

OS PROJECT:

This project is implemented to simulate a drop-box application in which users are assigned quota and they upload their files and folders. The quota is tracked and updated with each upload and delete. The users can't upload files once the quota is reached.

The project utilizes multithreading processing in which there are multiple workers which are running continuously. The main thread of the server pushes the sockets into the queue, which are the tasks to be executed by the worker threads. The worker threads take out the tasks and execute them once completed they inform the client of the completion.

We had to take care of the race condition and any minor leakage of memory which is assured by using tools valgrind and tmutex.

One server thread was running which was connected to three clients simultaneously and they requested execution of multiple commands. After execution they were thoroughly checked out for memory leaks and race conditions and they were eliminated to the best of our efforts.

Commands:

SERVER:

```
valgrind --leak-check=full --show-leak-kinds=all --track-origins=yes --verbose  
--log-file=valgrind-report.txt ./server
```

CLIENT:

Terminal 2

./client

```
> REGISTER user1 pass1  
> LOGIN user1 pass1  
> UPLOAD utils.h  
> UPLOAD queue.c  
> LIST  
> DELETE utils.h  
> LIST  
> QUIT
```

Terminal 3

./client

```
> REGISTER user2 pass2
> LOGIN user2 pass2
> UPLOAD server.c
> LIST
> DOWNLOAD server.c
> QUIT
```

Terminal 4

./client

```
> REGISTER user3 pass3
> LOGIN user3 pass3
> UPLOAD client.c
> UPLOAD makefile
> LIST
> DELETE makefile
> LIST
> QUIT
```

``` \*\*Terminal 1 - Shutdown server:\*\* ``

Ctrl+C

## **MEMORY LEAK VALGRIND REPORT:**

“

```
device@ibrahim-bin-ahmed:~/university/5thSmes/OS/osproject$ cat valgrind-report.txt
==16845== Memcheck, a memory error detector
==16845== Copyright (C) 2002-2022, and GNU GPL'd, by Julian Seward et al.
==16845== Using Valgrind-3.22.0-bd4db67b1d-20231031 and LibVEX; rerun with -h for
copyright info
==16845== Command: ./server
==16845== Parent PID: 16040
==16845==
--16845--
--16845-- Valgrind options:
--16845-- --leak-check=full
--16845-- --show-leak-kinds=all
--16845-- --track-origins=yes
--16845-- --verbose
--16845-- --log-file=valgrind-report.txt
--16845-- Contents of /proc/version:
--16845-- Linux version 6.14.0-33-generic (buildd@lcy02-amd64-026)
(x86_64-linux-gnu-gcc-13 (Ubuntu 13.3.0-6ubuntu2~24.04) 13.3.0, GNU ld (GNU
```

Binutils for Ubuntu) 2.42) #33~24.04.1-Ubuntu SMP PREEMPT\_DYNAMIC Fri Sep 19 17:02:30 UTC 2

--16845--

--16845-- Arch and hwcaps: AMD64, LittleEndian,  
amd64-cx16-lzcnt-rdtscp-sse3-ssse3-avx-avx2-bmi-f16c-rdrand-rdseed

--16845-- Page sizes: currently 4096, max supported 4096

--16845-- Valgrind library directory: /usr/libexec/valgrind

--16845-- Reading syms from /home/device/university/5thSmes/OS/osproject/server

--16845-- Reading syms from /usr/lib/x86\_64-linux-gnu/ld-linux-x86-64.so.2

--16845-- Considering

/usr/lib/debug/.build-id/52/0e05878220fb2fc6d28ff46b63b3fd5d48e763.debug ..

--16845-- .. build-id is valid

--16845-- Reading syms from /usr/libexec/valgrind/memcheck-amd64-linux

--16845-- object doesn't have a dynamic symbol table

--16845-- Scheduler: using generic scheduler lock implementation.

--16845-- Reading suppressions file: /usr/libexec/valgrind/default.supp

==16845== embedded gdbserver: reading from

/tmp/vgdb-pipe-from-vgdb-to-16845-by-device-on-???

==16845== embedded gdbserver: writing to

/tmp/vgdb-pipe-to-vgdb-from-16845-by-device-on-???

==16845== embedded gdbserver: shared mem

/tmp/vgdb-pipe-shared-mem-vgdb-16845-by-device-on-???

==16845==

==16845== TO CONTROL THIS PROCESS USING vgdb (which you probably

==16845== don't want to do, unless you know exactly what you're doing,

==16845== or are doing some strange experiment):

==16845== /usr/bin/vgdb --pid=16845 ...command...

==16845==

==16845== TO DEBUG THIS PROCESS USING GDB: start GDB like this

==16845== /path/to/gdb ./server

==16845== and then give GDB the following command

==16845== target remote | /usr/bin/vgdb --pid=16845

==16845== --pid is optional if only one valgrind process is running

==16845==

--16845-- REDIR: 0x4028b00 (ld-linux-x86-64.so.2:strlen) redirected to 0x580c2e1a  
(???)

--16845-- REDIR: 0x40272b0 (ld-linux-x86-64.so.2:index) redirected to 0x580c2e34  
(???)

--16845-- Reading syms from /usr/libexec/valgrind/vgpreload\_core-amd64-linux.so

--16845-- Reading syms from /usr/libexec/valgrind/vgpreload\_memcheck-amd64-linux.so

==16845== WARNING: new redirection conflicts with existing -- ignoring it

--16845-- old: 0x04028b00 (strlen) R-> (0000.0) 0x580c2e1a ???

--16845-- new: 0x04028b00 (strlen) R-> (2007.0) 0x0484f340 strlen

--16845-- REDIR: 0x40274e0 (ld-linux-x86-64.so.2:strcmp) redirected to 0x4850460 (strcmp)  
--16845-- REDIR: 0x4026910 (ld-linux-x86-64.so.2:memcpy) redirected to 0x4853cd0 (memcpy)  
--16845-- Reading syms from /usr/lib/x86\_64-linux-gnu/libc.so.6  
--16845-- Considering  
/usr/lib/debug/.build-id/27/4eec488d230825a136fa9c4d85370fed7a0a5e.debug ..  
--16845-- .. build-id is valid  
--16845-- REDIR: 0x4028ca0 (ld-linux-x86-64.so.2:strncmp) redirected to 0x484fc90 (strncmp)  
--16845-- REDIR: 0x491f050 (libc.so.6:strnlen) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x491f0e0 (libc.so.6:stpbrk) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x491d1a0 (libc.so.6:strcmp) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x49363b0 (libc.so.6:wcsnlen) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x491c290 (libc.so.6:memset) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x4935b20 (libc.so.6:wcslen) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x49a13f0 (libc.so.6:\_\_\_memcpy\_chk) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x491c200 (libc.so.6:memrchr) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x4936350 (libc.so.6:wcsncpy) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x491b720 (libc.so.6:memcpy@@GLIBC\_2.14) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x49348e0 (libc.so.6:wcschr) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x491d090 (libc.so.6:index) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x491f110 (libc.so.6:rindex) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x4934990 (libc.so.6:wcsncmp) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x491c4b0 (libc.so.6:stpncpy) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x4942eb0 (libc.so.6:wmemchr) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)  
--16845-- REDIR: 0x491eef0 (libc.so.6:strncmp) redirected to 0x483d1c0 (\_vgnU\_ifunc\_wrapper)

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--16845-- REDIR: 0x491c510 (libc.so.6:strcasecmp) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491e310 (libc.so.6:strcspn) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x49358f0 (libc.so.6:wscpy) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491d020 (libc.so.6:strcat) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491edf0 (libc.so.6:strncasecmp_l) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491d110 (libc.so.6:strchrnul) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491b630 (libc.so.6:bcmp) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491e2a0 (libc.so.6:strcpy) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491c5b0 (libc.so.6:strcasecmp_l) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491ecc0 (libc.so.6:strlen) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491ef90 (libc.so.6:strncpy) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x4942f30 (libc.so.6:wmemcpy) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x49a1510 (libc.so.6:___memmove_chk) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
==16845== WARNING: new redirection conflicts with existing -- ignoring it
--16845-- old: 0x049f2a10 (___memcpy_chk_avx_una) R-> (2030.0) 0x04853dd0
___memcpy_chk
--16845-- new: 0x049f2a10 (___memcpy_chk_avx_una) R-> (2024.0) 0x04853740
___memmove_chk
--16845-- REDIR: 0x491c440 (libc.so.6:stpcpy) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491bfc0 (libc.so.6:memmove) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
==16845== Preferring higher priority redirection:
--16845-- old: 0x049f2a40 (___memcpy_avx_unalign) R-> (2018.0) 0x04851580
___memcpy_avx_unaligned_erms
--16845-- new: 0x049f2a40 (___memcpy_avx_unalign) R-> (2018.1) 0x04852d60
memmove
--16845-- REDIR: 0x491b5b0 (libc.so.6:memchr) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491f2e0 (libc.so.6:strspn) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)

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--16845-- REDIR: 0x491c0e0 (libc.so.6:mempcpy) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x491ed50 (libc.so.6:strncasecmp) redirected to 0x483d1c0
(_vgnU_ifunc_wrapper)
--16845-- REDIR: 0x49f7630 (libc.so.6:__strchr_avx2) redirected to 0x484ed20 (rindex)
--16845-- REDIR: 0x49f5780 (libc.so.6:__strlen_avx2) redirected to 0x484f220 (strlen)
--16845-- REDIR: 0x4917650 (libc.so.6:malloc) redirected to 0x48467b0 (malloc)
--16845-- REDIR: 0x49f4de0 (libc.so.6:__strchrnul_avx2) redirected to 0x48537b0
(strchrnul)
--16845-- REDIR: 0x49f2a40 (libc.so.6:__memcpy_avx_unaligned_erms) redirected to
0x4852d60 (memmove)
--16845-- REDIR: 0x49f2a00 (libc.so.6:__mempcpy_avx_unaligned_erms) redirected to
0x48538d0 (mempcpy)
--16845-- REDIR: 0x4917d30 (libc.so.6:free) redirected to 0x4849820 (free)
--16845-- REDIR: 0x49187a0 (libc.so.6:calloc) redirected to 0x484d8a0 (calloc)
--16845-- REDIR: 0x4a11fb0 (libc.so.6:__strcspn_sse42) redirected to 0x4854010
(strcspn)
--16845-- REDIR: 0x49f4fd0 (libc.so.6:__strcmp_avx2) redirected to 0x4850360 (strcmp)
--16845-- REDIR: 0x49f6ec0 (libc.so.6:__strncpy_avx2) redirected to 0x484f4f0 (strncpy)
--16845-- REDIR: 0x49f4ba0 (libc.so.6:__strchr_avx2) redirected to 0x484ef00 (index)
--16845-- REDIR: 0x49f3440 (libc.so.6:__memset_avx2_unaligned_erms) redirected to
0x4852c50 (memset)
==16845==
==16845== HEAP SUMMARY:
==16845== in use at exit: 0 bytes in 0 blocks
==16845== total heap usage: 77 allocs, 77 frees, 450,776 bytes allocated
==16845==
==16845== All heap blocks were freed -- no leaks are possible
==16845==
==16845== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)

```

”

## **RACE CONDITION:**

Valgrind was having some memory map issues and I then used helgrind to detect race conditions some of them rose during shutdown which I handled using mutexes.

## **SCRIPT COMMAND**

./run\_server\_tsan.sh

**REPORT:**

**==22944== Helgrind, a thread error detector**

**==22944== Copyright (C) 2007-2017, and GNU GPL'd, by OpenWorks LLP et al.**

**==22944== Using Valgrind-3.22.0 and LibVEX; rerun with -h for copyright info**

**==22944== Command: ./server**

**==22944== Parent PID: 22913**

**==22944==**

**==22944==**

**==22944== Use --history-level=approx or =none to gain increased speed, at**

**==22944== the cost of reduced accuracy of conflicting-access information**

**==22944== For lists of detected and suppressed errors, rerun with: -s**

**==22944== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 145 from 35)**