

Remote debugging

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Installing gdbserver to the Raspberry Pi

The toolchain includes a tool called **gdbserver**. This program will run on the Raspberry Pi, and we'll connect to it using **gdb** on our computer. First install **gdbserver** to the Pi:

```
$ scp ~/GitHub/RPi-Cpp-Toolchain/toolchain/x-tools/armv6-rpi-linux-gnueabi/gdbserver/armv6-rpi-linux-gnueabi/debug-  
root/usr/bin/gdbserver RPi0:~  
$ ssh RPi0 sudo mv gdbserver /usr/local/bin  
$ ssh RPi0 gdbserver --version  
GNU gdbserver (crosstool-NG UNKNOWN) 9.2  
Copyright (C) 2020 Free Software Foundation, Inc.  
gdbserver is free software, covered by the GNU General Public License.  
This gdbserver was configured as "armv6-rpi-linux-gnueabi"
```

Installing extra libraries to the sysroot

By default, Raspberry Pi OS preloads a custom **memcpy** implementation. When debugging, GDB needs that library in the sysroot as well. Install it using:

```
$ echo "deb http://archive.raspberrypi.org/debian/ buster main" | sudo tee /var/lib/schroot/chroots/rpizero-buster-  
armhf/etc/apt/sources.list.d/raspi.list  
$ wget -qO - https://archive.raspberrypi.org/debian/raspberrypi.gpg.key | sudo schroot -c source:rpizero-buster-armhf -u  
root -d / -- apt-key add -  
$ sudo sbuild-apt rpizero-buster-armhf apt-get update  
$ sudo sbuild-apt rpizero-buster-armhf apt-get install raspi-copies-and-fills
```

Installing GDB on your computer

To debug ARM devices, you need an ARM version of GDB. You can install one using:

```
$ sudo apt install gdb-multiarch
```

The toolchain includes **armv6-rpi-linux-gnueabi-gdb**, but for some reason, this version of GDB doesn't play well with VSCode.

Running GDB manually from the command line

To make sure everything works correctly, let's start GDB from a command line and debug the program we compiled and copied to the Pi on the previous page:

```
$ armv6-rpi-linux-gnueabi-gdb ./build/hello
```

Set the sysroot and start gdbserver over SSH. Then type **c** or **continue** to run the program:

```
(gdb) set sysroot /var/lib/schroot/chroots/rpizero-buster-armhf  
(gdb) target remote | ssh RPi0 gdbserver - '~/hello' --name Pieter  
(gdb) continue
```

Use **q** or **Ctrl+D** to quit GDB.

```

~/G/RPi-Cross-Cpp-Development master > scp build/hello RPi0:~
hello
~/G/RPi-Cross-Cpp-Development master > armv6-rpi-linux-gnueabi-hf-gdb ./build/hello
GNU gdb (crosstool-NG UNKNOWN) 9.2
Copyright (C) 2020 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "--host=x86_64-build_pc-linux-gnu --target=armv6-rpi-linux-gnueabi-hf".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./build/hello...
(gdb) set sysroot /var/lib/schroot/chroots/rpizero-buster-armhf
(gdb) target remote | ssh RPi0 gdbserver - './hello' --name Pieter
Remote debugging using | ssh RPi0 gdbserver - './hello' --name Pieter
stdin/stdout redirected
Process /home/pi/hello created; pid = 3965
Remote debugging using stdio
Reading symbols from /var/lib/schroot/chroots/rpizero-buster-armhf/lib/ld-linux-armhf.so.3...
(No debugging symbols found in /var/lib/schroot/chroots/rpizero-buster-armhf/lib/ld-linux-armhf.so.3)
0xb6fcea30 in ?? () from /var/lib/schroot/chroots/rpizero-buster-armhf/lib/ld-linux-armhf.so.3
(gdb) c
Continuing.
Hello, Pieter!
[Inferior 1 (process 3965) exited normally]
(gdb) q
~/G/RPi-Cross-Cpp-Development master >

```

Debugging using VSCode

The example project includes `task.json` and `launch.json` files that automatically copy the binary to the Raspberry Pi and start gdbserver when you hit **F5**. This allows you to set breakpoints, inspect the call stack and variables, and so on, like you would during a normal native debug session.

The "C/C++" extension by Microsoft is required for debugging support.

```

C++ main.cpp > main
1 #include <boost/program_options.hpp>
2 namespace po = boost::program_options;
3 #include <iostream>
4 #include <string>
5
6 int main(int argc, char *argv[]) {
7     try {
8         // Define and parse the command line arguments
9         po::options_description desc("Options");
10        desc.add_options() // clang-format off
11            ("help", "Print usage information and exit")
12            ("name", po::value<std::string>(), "The name of the person to greet")
13    }
14 }

```

Variables:

- Locals:
 - desc: {...}
 - vm: {...}
 - name: {...}
 - argc: 3
 - argv: 0xb6fffc94
 - *argv: 0xb6fffcdbb "/home/pi/hello"
- Registers:
 - CPU
 - IEEE Double
 - FPU
 - IEEE Single

Call Stack: PAUSED ON BREAKPOINT

- main(int argc, char ** argv) main.cpp

Breakpoints:

- main.cpp (9)
- main.cpp (45)

Debug Console:

```

Loaded /lib/arm-linux-gnueabi-hf/librt.so.1
Loaded /lib/arm-linux-gnueabi-hf/libm.so.6
Loaded /lib/arm-linux-gnueabi-hf/libpthread.so.0
Loaded /lib/ld-linux-armhf.so.3
Loaded '/usr/lib/arm-linux-gnueabi-hf/libarmmem-v6l.so.'. Cannot find or open the symbol file.
Loaded '/lib/arm-linux-gnueabi-hf/libboost_program_options.so.1.67.0'. Cannot find or open the symbol file.
Loaded '/usr/local/lib/arm-linux-gnueabi-hf/libstdc++.so.6'. Cannot find or open the symbol file.
Loaded '/lib/arm-linux-gnueabi-hf/libgcc_s.so.1'. Cannot find or open the symbol file.
Loaded '/lib/arm-linux-gnueabi-hf/libc.so.6'. Cannot find or open the symbol file.
Loaded '/lib/arm-linux-gnueabi-hf/librt.so.1'. Cannot find or open the symbol file.
Loaded '/lib/arm-linux-gnueabi-hf/libm.so.6'. Cannot find or open the symbol file.
Loaded '/lib/arm-linux-gnueabi-hf/libpthread.so.0'. Cannot find or open the symbol file.
Loaded '/lib/ld-linux-armhf.so.3'. Cannot find or open the symbol file.

Breakpoint 1, main (argc=3, argv=0xb6fffc94) at /home/pieter/GitHub/RPi-Cross-Cpp-Development/main.cpp:9
    po::options_description desc("Options");
Execute debugger commands using "-exec <command>", for example "-exec info registers" will list registers in use (when GDB is the debugger)

```

For some reason, the standard output of the program is not visible in VSCode. I'll probably open an issue to try and figure this out.