**COMPILATION ON DIFFERENT TARGETS**

Document outlining the compilation steps on different targets (x86 Ubuntu, Raspberry Pi, and BeagleBone), follow these general steps:

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# **Build steps for X86**

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Run the **make** command to compile your code:

$ make

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# **Build steps for BBB**

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## **Step 1: Environment Variables Setup**

1. **Set the ARCH and CROSS\_COMPILE** **environment Variables**

$ export ARCH=arm

$ export CROSS\_COMPILE=arm-linux-gnueabihf-

1. **Set the PATH to the Cross-Toolchain:**

$ export PATH=${HOME}/ela\_lab\_exercises/bbb\_build/toolchain/gcc-linaro-7.5.0-2019.12-x86\_64\_arm-linux-gnueabihf/bin/:$PATH

## **Step 2: Compilation**

$ make

## **Step 3:** **Transfer Binary file to target**

$ scp <binary\_file> <username>@<ip\_address>:<destination\_directory>

**Example:** $scp Thread\_Attributes [root@10.10.3.233:/User\_Programs](mailto:root@10.10.3.233:/User_Programs)

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# **Build steps for Raspberry Pi 4B**

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## **Step 1: Environment Variables Setup**

1. **Set the ARCH and CROSS\_COMPILE environment Variables**

$ export ARCH=arm64

$ export CROSS\_COMPILE=aarch64-linux-gnu-

1. **Set the PATH to the Cross-Toolchain**

$ export PATH=${HOME}/ela\_lab\_exercises\_rpi/rpi\_build/toolchain/gcc-linaro-7.5.0-2019.12-x86\_64\_aarch64-linux-gnu/bin/:$PATH

## **Step 2: Compilation**

$ make

## **Step 3: Transfer Binary file to target**

$ scp <binary\_file> <username>@<ip\_address>:<destination\_directory>

**Example:** $scp Thread\_Attributes [root@10.10.1.27:/User\_Programs](mailto:root@10.10.1.27:/User_Programs)

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**Running on Platform (x86, Raspberry Pi, BBB)**

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$ ./filename

* The overall output will be as given below:



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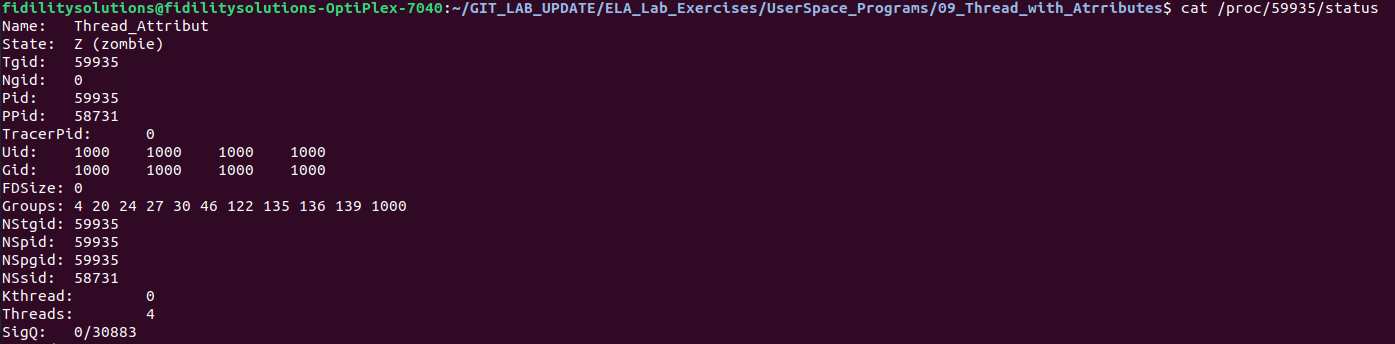
# **Understanding Processes Using /proc Interface**

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## **Using /proc Interface**

* Identify the Process ID -> 59935
* cat /proc/$pid/status

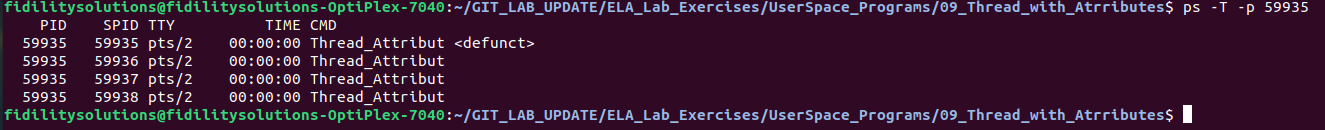
$ cat /proc/59935/status



## **Using top Command**

* To displays thread information for a specific process ID **-> ps -T -p <TID>**

$ ps -T -p 59935

* + The image shows four Threads are running under process. Replacing `<TID>` with the actual process ID (59935) to retrieve relevant thread information. This command helps in monitoring and managing threads within a process efficiently.

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# **Understanding Of Program Sequence**

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Here are the step-by-step explanations of thread attribute program.

1. **Initialization of Thread Attributes:** The program starts by initializing pthread attributes using **pthread\_attr\_init().** This initializes a pthread attribute object which is used to specify various attributes for threads.
2. **Setting Thread Attributes** : It sets the stack size for the threads using **pthread\_attr\_setstacksize()** to 1MB. This customizes the stack size for the threads.
3. **Setting Detached State** : The program sets the detached state of the threads using **pthread\_attr\_setdetachstate().** Detached threads are those that operate independently and their resources are automatically released when they terminate without needing to be explicitly joined.
4. **Creating Thread Arguments:** It creates arguments for each thread, including a thread number, message, and message size.
5. **Creating Threads:** Using a loop, the program creates multiple threads (NUM\_THREADS) with the specified attributes and passes the thread arguments to each thread.
6. **Thread Function Execution:** Each thread executes the **threadfunction(**) function, which prints information about the thread attributes and performs specific actions based on the thread number.
7. **Exiting Main Thread:** The main thread exits without waiting for the detached threads to complete. This is because detached threads operate independently and do not need to be joined explicitly.
8. **Thread Attributes Destruction:** Finally, the program demonstrates how to destroy thread attributes using **pthread\_attr\_destroy()** without affecting the threads themselves.

Overall, the program is to illustrate the creation and execution of detached threads with custom thread attributes, including stack size and detached state, and to show how the main thread can exit without waiting for the detached threads to finish their execution.