This section describes the procedure for generating a core dump and analyzing it to understand the possible reasons for the software crash.

# Prerequisites

## Install Talaria TWO SDK

1. Download Talaria TWO FreeRTOS SDK from the InnoPhase portal: <https://innophaseiot.com/portal/portal-hub/>
2. Unzip the SDK in an appropriate location as per requirement.

## Required Software

1. PC with Ubuntu 20.04 (or higher).
2. GNU GDB v.10.1 (or higher).

**Note**: For details regarding Linux set-up, refer the following document: UG\_Environment\_Setup\_for\_Linux.pdf.

# Talaria TWO Software Crash

When the application on Talaria TWO crashes, a coredump file can be generated. Coredump captures the working memory of the application and firmware and generates a coredump file that is used for analyzing the cause of the crash.

Following method is used to collect the coredump:

Assuming Talaria TWO has already crashed for a particular reason and is currently in a crashed state, open a new terminal window in Linux and execute the commands mentioned in the following section to collect core dump.

## Generate Coredump from within GDB

1. Execute the following command in VM UBUNTU Linux shell

|  |
| --- |
| echo "set auto-load safe-path /" > ~/.gdbinit |

1. Change directory to conf folder in SDK

|  |
| --- |
| cd ~/sdks/sdk\_x.y |

1. Execute the following command from the same shell as mentioned in step 2

|  |
| --- |
| openocd -s ./conf -f ftdi.cfg -f t2.cfg |

1. Let the openocd run in the current shell and open a new Linux shell to execute the following. The output of the openocd execution is shown in Figure 1.

Text

Description automatically generated

Figure : Terminal output

1. Execute the following command from apps folder

**Note**: The default elf given with the SDK package under bin will be a stripped one and this cannot be used for coredump analysis. Hence, do a make for the application which needs to be tested and use the elf from the out folder.

|  |
| --- |
| gdb-multiarch ./my\_test.elf |

1. gdb session will start now and execute the command ocd in GDB session.

|  |
| --- |
| (gdb) ocd |

1. Collect the core dump using the following command:

|  |
| --- |
| (gdb) coredump coredump\_any\_filename.bin |

1. Core dump is collected in coredump\_any\_filename.bin.
2. Core dump file can be opened using xxd editor to check the content\ from the Linux shell.

|  |
| --- |
| xxd coredump\_any\_filename.bin |

Output for the sample elf is as shown in Figure 2.

Text

Description automatically generated

Figure : Opening the coredump file

# Analyzing the Coredump

The coredump analysis will be done after capturing the coredump file to identify the section of the code that caused the crash. The following procedure describes the core dump analysis.

1. Start GDB server with the coredump file from the SDK directory:

|  |
| --- |
| ./script/gdbremote.py --core coredump.bin |

and the GDB will start listening on port 3333.



Figure : GDB listening on port 3333

1. Start GDB to inspect the coredump in a separate terminal from the SDK directory:

|  |
| --- |
| gdb-multiarch apps/my-program.elf |

and the GDB prompt is observed.

1. In the GDB prompt execute the following command:

|  |
| --- |
| (gdb) target remote localhost:3333 |

The following output is observed once the remote debugging has started.

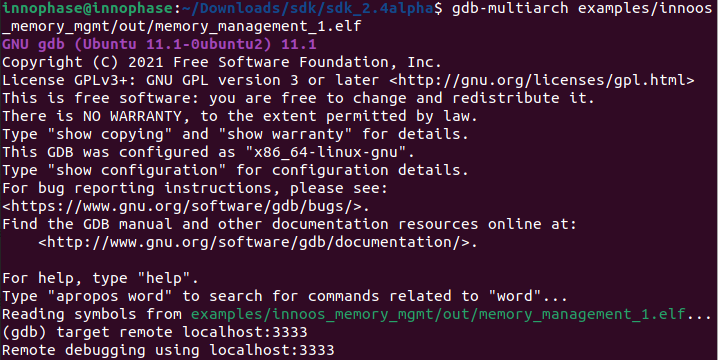


Figure : Remote debugging

## Capturing a Back Trace

Backtrace shows the point of crash which helps identify the problem. It shows the contents of the stack. In this section, the analysis of the coredump is done for two applications that has crashed for different reasons.

**Sample application-1:**

1. Execute the following instruction:

|  |
| --- |
| (gdb) bt |

The bt instructions prints the content of the stack.

Text

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Figure : Contents of the stack

1. Execute the instruction list\_thread to display the address of the thread and the last thread executed prior to the crash. In the sample app sensor.elf, a thread with the name app is executed prior to the crash. The thread app is indicated with \* mark as shown in Figure 6 when the list\_thread instruction is executed.

Text

Description automatically generated with medium confidence

Figure : app - list\_thread instruction

1. The address of the app thread of the sensor application as shown in Figure 6 is 0xb9738. Now, resolve thread <address of the thread> instruction is executed to point to the location of the instruction in the code that was executed just before the crash.

Text

Description automatically generated

Figure : Resolve thread instruction

1. Last instruction executed was from the file sensor/main.c at line number 525. An assert function was called to crash the application at this point.

This helps identify the problem by pointing to the last instruction executed prior to the crash that could be the reason for the crash.

**Sample application 2:**

1. The coredump for the sample application 2 is captured using the same procedure described in section: *Generate Coredump from within GDB*.
2. The output of list\_threads instruction for the sample application 2 displays the following:

Shape, rectangle

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Figure : list\_threads output

1. The last thread executed just before the crash is wifi as shown in Figure 8. However, when the restore\_thread command is executed, the following output is observed:



Figure : restore\_thread output

Looking back at the crash log captured in the download tool’s console, The PC and BFAR values shows that address 0x60dbc (callback from the app) tries to access address 0xc0073 (outside RAM area). This is done in an interrupt context and is the reason why the list\_threads do not provide the right information running in process context.

Table

Description automatically generated

Figure : Download tool - crash log

1. When the restore\_thread is executed for a different thread – mqttcli, the following output is observed:

Text

Description automatically generated

Figure : restore\_thread for - mqttcli

It is observed that there is no message Thread stack does not seem to have a pushed exception frame when the restore\_thread command is executed. This is checked on the mqttcli thread as this thread is receiving the data from a callouts handler that is executing in the interrupt context. After checking the mqttcli thread, it is observed that the reason for the crash is because a pointer is accessed and freed with out allocating any memory for it.