Zephyr GDB Debugger Lab

Rev1.0, May 29, 2022

Objectives

In this lab, you will learn

- → Flash and debug a Zephyr application using gdb command-line

Pre-Requisites

This lab is written for Windows10, but Zephyr and this lab can easily be done in Linux or MacOS. This lab guide was written for Zephyr release v3.0.0.

- Follow Zephyr_Installation_Lab.pdf
- Terminal Program, like PuTTY or Tera Term
- Follow Zephyr_hello_world_Sample_Lab.pdf to prepare the hardware, verify environment variables, connect the terminal to the board

Hardware Requirements

- MIMXRT1060-EVKB
- Micro-USB cable (may need two cables, see Zephyr_hello_world_Sample_Lab.pdf)

Running the lab

Prepare Command Line

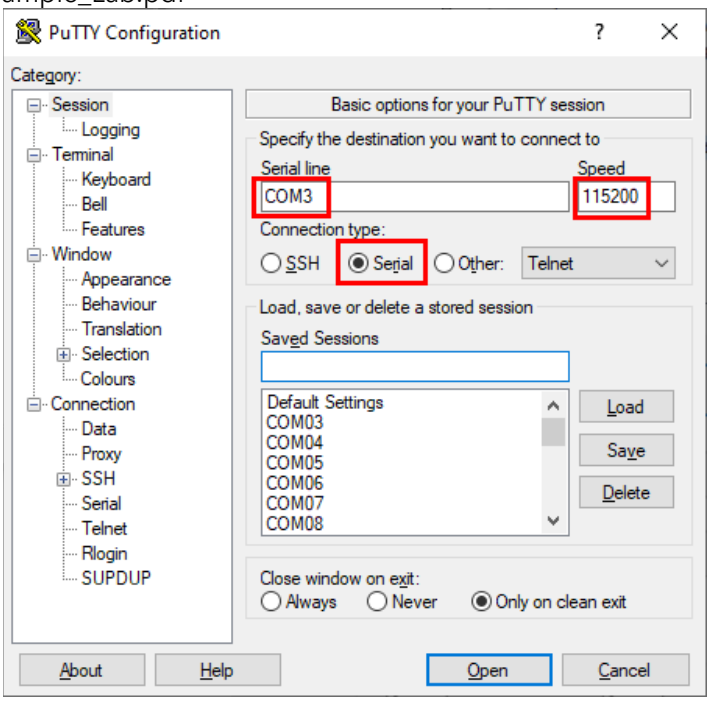
Before using the West commands, a command window should be opened, python virtual environment activated, and environment variables set. These steps only need to be done once after a command window is opened. If already done in a previous lab, skip to the next section. See Zephyr_hello_world_Sample_Lab.pdf for more details.

1. Open a normal command prompt in Windows
2. Navigate to the zephyr directory:
   cd %userprofile%\zephyrproject\zephyr

3. Activate the python virtual environment. After activating, the prompt should now include (.venv), see screenshot below:
   ..\.venv\Scripts\activate.bat

4. Set the environmental variables. Note, when using a command file like this to set the variables, the command file needs to be executed once anytime a new command window is opened:
   zephyr-env.cmd

5. Connect a terminal program to the board's COM port, for help see Zephyr_hello_world_Sample_Lab.pdf



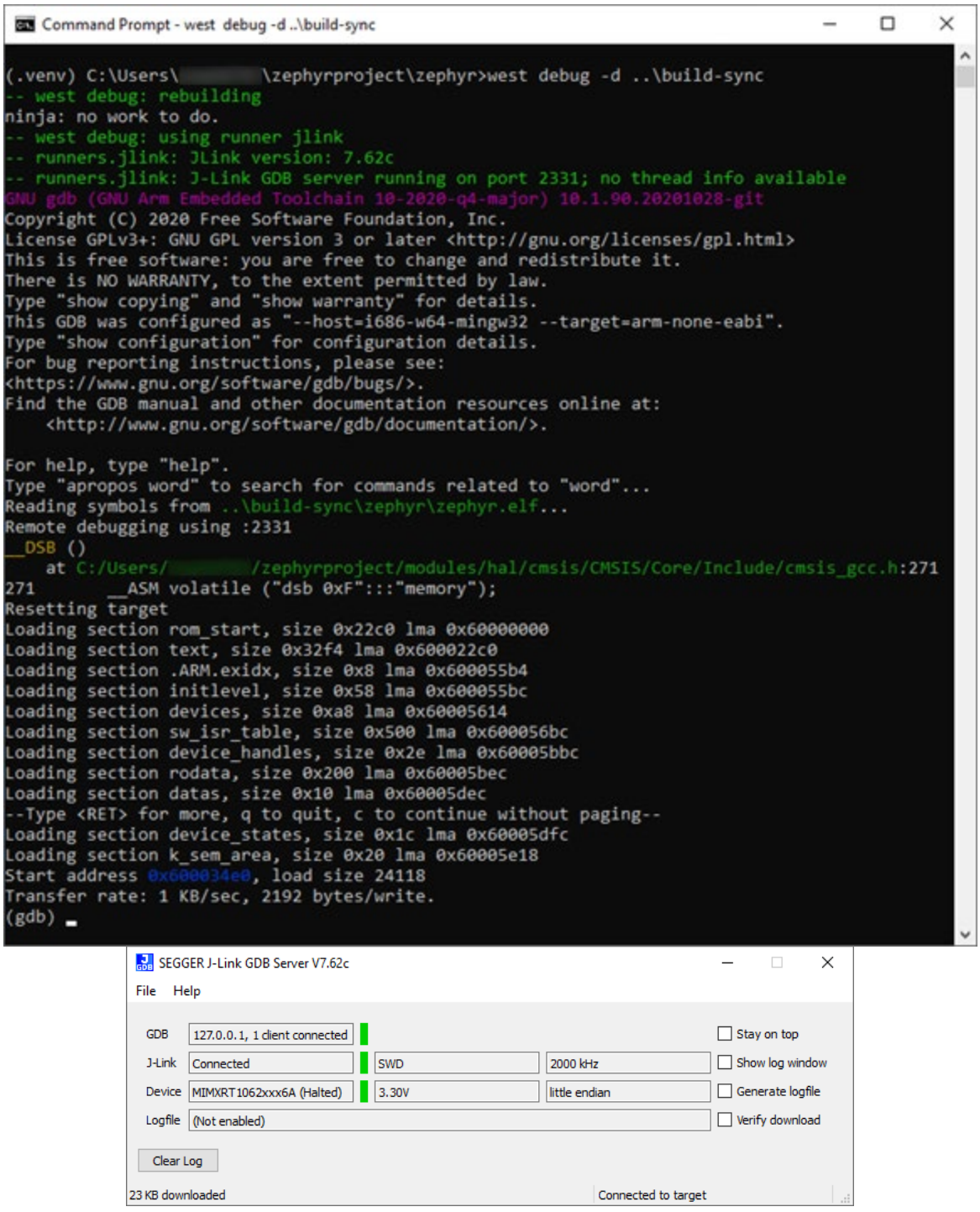
Debugging an application with GDB

In this section, we will walk through using GDB command line to connect to your target, set breakpoints, and perform a stack backtrace.

6. Build the synchronization example using west:
   west build -b mimxrt1060_evk -d ..\build-sync samples\synchronization --pristine

7. Debug the application:
   west debug -d ..\build-sync

8. You should see the J-Link GDB Server pop up



9. Reset the device
   monitor reset

10. Open the source file **%userprofile%/zephyrproject/zephyr/samples/synchronization/src/main.c**. If you don't have a preferred editor, you can use Notepad++ to view the code with line numbers. We will set a breakpoint in the next step in helloLoop() at the highlighted line 50 below.

```
void helloLoop(const char *my_name,
               struct k_sem *my_sem, struct k_sem *other_sem)
{
        const char *tname;
        uint8_t cpu;
        struct k_thread *current_thread;

        while (1) {
                /* take my semaphore */
                k_sem_take(my_sem, K_FOREVER);

                current_thread = k_current_get();
                tname = k_thread_name_get(current_thread);
#if CONFIG_SMP
                cpu = arch_curr_cpu()->id;
#else
                cpu = 0;
#endif
                /* say "hello" */
                if (tname == NULL) {
                        printk("%s: Hello World from cpu %d on %s!\n",
                                my_name, cpu, CONFIG_BOARD);
                } else {
                        printk("%s: Hello World from cpu %d on %s!\n",
                                tname, cpu, CONFIG_BOARD);
                }

                /* wait a while, then let other thread have a turn */
                k_busy_wait(100000);
                k_msleep(SLEEPTIME);
                k_sem_give(other_sem);
        }
}
```

11. Set a breakpoint in application. We will place the breakpoint at the highlighted line above:
    break main.c:50

```
(gdb) break main.c:50
Breakpoint 1 at 0x600025ea: file C:/Users/        /zephyrproject/zephyr/samples/synchronization/src/main.c, line 50.
```

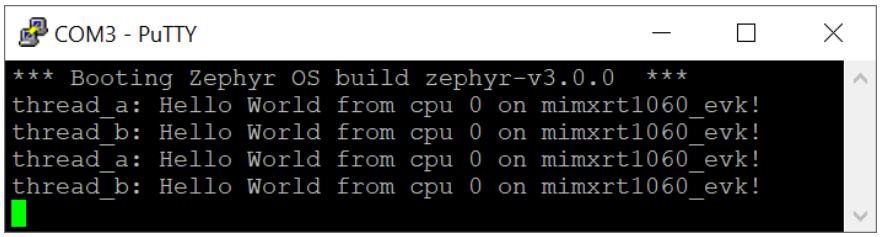
12. Continue your app. This will halt at your breakpoint.
    c

13. Continue a few more times. You will repeatedly halt at this breakpoint in the loop. Notice the thread calling this loop toggles between threadA and threadB. And the app will print a line to the terminal with each run through the loop
    c <repeat a few times>

```
Breakpoint 1, helloLoop (my_name=my_name@entry=0x60005d55 <__func__.0> "threadA", my_sem=my_sem@entry=0x8000002c <threadA_sem>,
    other_sem=other_sem@entry=0x8000003c <threadB_sem>) at C:/Users/        'zephyrproject/zephyr/samples/synchronization/src/main.c:50
50                      tname = k_thread_name_get(current_thread);
(gdb) c
Continuing.

Breakpoint 1, helloLoop (my_name=my_name@entry=0x60005d5d <__func__.1> "threadB", my_sem=my_sem@entry=0x8000003c <threadB_sem>,
    other_sem=other_sem@entry=0x8000002c <threadA_sem>) at C:/Users/        /zephyrproject/zephyr/samples/synchronization/src/main.c:50
50                      tname = k_thread_name_get(current_thread);
(gdb) c
Continuing.

Breakpoint 1, helloLoop (my_name=my_name@entry=0x60005d55 <__func__.0> "threadA", my_sem=my_sem@entry=0x8000002c <threadA_sem>,
    other_sem=other_sem@entry=0x8000003c <threadB_sem>) at C:/Users/        /zephyrproject/zephyr/samples/synchronization/src/main.c:50
50                      tname = k_thread_name_get(current_thread);
(gdb)
```



14. Display some local variables while debugging
    display current_thread
    display tname
    c <two times>

```
Breakpoint 1, helloLoop (my_name=my_name@entry=0x60005d5d <__func__.1> "threadB", my_sem=my_sem@entry=0x8000003c <threadB_sem>,
    other_sem=other_sem@entry=0x8000002c <threadA_sem>) at C:/Users/        /zephyrproject/zephyr/samples/synchronization/src/main.c:50
50                      tname = k_thread_name_get(current_thread);
1: current_thread = (struct k_thread *) 0x800000f8 <threadB_data>
2: tname = <optimized out>
(gdb) c
Continuing.

Breakpoint 1, helloLoop (my_name=my_name@entry=0x60005d55 <__func__.0> "threadA", my_sem=my_sem@entry=0x8000002c <threadA_sem>,
    other_sem=other_sem@entry=0x8000003c <threadB_sem>) at C:/Users/        /zephyrproject/zephyr/samples/synchronization/src/main.c:50
50                      tname = k_thread_name_get(current_thread);
1: current_thread = (struct k_thread *) 0x80000050 <threadA_data>
2: tname = <optimized out>
```

15. Step into the next line
    s (for step)

16. Step over a line
    n (for next)

17. Perform a stack backtrace to see the history of the stack:
    bt

18. Show the breakpoints:
    info breakpoints

```
(gdb) info breakpoints
Num     Type           Disp Enb Address    What
1       breakpoint     keep y   0x600025ea in helloLoop at C:/Users/        /zephyrproject/zephyr/samples/synchronization/src/main.c:50
```

19. Delete your breakpoint
    delete 1

20. Let the app run with no breakpoints, and see the app print to the terminal
    c

21. Halt the app
    Ctrl+c

22. Quit GDB with the command below.
    quit
    y

This completes this lab.

Additional resources:

To learn more about GDB debugging, see this presentation about Linaro:

https://connect.linaro.org/resources/lvc21/lvc21-308/

Revision History

Rev	Date	Details
1.0	5/29/2022	Initial version