Concurrent Webserver

Task Requirement:

Write a program webserver.c using threads and sockets supporting HTTP GET requests which works in the following way:

- It creates a pool of threads in the beginning
- Main thread waits on `epoll_wait` for any I/O on sockets
- It stores the requests in a message queue used by all the threads.
- Each client is supposed to go through following stages
  - READING_REQUEST
  - HEADER_PARSING
  - READING_DISKFILE
  - WRITING_HEADER
  - WRITING_BODY
- After WRITING_HEADER stage, client cycles between READING_DISKFILE and WRITING_BODY stage until full file is transferred
- Connection is not closed until server receives an EOF (i.e. client itself has closed the connection).
- I/O on sockets is non blocking, but reading from file is blocking since it'll always succeed.

Server performance

Testing is done using `httpref` which can be installed via `sudo apt install httpref`

Some snapshots for the statistics can be found here :

1. Number of connections : 100, Rate : 10, File size : 1450 bytes

2. Number of connections : 3000, Rate : 50, File size : 1450 bytes

```
singhcoder@singhcoder:~/Desktop/Network-Programming/Assignments/Assignment2$ httperf --server 127.0.0.1 --port 8004 --uri=/files/mrunal.png --num-conns 3000 --rate 50
--timeout 1
httperf --timeout=1 --client=0/1 --server=127.0.0.1 --port=8004 --uri=/files/mrunal.png --rate=50 --send-buffer=4096 --recv-buffer=16384 --num-conns=3000 --num-calls=
1
httperf: warning: open file limit > FD_SETSIZE; limiting max. # of open files to FD_SETSIZE
Maximum connect burst length: 1

Total: connections 3000 requests 3000 replies 3000 test-duration 59.981 s

Connection rate: 50.0 conn/s (20.0 ms/conn, <=3 concurrent connections)
Connection time [ms]: min 0.2 avg 0.4 max 49.8 median 0.5 stddev 1.2
Connection time [ms]: connect 0.0
Connection length [replies/conn]: 1.000

Request rate: 50.0 req/s (20.0 ms/req)
Request size [B]: 78.0

Reply rate [replies/s]: min 50.0 avg 50.0 max 50.0 stddev 0.0 (11 samples)
Reply time [ms]: response 0.3 transfer 0.2
Reply size [B]: header 82.0 content 60960.0 footer 0.0 (total 61042.0)
Reply status: 1xx=0 2xx=3000 3xx=0 4xx=0 5xx=0

CPU time [s]: user 13.47 system 46.41 (user 22.5% system 77.4% total 99.8%)
Net I/O: 2985.3 KB/s (24.5*10^6 bps)

Errors: total 0 client-timo 0 socket-timo 0 connrefused 0 connreset 0
Errors: fd-unavail 0 addrunavail 0 ftab-full 0 other 0
```

3. Number of connections : 10000, Rate : 50, File size : 1509793 bytes (15.1 MB)

```
singhcoder@singhcoder:~/Desktop/Network-Programming/Assignments/Assignment2$ httperf --server 127.0.0.1 --port 8004 --uri=/files/video.mp4 --num-conns 10000 --rate 50
--timeout 1
httperf --timeout=1 --client=0/1 --server=127.0.0.1 --port=8004 --uri=/files/video.mp4 --rate=50 --send-buffer=4096 --recv-buffer=16384 --num-conns=10000 --num-calls=
1
httperf: warning: open file limit > FD_SETSIZE; limiting max. # of open files to FD_SETSIZE
Maximum connect burst length: 1

Total: connections 10000 requests 9426 replies 9398 test-duration 199.980 s

Connection rate: 50.0 conn/s (20.0 ms/conn, <=19 concurrent connections)
Connection time [ms]: min 2.1 avg 44.6 max 329.8 median 33.5 stddev 34.2
Connection time [ms]: connect 0.1
Connection length [replies/conn]: 1.000

Request rate: 47.1 req/s (21.2 ms/req)
Request size [B]: 77.0

Reply rate [replies/s]: min 0.0 avg 48.2 max 50.6 stddev 8.3 (39 samples)
Reply time [ms]: response 0.5 transfer 44.0
Reply size [B]: header 100.0 content 15086950.0 footer 0.0 (total 15087050.0)
Reply status: 1xx=0 2xx=9398 3xx=0 4xx=0 5xx=0

CPU time [s]: user 24.03 system 175.78 (user 12.0% system 87.9% total 99.9%)
Net I/O: 692396.6 KB/s (5672.1*10^6 bps)

Errors: total 602 client-timo 26 socket-timo 0 connrefused 574 connreset 2
Errors: fd-unavail 0 addrunavail 0 ftab-full 0 other 0
```
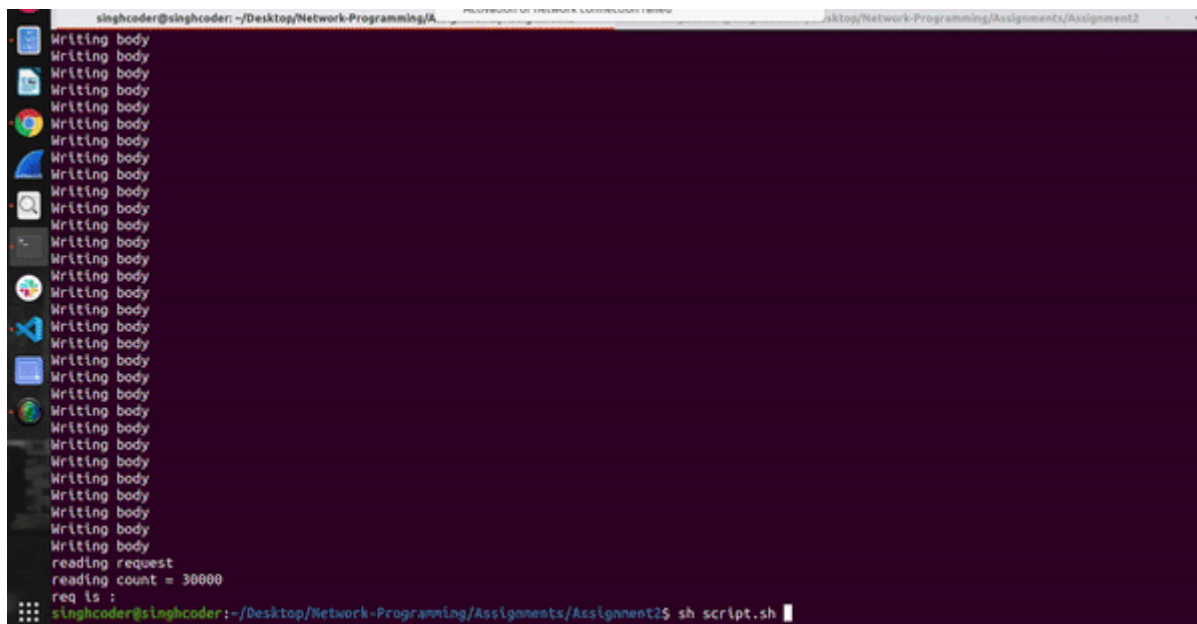
Demo Run

Dependencies:

- Linux kernal v4.15.0 (or higher)