=(urls[k], True, TARGET
        texec[k].start()
    #setelah menyelesaikan tugasnya, dikembalikan ke main process dengan join
    for k in urls:
```

1. Client (alpine-1)

Hasil Output multi_process.py

1. Client (alpine-1)

```
< alpine-1 x alpine-2 x alpine-3 x > - x
/home/Pemrograman_Jaringan_E/progjar3/jawaban # python3 multi_process.py
mendownload https://www.its.ac.id/wp-content/uploads/2017/10/logo-its-1.png
broadcast file logo-its-1.png
WARNING:root:writing logo-its-1.png dalam waktu 0:00:02.216464 2021-07-19 16:05:
18.675978 s/d 2021-07-19 16:05:20.892454
Waktu TOTAL yang dibutuhkan 0:00:02.238051 detik 2021-07-19 16:05:18.664139 s/d
2021-07-19 16:05:20.902190
/home/Pemrograman_Jaringan_E/progjar3/jawaban #
```

2. Server1 (alpine-2)

```
< alpine-1 x alpine-2 x alpine-3 x > - x
x12]U\xfe|\xaf\x9f\xbb0D.\xec\x8b\xf5\xd3Va\xdb\x8e1\x0f7\xc2\xcc\xdu\x5\xee\x
15-Z\|xa8eYN\xdb\x4\x2\xaf\xcd\xaf\xad)\x01\xb3;\x02\xe04)\xdbJ_\x8fI\xdb\x6\x
f0\x9e\x1d @\t\r\x95\x99\xal\x3\x4e4@iTi;\xcd\r\xfd\xdba\xcl\xde]K\xfa\x3X\x
c0\x
d9\xcf\x3\xdb69\xedQw\r5\x9f\xbc\x3\x8d\x6\x9\xdb\x0n\xce\x18\x0e\x00]g\x
f
b\x93\x01\x140\xab\x1b\x5g\xdd\x13\x07\x16za\xeb\x0e\x9b\x8c\xdbt1\xef\xacv\x
c
0h\xdaT\xf5\xb3\x01\x0c\x06\x9e\x156\x1e\xdb6\t'\x6D\x12\xdb\x6\x3\xec\xdb6\x
b3w\
x9f^=\xbavp6aA\x0a'Z\x30\x914\xdfUu$\xabm\xa2'\xeb{ \x9e\xal\x16,\xf5YtmY\x08
Eb+\x87\x20\xef\x13\x3d\n~\x18Y\xa0\x8bGI(,\x88\xcd\x93\x9b\x88o\xccW\x97\xdc
'\x1a\x98\xeb\xcbc*\xae\x91n\x83\x9f\x0f\x8c\x8\x7fEco\x589\xeehx\xdf\xdb6\x
2e'h\xba\x6\x9e?\xad\x8dI\x8P\xdd\x8c\x3Y+Z\x2>5\x02s|\xb4\xa9\x89Vj\r\xce\
xed\xdf\x4d)-\x88\xee\x17+n\x4jHD\x5Uu\x95%\x1f\xdf\xbd\x9f\x90WQUU-j\xfc\xal\
\x88p\x3Bf\x5\x05\307\xcdB-\xf0\xa2\x2\x9d\xdf \x05H\x1a\x6W\xce\x7\xfeI\xelg\
xa8\xa44q\x9da\xa3\xbe;\x03\xf7\xb6\xec\x9b+\x9a\xbd(\xabo\x921\xa5\xf4\xdf\x17
'\xf6\x9e\xdf\x98c\x3\xafy\xca\xfe\x3\x2\xea2\xffz\xel\x7AU\x95\x8bK\x8c%\xf
8\x1\x84\x2|\xc8\x8eTQ\x93\xa3*\xbd\x19\xde\x95\x0f~<\x81t\x9c'\xdejZ\x7\x95
\x1\x3\xcb\x8c\x01~P!\xd1l\xffx\x3T\xa4\x84\x7\xfc9\x14\x08\xfc\x0\x2\x8e\
\x13>\xaf\\\xf2U\x9c\xaaK2nL\x5\x00\xff\t\xel\x9f\xae\xba\x0"\xa7\xfaK5\xea\x
d\x9d\x8c\x10(\xf0\x1f\x12N\x87\xa0Ug\x9e\x7\x8b?\x13T\x5\xbb\x98\xdd\x3\x06Z
\x92\x1\x7fM(f\x1e\x83\xa7\xee\xbe\x9d\xde\x8.\xb2(\xfe\xec\x21\xbd\x9dy\x0\
\xbf*]~+\x7\xce\x13\x7~I10f\x15g\xde?\xbexp(\x07\x13\x0e\x0c\xfe\x3\x02\x91i\x
0c\x16\x7\x1b|\xff\x94r\xco>O/R(ZyN\x2\xfd\x3\xfb"fw2\x40\x9e\x94\xff<\'\xb
5fT\x96\x6\xbe\x1b\x89\xal\xae\x16\x95'A\x08!\x84\x10B\x08!\x84\x10B\x08!\xdf\
\xfe\x0f\x1ct\x8a\x05\xdaUD\x96\x00\x00\x00\x00IEND\xaeB`x82'
dikirim oleh ('192.168.122.103', 42226)
```

3. Server2 (alpine-3)

```
< alpine-1 x alpine-2 x alpine-3 x > - x
x12]U\xfe|\xaf\x9f\xbb0D.\xec\x8b\xf5\xd3Va\xdb\x8e1\x0f7\xc2\xcc\xdu\x5\xee\x
15-Z\|xa8eYN\xdb\x4\x2\xaf\xcd\xaf\xad)\x01\xb3;\x02\xe04)\xdbJ_\x8fI\xdb\x6\x
f0\x9e\x1d @\t\r\x95\x99\xal\x3\x4e4@iTi;\xcd\r\xfd\xdba\xcl\xde]K\xfa\x3X\x
c0\x
d9\xcf\x3\xdb69\xedQw\r5\x9f\xbc\x3\x8d\x6\x9\xdb\x0n\xce\x18\x0e\x00]g\x
f
b\x93\x01\x140\xab\x1b\x5g\xdd\x13\x07\x16za\xeb\x0e\x9b\x8c\xdbt1\xef\xacv\x
c
0h\xdaT\xf5\xb3\x01\x0c\x06\x9e\x156\x1e\xdb6\t'\x6D\x12\xdb\x6\x3\xec\xdb6\x
b3w\
x9f^=\xbavp6aA\x0a'Z\x30\x914\xdfUu$\xabm\xa2'\xeb{ \x9e\xal\x16,\xf5YtmY\x08
Eb+\x87\x20\xef\x13\x3d\n~\x18Y\xa0\x8bGI(,\x88\xcd\x93\x9b\x88o\xccW\x97\xdc
'\x1a\x98\xeb\xcbc*\xae\x91n\x83\x9f\x0f\x8c\x8\x7fEco\x589\xeehx\xdf\xdb6\x
2e'h\xba\x6\x9e?\xad\x8dI\x8P\xdd\x8c\x3Y+Z\x2>5\x02s|\xb4\xa9\x89Vj\r\xce\
xed\xdf\x4d)-\x88\xee\x17+n\x4jHD\x5Uu\x95%\x1f\xdf\xbd\x9f\x90WQUU-j\xfc\xal\
\x88p\x3Bf\x5\x05\307\xcdB-\xf0\xa2\x2\x9d\xdf \x05H\x1a\x6W\xce\x7\xfeI\xelg\
xa8\xa44q\x9da\xa3\xbe;\x03\xf7\xb6\xec\x9b+\x9a\xbd(\xabo\x921\xa5\xf4\xdf\x17
'\xf6\x9e\xdf\x98c\x3\xafy\xca\xfe\x3\x2\xea2\xffz\xel\x7AU\x95\x8bK\x8c%\xf
8\x1\x84\x2|\xc8\x8eTQ\x93\xa3*\xbd\x19\xde\x95\x0f~<\x81t\x9c'\xdejZ\x7\x95
\x1\x3\xcb\x8c\x01~P!\xd1l\xffx\x3T\xa4\x84\x7\xfc9\x14\x08\xfc\x0\x2\x8e\
\x13>\xaf\\\xf2U\x9c\xaaK2nL\x5\x00\xff\t\xel\x9f\xae\xba\x0"\xa7\xfaK5\xea\x
d\x9d\x8c\x10(\xf0\x1f\x12N\x87\xa0Ug\x9e\x7\x8b?\x13T\x5\xbb\x98\xdd\x3\x06Z
\x92\x1\x7fM(f\x1e\x83\xa7\xee\xbe\x9d\xde\x8.\xb2(\xfe\xec\x21\xbd\x9dy\x0\
\xbf*]~+\x7\xce\x13\x7~I10f\x15g\xde?\xbexp(\x07\x13\x0e\x0c\xfe\x3\x02\x91i\x
0c\x16\x7\x1b|\xff\x94r\xco>O/R(ZyN\x2\xfd\x3\xfb"fw2\x40\x9e\x94\xff<\'\xb
5fT\x96\x6\xbe\x1b\x89\xal\xae\x16\x95'A\x08!\x84\x10B\x08!\x84\x10B\x08!\xdf\
\xfe\x0f\x1ct\x8a\x05\xdaUD\x96\x00\x00\x00\x00IEND\xaeB`x82'
dikirim oleh ('192.168.122.103', 42226)
```

Hasil Output multi_thread_async.py

1. Client (alpine-1)

```
< ole alpine-1 x alpine-2 x alpine-3 x - x
/home/Pemrograman Jaringan E/progjar3/jawaban # python3 multi_thread_async.py
mendownload https://www.its.ac.id/wp-content/uploads/2017/10/logo-its-1.png
broadcast file logo-its-1.png
WARNING:root:writing logo-its-1.png dalam waktu 0:00:02.088917 2021-07-19 16:14:
55.137974 s/d 2021-07-19 16:14:57.226896
Waktu TOTAL yang dibutuhkan 0:00:02.092407 detik 2021-07-19 16:14:55.134962 s/d
2021-07-19 16:14:57.227369
hasil task yang dijalankan
{'its': datetime.timedelta(seconds=2, microseconds=88917)}
/home/Pemrograman_Jaringan_E/progjar3/jawaban #
```

2. Server1 (alpine-2)

```
< ole alpine-1 x alpine-2 x alpine-3 x - x
x12]U\xfe|\xaf\x9f\xbbOD.\xec\x8b\x5f\x3d3Va\xdb\x8e1\x0f7\xc2\xcc\x0u\x5\xee\x
15-Z\xa8eYN\xdb\x4\x2\xaf\xcd\xaf\xad)\x01\x3;\x02\Xe04]\xdbJ \x8fI\x6\x0f\x
f0\x9e\x1d @\t\r\x95\x99\xal\x3\x4@iTi;\xcd\r\xfd\xdba\xcl\xde]K\xfa\x3X\x0\
xd9\xcf\x3\xdb69\xedQw\r5\x9f\xbc\x3\x8d\x8f6\x9\xdb6\x0n\xce\x18\x0e\x00]g\x
b\x93\x01\x140\xab\x1b\x5g\xdd\x13\x07\x16za\xeb\x0e\x9b\x8c\xdbt1\xef\xacv\x
0h\xdaT\x1f5\x3\x01\x0c\x06\x9e\x156\x1e\x06\t\`6D\x12\x8d\x8b\x3\xec\x06\x3w\
x9f^=\xbavp6aA\x0a`Z\x30\x914\xdfUu$\xabm\xa2`\xeb( \x9e\xal\x16,\xf5YtmY\x08
Eb+\x87\x20\xef\x13\x3d\n~\x18Y\x0a0\x8bGI(,\x88\xcd\x93\x9b\x88o\xccW\x97\xdc
`\x1a\x98\xeb\xcbc*\xae\x91n\x83\x9f9\x0f\x8c\x8\x8f7fEco\x589\xeehx\xdf\x06\x
2e`h\xba\x6\x9e2\xad\x8dI\x8P\xdd\x8\x3%Y+Z\x2>5\x02s|\xb4\x9a\x89Vj\r\xce\
xed\xdf\x4d4)-\x88\xee\x17+n\x4jHD\x5UU\x95%\x1f\xdf\xbd\x9f\x90WQUU-j\xfc\xal\
x88p5\x3F5\x05\307\xcdB-\xf0\x2\x2\x9d\xdf \x05H\x1a\x16W\xce\x7\xfeL\xelg\
x8a\x44q\x9dA\x3\xbe;\x03\x7\x6\xec\x9+\x9a\xbd(\xabo\x921\x5a5\x1f4\xdf\x17
`\xf6\rQe\xdf\x98c\x3\xafy\xca\xfe\x3\x2\xea2\xffz\x1e\x7A0\x95\x8b\x8c%\xf
8\x1\x84\x2\x8c\x8eTQ\x93\x3*\xbd\x19\xde\x95\x0f<\x81t\x9c'\x8eJZ\x7e7\x95
\x1\x3\xcb\x8c\x01~P!\xd11\xff\x3T\xa4\x84\x7\xfc9\x14\x08\xfc\x0\x2\x8e8\
xb13>\xaf\\xf2U\x9c\xaaK2nL\x5\x00\xff\t\x1e\x9f\x9a\xba\x0" \xa7\xfaK5\xea\x
d\x9d\x8c\x10(\xf0\x1f\x12N\x87\x0a0Ug\x9e\x7\x8b2\x13T\x5\xbb\x98\xdd\x3\x06Z
\x92\x1\x7fM(f\x1e\x83\xa7\xee\xbe\x9d\xde\x8d.\xb2(\xfe\xec\x21\xbd\x9dy\x0\
\xbf*]~\x7\xce\x13\x7~I10f\x15g\xde2\xbeexp(\x07\x13\x0e\x0c\xfe\x3\x02\x91i\x
0c\x16\x7\x1\x1\xff\x94\r\x7o>O/R(ZyN\x2\xfd\x3\xfb"fw2\x40\x9e\x94\xff<\xb
5fT\x96\x6\xbe\x1\x89\xal\xae\x16\x95`A\x08!\x84\x10B\x08!\x84\x10B\x08!\xdf\
\xfe\x0f\x1ct\x8a\x05\xdaUD\x96\x00\x00\x00IEND\xaeB`x82'
dikirim oleh ('192.168.122.103', 41767)
```

3. Server2 (alpine-3)

```
< alpine-1 x alpine-2 x alpine-3 x - x
x12]U\xfe|\xaf\x9f\xbbOD.\xec\x8b\x5f\x3d3Va\xdb\x8e1\x0f7\xc2\xcc\x0u\x5\xee\x
15-Z\xa8eYN\xdb\x4\x2\xaf\xcd\xaf\xad)\x01\x3;\x02\Xe04]\xdbJ \x8fI\x6\x0f\x
f0\x9e\x1d @\t\r\x95\x99\xal\x3\x4@iTi;\xcd\r\xfd\xdba\xcl\xde]K\xfa\x3X\x0\
xd9\xcf\x3\xdb69\xedQw\r5\x9f\xbc\x3\x8d\x8f6\x9\xdb6\x0n\xce\x18\x0e\x00]g\x
b\x93\x01\x140\xab\x1b\x5g\xdd\x13\x07\x16za\xeb\x0e\x9b\x8c\xdbt1\xef\xacv\x
0h\xdaT\x1f5\x3\x01\x0c\x06\x9e\x156\x1e\x06\t\`6D\x12\x8d\x8b\x3\xec\x06\x3w\
x9f^=\xbavp6aA\x0a`Z\x30\x914\xdfUu$\xabm\xa2`\xeb( \x9e\xal\x16,\xf5YtmY\x08
Eb+\x87\x20\xef\x13\x3d\n~\x18Y\x0a0\x8bGI(,\x88\xcd\x93\x9b\x88o\xccW\x97\xdc
`\x1a\x98\xeb\xcbc*\xae\x91n\x83\x9f9\x0f\x8c\x8\x8f7fEco\x589\xeehx\xdf\x06\x
2e`h\xba\x6\x9e2\xad\x8dI\x8P\xdd\x8\x3%Y+Z\x2>5\x02s|\xb4\x9a\x89Vj\r\xce\
xed\xdf\x4d4)-\x88\xee\x17+n\x4jHD\x5UU\x95%\x1f\xdf\xbd\x9f\x90WQUU-j\xfc\xal\
x88p5\x3F5\x05\307\xcdB-\xf0\x2\x2\x9d\xdf \x05H\x1a\x16W\xce\x7\xfeL\xelg\
x8a\x44q\x9dA\x3\xbe;\x03\x7\x6\xec\x9+\x9a\xbd(\xabo\x921\x5a5\x1f4\xdf\x17
`\xf6\rQe\xdf\x98c\x3\xafy\xca\xfe\x3\x2\xea2\xffz\x1e\x7A0\x95\x8b\x8c%\xf
8\x1\x84\x2\x8c\x8eTQ\x93\x3*\xbd\x19\xde\x95\x0f<\x81t\x9c'\x8eJZ\x7e7\x95
\x1\x3\xcb\x8c\x01~P!\xd11\xff\x3T\xa4\x84\x7\xfc9\x14\x08\xfc\x0\x2\x8e8\
xb13>\xaf\\xf2U\x9c\xaaK2nL\x5\x00\xff\t\x1e\x9f\x9a\xba\x0" \xa7\xfaK5\xea\x
d\x9d\x8c\x10(\xf0\x1f\x12N\x87\x0a0Ug\x9e\x7\x8b2\x13T\x5\xbb\x98\xdd\x3\x06Z
\x92\x1\x7fM(f\x1e\x83\xa7\xee\xbe\x9d\xde\x8d.\xb2(\xfe\xec\x21\xbd\x9dy\x0\
\xbf*]~\x7\xce\x13\x7~I10f\x15g\xde2\xbeexp(\x07\x13\x0e\x0c\xfe\x3\x02\x91i\x
0c\x16\x7\x1\x1\xff\x94\r\x7o>O/R(ZyN\x2\xfd\x3\xfb"fw2\x40\x9e\x94\xff<\xb
5fT\x96\x6\xbe\x1\x89\xal\xae\x16\x95`A\x08!\x84\x10B\x08!\x84\x10B\x08!\xdf\
\xfe\x0f\x1ct\x8a\x05\xdaUD\x96\x00\x00\x00IEND\xaeB`x82'
dikirim oleh ('192.168.122.103', 41767)
```

Hasil Output multi_thread.py

1. Client (alpine-1)

```
< file alpine-1 x alpine-2 x alpine-3 x > - X
/home/Pemrograman_Jaringan_E/progjar3/jawaban # python3 multi_thread.py
mendownload https://www.its.ac.id/wp-content/uploads/2017/10/logo-its-1.png
broadcast file logo-its-1.png
WARNING:root:writing logo-its-1.png dalam waktu 0:00:02.088498 2021-07-19 16:16:
49.143445 s/d 2021-07-19 16:16:51.231947
Waktu TOTAL yang dibutuhkan 0:00:02.091500 detik 2021-07-19 16:16:49.141011 s/d
2021-07-19 16:16:51.232511
/home/Pemrograman_Jaringan_E/progjar3/jawaban # []
```

2. Server1 (alpine-2)

```
< file alpine-1 x alpine-2 x alpine-3 x > - X
x12]U\xfe|\xaf\x9f\xbb0D.\xec\x8b\xf5\xd3Va\xdb\x8e1\x0f7\xc2\xcc\x0d0u\xc5\xee\x
15-Z\x8eYN\xdb\x84\xc2\xaf\xcd\xaf\xad)\x01\xb3;\x02\xe04)\xdbJ \x8fI\xdb6\x0f0\x
f0\x9e9\x1d @t\r\x95\x99\x91\x9f3\xe4@iTi;\xcd\r\xfd\xdba\x01\xdeJ\x8fK\xfa\x03X\x00\
xd9\xcf5\x03\x8b9\xed0w\r5\x9f\xbc\xe3\x08\x0f6\x09\x0d6\x0c0n\xce\x18\x0e\x00jg\x0f
b\x93\x01\x140\xab\x1b\x05g\xdd\x0e13\x07\x16za\xeb\x0e\x9b\x8c\xdbt1\xef\xacv\x0c
0h\xdat\xf5\x01\x0c\x06\x9e\x156\x1e\x06\t'6D\x12\x08\x06\x0f3\xec\x06\x03w\
x9f'=\xbavp6aA\x0a'Z\x030\x914\xdfUu$\xabm\xa2'\xeb{ \x9e\x01\x16,\xf5YtmY\x08
Eb+\x87\x020\xef\x13\x03d\n~\x18Y\x0a0\x8bGI(,\x88\xcd\x93\x0b9B\x88o\xccW\x97\xdc
'\x1a\x98\xeb\x0bc*\xae\x91n\x83\x0f9\x0f\x0c8\x08\x0f7fEco\x0589\xeehx\xdf\x066\x0b
2e'h\xba\x06\x9e2\xad\x8dI\x08P\xdd\x08\x03Y+Z\x02s|\xb4\x09\x89Vj\r\xce\
xed\xdf\x04d)-\x88\xee\x17+n\x04jHD\x05U0\x95%\x1f\xdf\x0d\x0f9\x90WQUU-j\xfc\x0a1\
x88p8\x03f5\x05\307\xcdB-\xf0\x02\x02\x09\xdf \x05H\x1a\x06W\xce\x07\xfeL\x0e1g\
x8a\x044q\x09dA\x03\x0e;\x03\xf7\x06\xec6\x09+\x0a\x0d(\xab0\x921\x05\x0f4\xdf\x017
\x0f6\rqe\xdf\x98c\x03\xafy\x0ca\x0e\x03\x02\x0ea2\xffz\x01\x07AU\x95\x0b8k\x08c%\xf
8\x01\x84\x02|\x08\x8eTQ\x93\x03*\x0d\x19\xde\x95\x0f~<\x08t\x9c'\x0deJZ\x07\x95
\x01\x03\x0b\x08c\x01~P!\x0d1\xffx\x03T\x04\x08\x07\x0fc9\x14\x08\x0c\x0d0\x0c2\x08\
\x013>\xaf\\\xf2U\x9c\x0aK2nL\x05\x00\xff\t\x01\x0f9\x0e\x0a\x0f0"\x07\x0faK5\x0ea\x0d
d\x09\x0c8\x010(\xf0\x1f\x12N\x07\x0a0Ug\x09e\x07\x08b?\x13T\x05\x0bb\x098\xdd\x0b3\x06Z
\x02\x0c1\x07FM(f\x01e\x03\x07\x0e\x0e\x09d\x0e\x08.\x02(\xfe\xec\xf21\x0bd\x09dy\x0e0\
\x0bf*]T+\x07\x0ce\x13\x07~I10f\x15g\x0e2\x0bexp(\x07\x13\x0e\x0c\x0e\x03\x02\x091i\x
0c\x16\x07\x0b1\xff\x94\r\x0c7o>O/R(ZyN\x02\x0f\x03\x0fb"fw2\x040\x09\x94\xff<'\x0b
5#T\x96\x06\x0e\x01\x089\x0a1\x0e\x16\x95'A\x08!\x04\x10B\x08!\x04\x10B\x08!\x0df\
\xfe\x0f\x1c\x08a\x05\x0daU\x96\x00\x00\x00IEND\x0eb'\x02'
dikirim oleh ('192.168.122.103', 47007)
```

3. Server2 (alpine-3)

```
< alpine-1 x alpine-2 x alpine-3 x > - X
x12]U\xfe|\xaf\x9f\xbb0D.\xec\x8b\xf5\xd3Va\xdb\x8e1\x0f7\xc2\xcc\x0d0u\xc5\xee\x
15-Z\x8eYN\xdb\x84\xc2\xaf\xcd\xaf\xad)\x01\xb3;\x02\xe04)\xdbJ \x8fI\xdb6\x0f0\x
f0\x9e9\x1d @t\r\x95\x99\x91\x9f3\xe4@iTi;\xcd\r\xfd\xdba\x01\xdeJ\x8fK\xfa\x03X\x00\
xd9\xcf5\x03\x8b9\xed0w\r5\x9f\xbc\xe3\x08\x0f6\x09\x0d6\x0c0n\xce\x18\x0e\x00jg\x0f
b\x93\x01\x140\xab\x1b\x05g\xdd\x0e13\x07\x16za\xeb\x0e\x9b\x8c\xdbt1\xef\xacv\x0c
0h\xdat\xf5\x01\x0c\x06\x9e\x156\x1e\x06\t'6D\x12\x08\x06\x0f3\xec\x06\x03w\
x9f'=\xbavp6aA\x0a'Z\x030\x914\xdfUu$\xabm\xa2'\xeb{ \x9e\x01\x16,\xf5YtmY\x08
Eb+\x87\x020\xef\x13\x03d\n~\x18Y\x0a0\x8bGI(,\x88\xcd\x93\x0b9B\x88o\xccW\x97\xdc
'\x1a\x98\xeb\x0bc*\xae\x91n\x83\x0f9\x0f\x0c8\x08\x0f7fEco\x0589\xeehx\xdf\x066\x0b
2e'h\xba\x06\x9e2\xad\x8dI\x08P\xdd\x08\x03Y+Z\x02s|\xb4\x09\x89Vj\r\xce\
xed\xdf\x04d)-\x88\xee\x17+n\x04jHD\x05U0\x95%\x1f\xdf\x0d\x0f9\x90WQUU-j\xfc\x0a1\
x88p8\x03f5\x05\307\xcdB-\xf0\x02\x02\x09\xdf \x05H\x1a\x06W\xce\x07\xfeL\x0e1g\
x8a\x044q\x09dA\x03\x0e;\x03\xf7\x06\xec6\x09+\x0a\x0d(\xab0\x921\x05\x0f4\xdf\x017
\x0f6\rqe\xdf\x98c\x03\xafy\x0ca\x0e\x03\x02\x0ea2\xffz\x01\x07AU\x95\x0b8k\x08c%\xf
8\x01\x84\x02|\x08\x8eTQ\x93\x03*\x0d\x19\xde\x95\x0f~<\x08t\x9c'\x0deJZ\x07\x95
\x01\x03\x0b\x08c\x01~P!\x0d1\xffx\x03T\x04\x08\x07\x0fc9\x14\x08\x0c\x0d0\x0c2\x08\
\x013>\xaf\\\xf2U\x9c\x0aK2nL\x05\x00\xff\t\x01\x0f9\x0e\x0a\x0f0"\x07\x0faK5\x0ea\x0d
d\x09\x0c8\x010(\xf0\x1f\x12N\x07\x0a0Ug\x09e\x07\x08b?\x13T\x05\x0bb\x098\xdd\x0b3\x06Z
\x02\x0c1\x07FM(f\x01e\x03\x07\x0e\x0e\x09d\x0e\x08.\x02(\xfe\xec\xf21\x0bd\x09dy\x0e0\
\x0bf*]T+\x07\x0ce\x13\x07~I10f\x15g\x0e2\x0bexp(\x07\x13\x0e\x0c\x0e\x03\x02\x091i\x
0c\x16\x07\x0b1\xff\x94\r\x0c7o>O/R(ZyN\x02\x0f\x03\x0fb"fw2\x040\x09\x94\xff<'\x0b
5#T\x96\x06\x0e\x01\x089\x0a1\x0e\x16\x95'A\x08!\x04\x10B\x08!\x04\x10B\x08!\x0df\
\xfe\x0f\x1c\x08a\x05\x0daU\x96\x00\x00\x00IEND\x0eb'\x02'
dikirim oleh ('192.168.122.103', 47007)
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