

# Remote debugging

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## Installing gdbserver to the Raspberry Pi

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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 ~/opt/x-tools/armv6-rpi-linux-gnueabi/hf/armv6-rpi-linux-gnueabi/hf/debug-root/usr/bin/gdbserver RPi0:~
$ ssh RPi0 sudo mv gdbserver /usr/local/bin
$ ssh RPi0 gdbserver --version
GNU gdbserver (crosstool-NG UNKNOWN) 10.2
Copyright (C) 2021 Free Software Foundation, Inc.
gdbserver is free software, covered by the GNU General Public License.
This gdbserver was configured as "armv6-rpi-linux-gnueabi/hf"
```

## Installing extra libraries to the sysroot

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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
```

This is not necessary when your Raspberry Pi runs Ubuntu, for example.

## Installing GDB on your computer

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To debug ARM devices, you need an ARM version of GDB. The toolchain includes **armv6-rpi-linux-gnueabi/hf-gdb** that you can use.

Alternatively, you can install the **gdb-multiarch** package using:

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

## Running GDB manually from the command line

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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/hf-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-gdb ./build/hello
GNU gdb (crossstool-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".
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.

Before you start debugging, edit `launch.json` and edit the paths to the sysroot as appropriate. You might want to edit the SSH configuration and destination path in `tasks.json` as well.

```

type -apropos word to search for commands related to 'word'
cmd-param-changed,param="pagination",value="off"
0xb6fcea30 in ?? () from /var/lib/schroot/chroots/rpizero-buster-armhf/lib/ld-linux-armhf.so.3
Loaded '/var/lib/schroot/chroots/rpizero-buster-armhf/lib/ld-linux-armhf.so.3'. Symbols loaded.

Breakpoint 1, main (argc=3, argv=0xb6fffc94) at /home/pieter/GitHub/RPi-Cross-Cpp-Development/main.cpp:9
9 po::options_description desc("Options");
Loaded '/var/lib/schroot/chroots/rpizero-buster-armhf/usr/lib/arm-linux-gnueabi/libc.so.1'. Symbols loaded.
Loaded '/var/lib/schroot/chroots/rpizero-buster-armhf/lib/arm-linux-gnueabi/libboost_program_options.so.1.67.0'. Symbols loaded.
Loaded '/var/lib/schroot/chroots/rpizero-buster-armhf/usr/local/lib/arm-linux-gnueabi/libstdc++.so.6'. Symbols loaded.
Loaded '/var/lib/schroot/chroots/rpizero-buster-armhf/lib/arm-linux-gnueabi/libc.so.6'. Symbols loaded.
Loaded '/var/lib/schroot/chroots/rpizero-buster-armhf/lib/arm-linux-gnueabi/librt.so.1'. Symbols loaded.
Loaded '/var/lib/schroot/chroots/rpizero-buster-armhf/lib/arm-linux-gnueabi/libm.so.6'. Symbols loaded.
Loaded '/var/lib/schroot/chroots/rpizero-buster-armhf/lib/arm-linux-gnueabi/libpthread.so.0'. Symbols loaded.
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.