CSE 344- HW5 Report

condition variables and barriers

Condition variables are used in buffer.c within the functions buffer_push and buffer_pop. They help to manage the buffer when it's full or empty by putting threads to sleep and waking them up when buffer is available.

Init empty and full condition variables:

pthread_cond_init(&buffer->empty, NULL);
pthread_cond_init(&buffer->full, NULL);

Waiting condition variables logic: while (buffer->count >= buffer->capacity)

pthread_cond_wait(&buffer->full, &buffer->mutex);

Barriers are used in main.c, manager.c, and worker.c to ensure all threads synchronize at certain points before proceeding. They help to ensure that all worker threads wait at a certain point before proceeding. This is useful to ensure all threads have completed a processing phase before moving to the next phase.

Init barrier: pthread_barrier_init(&barrier, NULL, worker_amount + 1);
Waiting logic: pthread_barrier_wait(barrier);

i add this waiting logic at the end of manager function and worker function.

components

1. **Main Function:**
    - It initializes a shared buffer used to store file descriptors and file names.
    - It sets up signal handlers for ctrl+z ctrl+c signals.

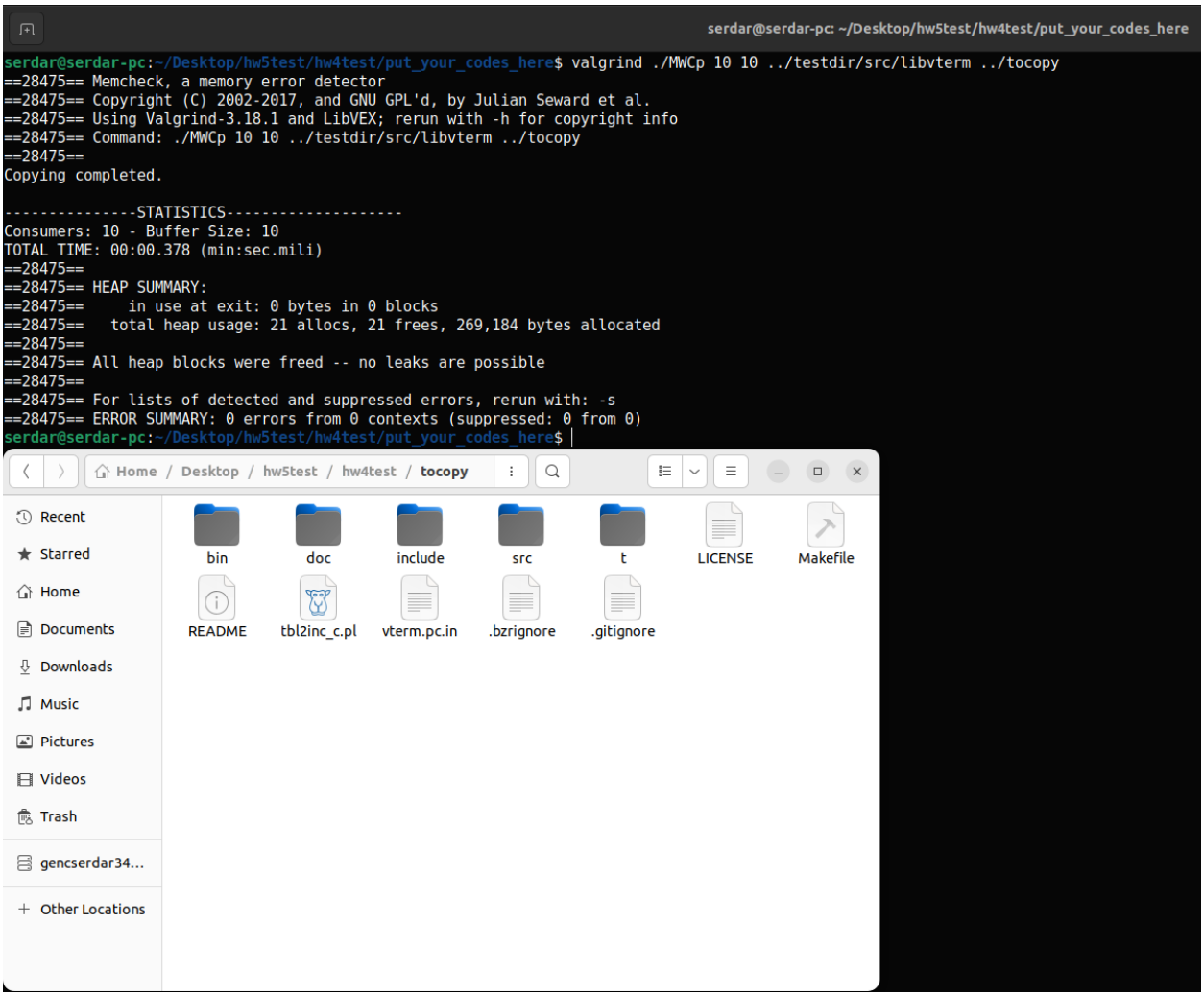
- It creates a manager thread to handle directory traversal and worker threads for every worker to perform the file copying.
- The start time is recorded at the beginning of main and end time is recorded at the end of main, end time – start time : gives us total time.

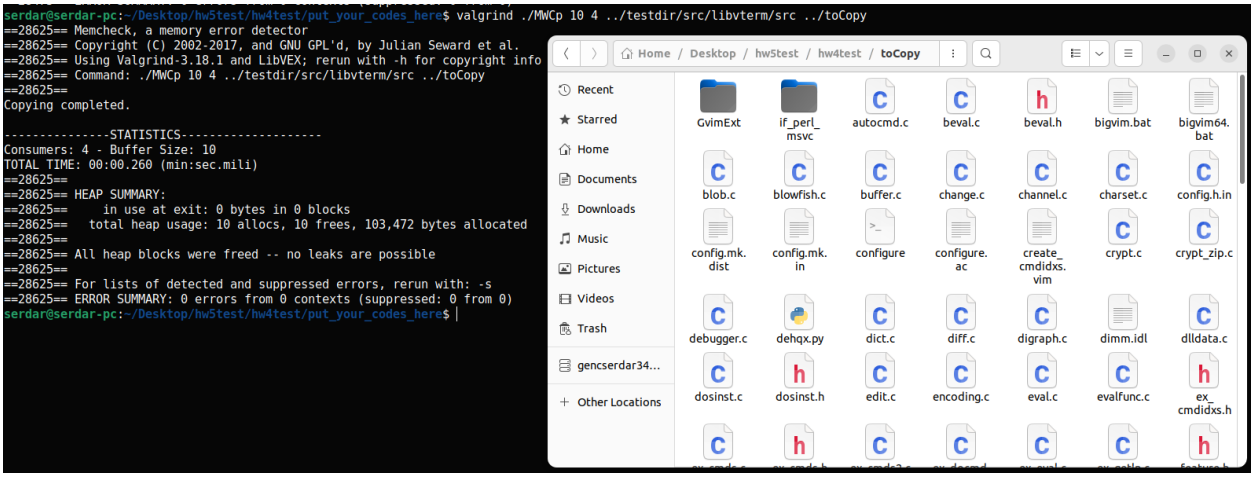
2. **Buffer:**
    - The buffer is a circular queue used to store file descriptors and file names. It is protected by mutexes and condition variables to ensure thread safety.
    - **Buffer Push:** Adds items to the buffer. If the buffer is full, the thread will wait until there is space.
    - **Buffer Pop:** Removes items from the buffer. If the buffer is empty and the copying process is not done, the thread will wait until there are items.
    - **Done Flag:** Indicates that the manager thread has finished processing all files and directories. Signals worker threads to stop waiting for new items.

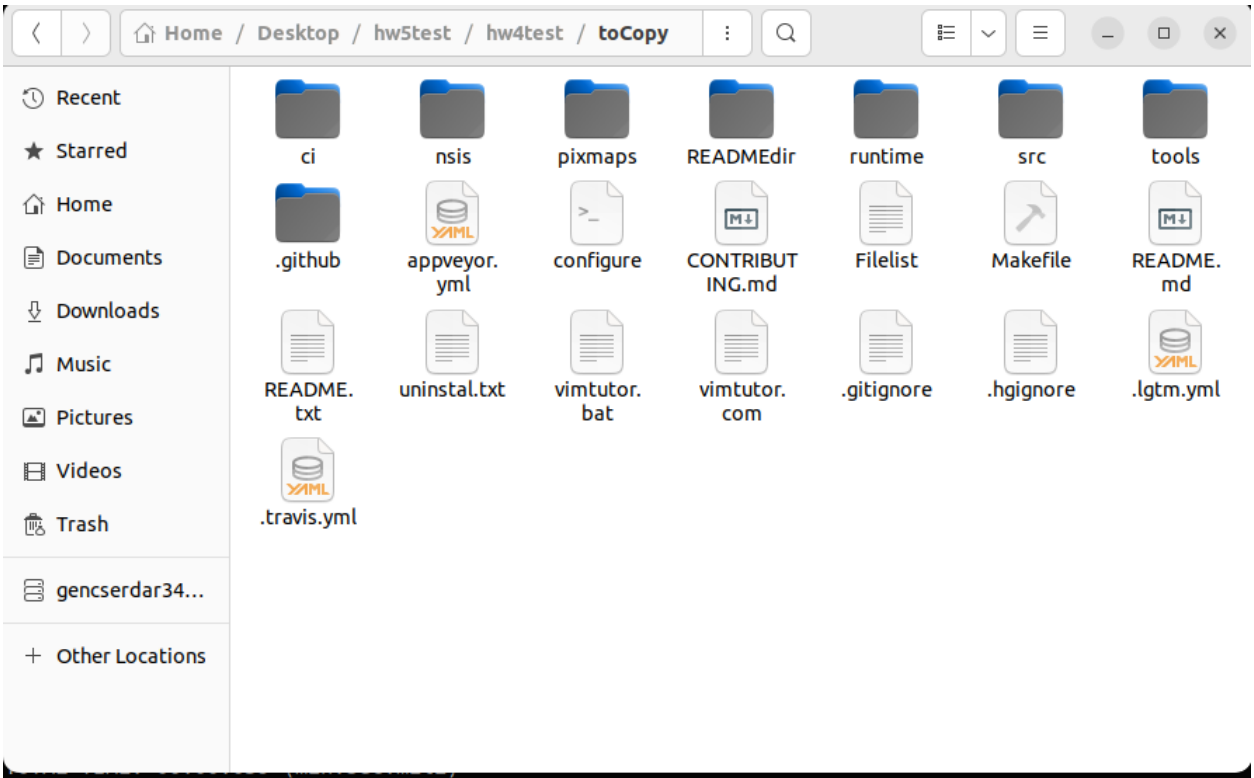
3. **Manager Thread:**
    - The manager thread recursively traverses the source directory, creating corresponding directories in the destination directory. (If destination directory does not exist, it will be created)
    - For each file encountered, it opens the source file for reading and the destination file for writing, then pushes the file descriptors and file names into the buffer for worker threads to process.
    - Once all files and directories have been processed, the manager thread sets the buffer's done flag to signal to the worker threads that no more items will be added.
4. **Worker Threads:**

    - Each worker thread continuously pops items from the buffer. For each item, it reads data from the source file and writes it to the destination file.
    - Worker threads keep processing items until the buffer's done flag is set and the buffer is empty.
5. **Resource Cleanup:** The buffer is destroyed to free allocated memory.
6. **Timing and Statistics:** The main function calculates and prints the total time taken for the copying process and other statistics.

testing


serdar@serdar-pc: ~/Desktop/hw5test/hw4test/put_your_codes_here
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$ valgrind ./MWCp 10 10 ../testdir/src/libvterm ../tocopy
==28475== Memcheck, a memory error detector
==28475== Copyright (C) 2002-2017, and GNU GPL'd, by Julian Seward et al.
==28475== Using Valgrind-3.18.1 and LibVEX; rerun with -h for copyright info
==28475== Command: ./MWCp 10 10 ../testdir/src/libvterm ../tocopy
==28475==
Copying completed.
--------------STATISTICS-------------------
Consumers: 10 - Buffer Size: 10
TOTAL TIME: 00:00.378 (min:sec.mili)
==28475==
==28475== HEAP SUMMARY:
==28475==   in use at exit: 0 bytes in 0 blocks
==28475==   total heap usage: 21 allocs, 21 frees, 269,184 bytes allocated
==28475==
==28475== All heap blocks were freed -- no leaks are possible
==28475==
==28475== For lists of detected and suppressed errors, rerun with: -s
==28475== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$
Home / Desktop / hw5test / hw4test / tocopy
Recent
Starred
Home
Documents
Downloads
Music
Pictures
Videos
Trash
gencserdar34...
Other Locations
bin
doc
include
src
t
LICENSE
Makefile
README
tbl2inc_c.pl
vterm.pc.in
.bzrignore
.gitignore


serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$ valgrind ./MWCp 10 4 ../testdir/src/libvterm/src ../toCopy
==28625== Memcheck, a memory error detector
==28625== Copyright (C) 2002-2017, and GNU GPL'd, by Julian Seward et al.
==28625== Using Valgrind-3.18.1 and LibVEX; rerun with -h for copyright info
==28625== Command: ./MWCp 10 4 ../testdir/src/libvterm/src ../toCopy
==28625==
Copying completed.
--------------STATISTICS-------------------
Consumers: 4 - Buffer Size: 10
TOTAL TIME: 00:00.260 (min:sec.mili)
==28625==
==28625== HEAP SUMMARY:
==28625==   in use at exit: 0 bytes in 0 blocks
==28625==   total heap usage: 10 allocs, 10 frees, 103,472 bytes allocated
==28625==
==28625== All heap blocks were freed -- no leaks are possible
==28625==
==28625== For lists of detected and suppressed errors, rerun with: -s
==28625== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$
Home / Desktop / hw5test / hw4test / toCopy
Recent
Starred
Home
Documents
Downloads
Music
Pictures
Videos
Trash
gencserdar34...
Other Locations
GvimExt
if_perl_msvc
autocmd.c
beval.c
beval.h
bigvim.bat
bigvim64.bat
blob.c
blowfish.c
buffer.c
change.c
channel.c
charset.c
config.h.in
config.mk.dist
config.mk.in
configure
configure.ac
create_cmdidxs.vim
crypt.c
crypt_zip.c
debugger.c
dehqx.py
dict.c
diff.c
digraph.c
dimm.idl
dlldata.c
dosinst.c
dosinst.h
edit.c
encoding.c
eval.c
evalfunc.c
ex_cmdidxs.h




```
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$ ./MWCp 10 10 ../testdir ../toCopy
Copying completed.

--------------STATISTICS--------------------
Consumers: 10 - Buffer Size: 10
TOTAL TIME: 00:00.052 (min:sec.mili)
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$
```

```
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$ ./MWCp 100 100 ../testdir ../toCopy
Copying completed.

--------------STATISTICS--------------------
Consumers: 100 - Buffer Size: 100
TOTAL TIME: 00:00.217 (min:sec.mili)
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$ ./MWCp 100 1000 ../testdir ../toCopy
Copying completed.

--------------STATISTICS--------------------
Consumers: 1000 - Buffer Size: 100
TOTAL TIME: 00:00.199 (min:sec.mili)
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$ ./MWCp 1000 1000 ../testdir ../toCopy
Copying completed.

--------------STATISTICS--------------------
Consumers: 1000 - Buffer Size: 1000
TOTAL TIME: 00:00.187 (min:sec.mili)
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$ ./MWCp 1000 1 ../testdir ../toCopy
Error opening source file: Too many open files
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$ ./MWCp 10 1000 ../testdir ../toCopy
Copying completed.

--------------STATISTICS--------------------
Consumers: 1000 - Buffer Size: 10
TOTAL TIME: 00:00.222 (min:sec.mili)
serdar@serdar-pc:~/Desktop/hw5test/hw4test/put_your_codes_here$
```