

Setting up and using Bochs with support for GDB

I uninstalled the existing Bochs in my Virtual Linux Machine using this command: '**sudo apt-get remove bochs**'. Next, I downloaded the latest version of Bochs (V2.7) from <http://sourceforge.net/projects/bochs/files/bochs/2.7/> in a .tar.gz format. I installed these two packages with these commands: '**sudo apt-get install libx11-dev**' and '**sudo apt-get install libxrandr-dev**'. Then, I extracted the .tar.gz file using this command: '**tar xvzf bochs-2.7.tar.gz**'. I opened the bochs-2.7 directory and executed the following commands in the same folder:

1. **sudo ./configure --enable-gdb-stub --with-x11**
2. **sudo make**
3. **sudo make install**

I added the '**-g**' and '**-OO**' options to the end of '**GCC_OPTIONS**' in the makefile and configured GDB in the Bochs configuration file 'bochsrc.bxrc' by adding this instruction:
'**gdbstub: enabled=1, port=1234, text_base=0, data_base=0, bss_base=0**'

Then, I ran these commands in the project folder:

1. **sudo make**
2. **sudo ./copykernel.sh**
3. **bochs -f bochsrc.bxrc**

Now, on the screen, I was presented with the following options:

1. Restore factory default configuration
2. Read options from...
3. Edit options
4. Save options to...
5. Restore the Bochs state from...
6. Begin simulation
7. Quit now

I selected option 6 to start the simulation, which launched the Bochs emulator with a blank screen. In a terminal, I opened the same project folder where I had executed these commands to open GDB '**gdb -q kernel.o**'. After GDB started, I entered this command '**target remote :1234**'. This command connected to the Bochs terminal. I added a breakpoint using '**b main**'. This set a breakpoint in 'kernel.c' at the 'main' function. I continued the function with the '**c**' command which reached the breakpoint. Then, I used the '**i**' command to print the lines at the breakpoint and '**info frame**' to print a verbose description of the selected stack frame. I continued the function again with '**c**' which started the Bochs emulator. In the Bochs emulator, I chose 'My Kernel,' which printed the welcome message and my name. Finally, I clicked on the Power icon to close the emulator. In the GDB terminal after clicking on power icon, I saw the message "Remote connection closed."

```
Activities Terminal Aug 31 19:11
csce410@csce410-VirtualBox: ~/Desktop/AshutoshPunyani_CSCE611/MP1

csce410@csce410-VirtualBox: ~/Desktop/AshutoshPunyani_CSCE611/MP1 x csce410@csce410-VirtualBox: ~/Desktop/AshutoshPunyani_CSCE611/MP1 x
csce410@csce410-VirtualBox:~/Desktop/AshutoshPunyani_CSCE611/MP1$ gdb -q kernel.o
Reading symbols from kernel.o...
(gdb) target remote :1234
Remote debugging using :1234
0x0000ffff in ?? ()
(gdb) b main
Breakpoint 1 at 0x0: file kernel.C, line 29.
(gdb) c
Continuing.

Breakpoint 1, main () at kernel.C:29
29 {
(gdb) l
24 /* ===== */
25 /* MAIN -- THIS IS WHERE THE OS KERNEL WILL BE STARTED UP */
26 /* ===== */
27
28 int main()
29 {
30
31 /* -- INITIALIZE CONSOLE */
32 Console::init();
33 Console::puts("Initialized console.\n");
(gdb) info frame
Stack level 0, frame at 0xffe0:
eip = 0x0 in main (kernel.C:29); saved eip = 0x9ff012e4
called by frame at 0x10002
```

```
Activities Terminal Aug 31 19:12
csce410@csce410-VirtualBox: ~/Desktop/AshutoshPunyani_CSCE611/MP1

csce410@csce410-VirtualBox: ~/Desktop/AshutoshPunyani_CSCE611/MP1 x csce410@csce410-VirtualBox: ~/Desktop/AshutoshPunyani_CSCE611/MP1 x
Breakpoint 1, main () at kernel.C:29
29 {
(gdb) l
24 /* ===== */
25 /* MAIN -- THIS IS WHERE THE OS KERNEL WILL BE STARTED UP */
26 /* ===== */
27
28 int main()
29 {
30
31 /* -- INITIALIZE CONSOLE */
32 Console::init();
33 Console::puts("Initialized console.\n");
(gdb) info frame
Stack level 0, frame at 0xffe0:
eip = 0x0 in main (kernel.C:29); saved eip = 0x9ff012e4
called by frame at 0x10002
source language c++.
Arglist at 0xffffa, args:
Locals at 0xffffa, Previous frame's sp is 0xffe0
Saved registers:
eip at 0xffffc
(gdb) c
Continuing.
Remote connection closed
(gdb) quit
csce410@csce410-VirtualBox:~/Desktop/AshutoshPunyani_CSCE611/MP1$
```

```
Activities Bochs Aug 31 19:10
Bochs x86 emulator, http://bochs.sourceforge.net/

USER Copy Paste Snapshot Reset Suspend Poweroff
Initialized console.
00 -- Replace the following <NAME> field with your name.
01 -- After your are done admiring your output, you can shutdown this 'machine'.
02 Bo
03
04 Th
05 ma
06 co
07 co
08 ah
09
10 Yo
11
12 1.
13 2.
14 3.
15 4.
16 5.
17 6.
18 7.
19
20 Pl
21 IPS: 10.351M
22 000000000000i[ ] installing x module as the Bochs GUI
23 000000000000i[ ] using log file bochsout.txt
24 Waiting for gdb connection on port 1234
25 Connected to 127.0.0.1
```

References:

1. https://people.engr.tamu.edu/bettati/Courses/OSProjects/project_overview.html
2. <https://bochs.sourceforge.io/doc/docbook/user/debugging-with-gdb.html>
3. <https://amelon.org/2018/02/25/integration-bochs.html>
4. <https://people.engr.tamu.edu/bettati/Courses/OSProjects/to-use-gdb-tools.pdf>
5. <https://sourceware.org/gdb/onlinedocs/gdb/Frame-Info.html>
6. <https://sourceware.org/gdb/onlinedocs/gdb/List.html>