

CS 314: Operating Systems Laboratory

Lab 2

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Part 1

NOTE: For all the parts, the work of sending files from ubuntu to minix was done using the scp command.

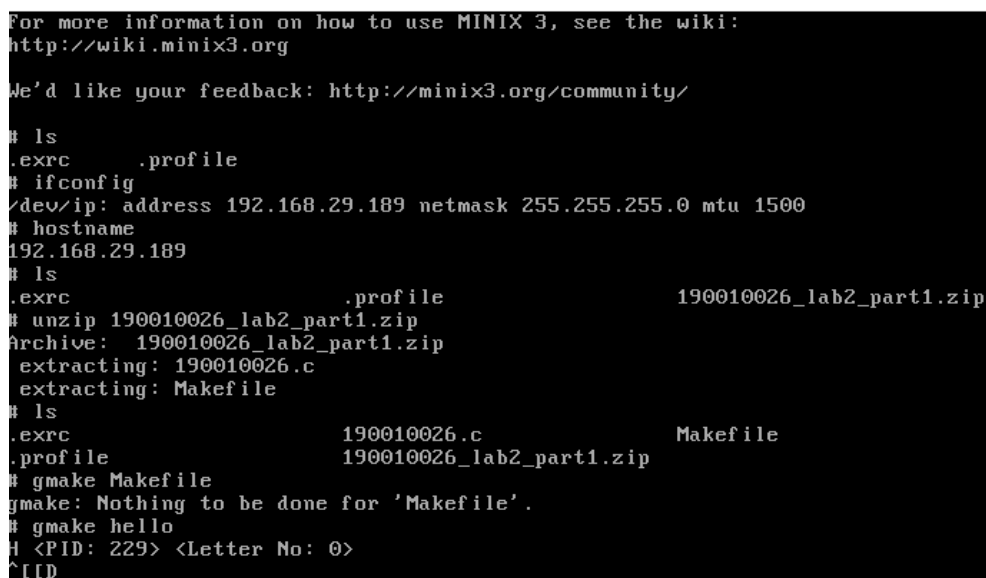
In Part 1, each letter of the string "Hello World" was printed one by one and also each letter was printed from the child processes for each letter.

In my code I have printed each in following order:

< Letter > < PID of process printing the letter > < Letter No. >

I think the minimum number of lines for the program would be 21. As per how I have written my code and by removing space taking comments.

The compiler used was clang as instructed. For running the code in Minix, the command used was: `gmake hello`. This command was run in the location where 190010026_lab2_part1.zip was unzipped. As seen in below figures:



```
For more information on how to use MINIX 3, see the wiki:
http://wiki.minix3.org

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# ls
.exrc      .profile
# ifconfig
/dev/ip: address 192.168.29.189 netmask 255.255.255.0 mtu 1500
# hostname
192.168.29.189
# ls
.exrc      .profile      190010026_lab2_part1.zip
# unzip 190010026_lab2_part1.zip
Archive:  190010026_lab2_part1.zip
  extracting: 190010026.c
  extracting: Makefile
# ls
.exrc      190010026.c      Makefile
.profile   190010026_lab2_part1.zip
# gmake Makefile
gmake: Nothing to be done for 'Makefile'.
# gmake hello
# <PID: 229> <Letter No: 0>
^[[D_
```

Figure 1: Unzipping part1 file

```

# ls
.exrc                190010026.c          Makefile
.profile            190010026_lab2_part1.zip
# gmake Makefile
gmake: Nothing to be done for 'Makefile'.
# gmake hello
H <PID: 229> <Letter No: 0>
^[[De <PID: 230> <Letter No: 1>
^Cgmake: *** wait: No child processes.  Stop.
gmake: *** Waiting for unfinished jobs....
gmake: *** wait: No child processes.  Stop.

# gmake hello
H <PID: 236> <Letter No: 0>
e <PID: 237> <Letter No: 1>
l <PID: 238> <Letter No: 2>
l <PID: 239> <Letter No: 3>
o <PID: 240> <Letter No: 4>
  <PID: 241> <Letter No: 5>
W <PID: 242> <Letter No: 6>
o <PID: 243> <Letter No: 7>
r <PID: 244> <Letter No: 8>
l <PID: 245> <Letter No: 9>
d <PID: 246> <Letter No: 10>
#

```

Figure 2: gmake hello command usage

Part 2

Here we see the order in which processes are created and terminated(exited). We see that the processes created like a tree. The root node being the parent process and the branches are the child processes. We see that parent creates the child. While exiting we see that the child process exits first then the parent process. This type of exiting and creating is correct because, a parent process can create a new child process after another child process exits but not when parent exits first.

For the Lab 2 Part 2, the code of the file "forkexit.c" was changed which is present in /usr/src/minix/servers/pm directory. When a process was created(forked) the following line of code was added(in do_fork):

```
printf("Minix: PID %d created", rmc->mp_pid); //PID added for create
```

Similarly, when a process was exited the following line of code was added(in do_exit):

```
printf("Minix: PID %d exited", mp->mp_pid); //PID added for exit
```

Here too the files were sent using scp as mentioned in the NOTE.

The OS was built first by using make build MKUPDATE=yes, as follows and minix was running as expected:

```

# cd /usr/src
# ls
.git          Makefile.inc docs          include      sbin         usr.bin
.gitignore    bin           etc           lib          share        usr.sbin
.gitreview    build.sh     external     libexec     sys
LICENSE       common       games        minix       tests
Makefile      distrib     gnu          reasetools  tools
# make build MKUPDATE=yes

```

```

install -N /usr/src/etc -c -p -r ../minix/servers/pm/pm /boot/minix/.temp/mod03_
pm
install -N /usr/src/etc -c -p -r ../minix/servers/sched/sched /boot/minix/.temp/
mod04_sched
install -N /usr/src/etc -c -p -r ../minix/servers/vfs/vfs /boot/minix/.temp/mod0
5_vfs
install -N /usr/src/etc -c -p -r ../minix/drivers/storage/memory/memory /boot/mi
nix/.temp/mod06_memory
install -N /usr/src/etc -c -p -r ../minix/drivers/tty/tty/tty /boot/minix/.temp/
mod07_tty
install -N /usr/src/etc -c -p -r ../minix/fs/mfs/mfs /boot/minix/.temp/mod08_mfs
install -N /usr/src/etc -c -p -r ../minix/servers/vm/vm /boot/minix/.temp/mod09_
vm
install -N /usr/src/etc -c -p -r ../minix/fs/pfs/pfs /boot/minix/.temp/mod10_pfs
install -N /usr/src/etc -c -p -r ../sbin/init/init /boot/minix/.temp/mod11_init
Done.
Build started at: Wed Jan 19 21:14:24 IST 2022
Build finished at: Wed Jan 19 21:32:38 IST 2022
# ls
.git          Makefile.inc docs          include      releasetools tools
.gitignore    bin           etc           lib          sbin        usr.bin
.gitreview    build.sh     external     libexec     share       usr.sbin
LICENSE       common       games        minix       sys
Makefile     distrib     gnu          params      tests
# reboot

```

```

Minix: PID 350 created
Minix: PID 350 exited
Minix: PID 351 created
Minix: PID 352 created
Minix: PID 353 created
Minix: PID 352 exited
Minix: PID 353 exited
Minix: PID 351 exited
Minix: PID 349 exited
Minix: PID 354 created
Minix: PID 355 created
Minix: PID 355 exited
Minix: PID 356 created
Minix: PID 357 created
Minix: PID 358 created
Minix: PID 357 exited
Minix: PID 358 exited
Minix: PID 356 exited
Minix: PID 354 exited
Minix: PID 200 exited
Minix: PID 181 exited
^[[D
Minix/i386 (192.168.29.221) (console)

login:

```

```

login:
  Password:
Login incorrect or refused on this terminal.
login: root
Password:
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  The NetBSD Foundation, Inc. All rights reserved.
Copyright (c) 1982, 1986, 1989, 1991, 1993
  The Regents of the University of California. All rights reserved.

For post-installation usage tips such as installing binary
packages, please see:
http://wiki.minix3.org/UsersGuide/PostInstallation

For more information on how to use MINIX 3, see the wiki:
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Minix: PID 359 created
Minix: PID 359 exited
Minix: PID 360 created
Minix: PID 360 exited
# _

```

```

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Minix: PID 359 created
Minix: PID 359 exited
Minix: PID 360 created
Minix: PID 360 exited
# cd /usr
# ls
Minix: PID 361 created
Makefile  bin      lib      man      preserve  spool     var
adm       etc      libdata  mdec     run       src
ast       games   libexec  minix3.zip sbin     tests
benchmarks include  log      pkg      share    tmp
Minix: PID 361 exited
#

```

```

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Minix: PID 359 created
Minix: PID 359 exited
Minix: PID 360 created
Minix: PID 360 exited
# cd /usr
# ls
Minix: PID 361 created
Makefile  bin      lib      man      preserve  spool     var
adm       etc      libdata  mdec     run       src
ast       games   libexec  minix3.zip  sbin     tests
benchmarks include  log      pkg      share    tmp
Minix: PID 361 exited
# pwd
/usr
# history
history: not found
# cp
Minix: PID 362 created
usage: cp [-R [-H | -L | -P]] [-f | -i] [-a|Np] src target
       cp [-R [-H | -L | -P]] [-f | -i] [-a|Np] src1 ... srcN directory
Minix: PID 362 exited
#

```

Then again the script file "part2.sh" was tested by running the command: `./part.sh` in the location where 190010026_lab2_part2.zip was unzipped(This was done in a clone of MINIX OS which wasn't altered earlier). Again the minix OS was running as expected:

```

replace part2.sh? [yles, [nlo, [All], [N]one, [r]ename: y
extracting: part2.sh
# ./part2.sh
.git      Makefile.inc docs      include  sbin      usr.bin
.gitignore bin      etc      lib      share     usr.sbin
.gitreview build.sh external libexec  sys
LICENSE   common  games   minix    tests
Makefile  distrib gnu      releasetools tools
# cd /root
# ls
.exrc      190010026_lab2_part2.zip  forkexit.c
.profile   Makefile                  part2.sh
190010026.c a.out                      try.zip
# rm forkexit.c
# rm part2.sh
# ls
.exrc      190010026_lab2_part2.zip  try.zip
.profile   Makefile
190010026.c a.out
# unzip 190010026_lab2_part2.zip
Archive:  190010026_lab2_part2.zip
extracting: forkexit.c
extracting: part2.sh
# ./part2.sh
_

```

```

.git          Makefile.inc docs          include      sbin          usr.bin
.gitignore    bin          etc          lib          share         usr.sbin
.gitreview    build.sh     external    libexec      sys
LICENSE       common      games       minix        tests
Makefile      distrib    gnu         releasetools tools
# cd /root
# ls
.exrc          190010026_lab2_part2.zip  forkexit.c
.profile       Makefile                part2.sh
190010026.c    a.out                  try.zip
# rm forkexit.c
# rm part2.sh
# ls
.exrc          190010026_lab2_part2.zip  try.zip
.profile       Makefile
190010026.c    a.out
# unzip 190010026_lab2_part2.zip
Archive:  190010026_lab2_part2.zip
  extracting: forkexit.c
  extracting: part2.sh
# ./part2.sh
UFS dupvm: getfd failed
UFS dupvm: getfd failed
UFS dupvm: getfd failed
# _

```

```

.git          Makefile.inc docs          include      sbin          usr.bin
.gitignore    bin          etc          lib          share         usr.sbin
.gitreview    build.sh     external    libexec      sys
LICENSE       common      games       minix        tests
Makefile      distrib    gnu         releasetools tools
# cd /root
# ls
.exrc          190010026_lab2_part2.zip  forkexit.c
.profile       Makefile                part2.sh
190010026.c    a.out                  try.zip
# rm forkexit.c
# rm part2.sh
# ls
.exrc          190010026_lab2_part2.zip  try.zip
.profile       Makefile
190010026.c    a.out
# unzip 190010026_lab2_part2.zip
Archive:  190010026_lab2_part2.zip
  extracting: forkexit.c
  extracting: part2.sh
# ./part2.sh
UFS dupvm: getfd failed
UFS dupvm: getfd failed
UFS dupvm: getfd failed
# reboot

```

```

updateMinix: PID 167 created
Minix: PID 168 created
Minix: PID 168 exited
cronMinix: PID 169 created
Minix: PID 170 created
Minix: PID 170 exited
Minix: PID 171 created
Minix: PID 171 exited
syslogdMinix: PID 172 created
.
Starting networking:Minix: PID 173 created
Minix: PID 173 exited
Minix: PID 174 created
Minix: PID 174 exited
Minix: PID 175 created
Minix: PID 176 created
Minix: PID 172 exited
Minix: PID 176 exited
dhcpcdMinix: PID 177 created
Minix: PID 178 created
Minix: PID 178 exited
nnamedMinix: PID 179 created
.
Minix: PID 180 created

```

```

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Minix: PID 212 created
Minix: PID 212 exited
Minix: PID 213 created
Minix: PID 213 exited
# ls
Minix: PID 214 created
.exrc          190010026_lab2_part2.zip  forkexit.c
.profile       Makefile                 part2.sh
190010026.c    a.out                   try.zip
Minix: PID 214 exited
#

```

```
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Minix: PID 212 created
Minix: PID 212 exited
Minix: PID 213 created
Minix: PID 213 exited
# ls
Minix: PID 214 created
.exrc                190010026_lab2_part2.zip  forkexit.c
.profile             Makefile                 part2.sh
190010026.c          a.out                   try.zip
Minix: PID 214 exited
# poweroff
Minix: PID 215 created
Minix: PID 169 exited
Minix: PID 175 exited
Minix: PID 179 exited
Minix: PID 207 exited
MINIX will now be shut down ...
```