3. Library Setup

3. 1. CPP Linux

3. 1. 1. Compiler and Builder

3. 1. 1. 1. Compiler

- GNU gcc ver. 5.4.0 20160609 or higher
- To check the version of your gcc compiler:

```
$ gcc -v
```

- Download the required compiler:

```
$ sudo apt-get install gcc-5
```

3. 1. 1. 2. Builder

- Build-essential pkg → make
- Download:

```
$ sudo apt-get install build-essential
```

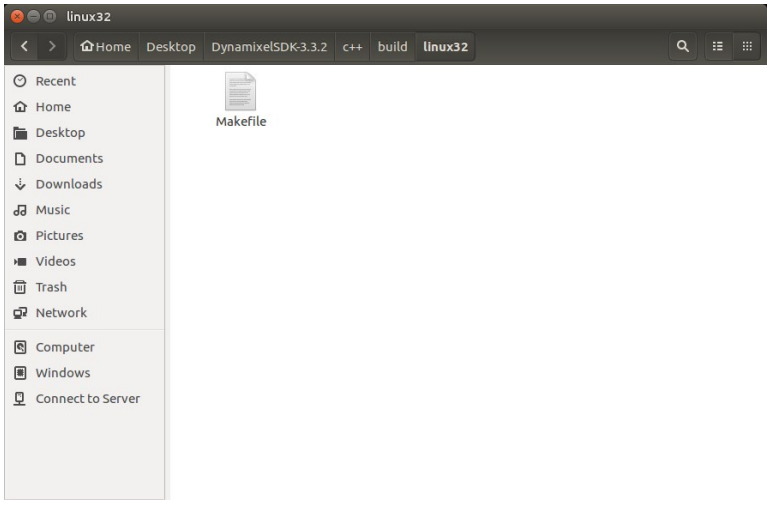
3. 1. 1. 3. Dependent Packages

- Packages needed for cross-compiling
- Download:

```
$ sudo apt-get install gcc-multilib g++-multilib
```

3. 1. 1. 4. Build the Library

- Choose which format (32bit or 64bit) do you want to build in. The Makefile is located in the following folder: `[DynamixelSDK folder]/cpp/build/linux32` OR `[DynamixelSDK folder]/cpp/build/linux64` folder for 64-bit platforms OR `[DynamixelSDK folder]/cpp/build/linux_sbc` folder for SBCs.
  Please note that if you will be building the 32-bit example source, you should build the 32-bit library.



- Go to the Makefile's directory located in `[DynamixelSDK folder]/cpp/build/linux32` OR `[DynamixelSDK folder]/cpp/build/linux64` OR `[DynamixelSDK folder]/cpp/build/linux_sbc` using $ `cd`.
- To build the library file:

```
$ make
```

```
leon@leon: ~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32
leon@leon:~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32$ make
mkdir -p ./.objects/
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/group_bulk_read.cpp -o .objects/group_bulk_read.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/group_bulk_write.cpp -o .objects/group_bulk_write.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/group_sync_read.cpp -o .objects/group_sync_read.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/group_sync_write.cpp -o .objects/group_sync_write.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/packet_handler.cpp -o .objects/packet_handler.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/port_handler.cpp -o .objects/port_handler.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/protocol1_packet_handler.cpp -o .objects/protocol1_packet_ha
ndler.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/protocol2_packet_handler.cpp -o .objects/protocol2_packet_ha
ndler.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk_linux/port_handler_linux.cpp -o .objects/port_handler_linux.
o
g++ -shared -fPIC -m32 -o ./libdxl_x86_cpp.so ./.objects/group_bulk_read.o ./.ob
jects/group_bulk_write.o ./.objects/group_sync_read.o ./.objects/group_sync_writ
e.o ./.objects/packet_handler.o ./.objects/port_handler.o ./.objects/protocol1_p
acket_handler.o ./.objects/protocol2_packet_handler.o ./.objects/port_handler_li
nux.o -lrt
```

- If there is an error:

```
$ make clean && make
```

- To delete the library file and object files:

```
$ make clean
```

```
leon@leon: ~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32
leon@leon:~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32$ make clean
rm -f ./.objects/group_bulk_read.o ./.objects/group_bulk_write.o ./.objects/grou
p_sync_read.o ./.objects/group_sync_write.o ./.objects/packet_handler.o ./.objec
ts/port_handler.o ./.objects/protocol1_packet_handler.o ./.objects/protocol2_pac
ket_handler.o ./.objects/port_handler_linux.o ./libdxl_x86_cpp.so
```

Copy (Install) the Library to the Root Directory

- To make library file and copy it to the root directory (to handle the serial port):

```
$ sudo make install
```

```
leon@leon: ~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32
leon@leon:~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32$ sudo make install
mkdir -p ./.objects/
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/group_bulk_read.cpp -o .objects/group_bulk_read.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/group_bulk_write.cpp -o .objects/group_bulk_write.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/group_sync_read.cpp -o .objects/group_sync_read.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/group_sync_write.cpp -o .objects/group_sync_write.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/packet_handler.cpp -o .objects/packet_handler.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/port_handler.cpp -o .objects/port_handler.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/protocol1_packet_handler.cpp -o .objects/protocol1_packet_ha
ndler.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk/protocol2_packet_handler.cpp -o .objects/protocol2_packet_ha
ndler.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -c -I../../include -m32 -fPIC -g -c ../.
./src/dynamixel_sdk_linux/port_handler_linux.cpp -o .objects/port_handler_linux.
o
g++ -shared -fPIC -m32 -o ./libdxl_x86_cpp.so ./.objects/group_bulk_read.o ./.ob
jects/group_bulk_write.o ./.objects/group_sync_read.o ./.objects/group_sync_writ
e.o ./.objects/packet_handler.o ./.objects/port_handler.o ./.objects/protocol1_p
acket_handler.o ./.objects/protocol2_packet_handler.o ./.objects/port_handler_li
nux.o -lrt
cp "./libdxl_x86_cpp.so" "/usr/local/lib/libdxl_x86_cpp.so"
ln -s "/usr/local/lib/libdxl_x86_cpp.so" "/usr/local/lib/libdxl_x86_cpp.so.2"
ln -s "/usr/local/lib/libdxl_x86_cpp.so" "/usr/local/lib/libdxl_x86_cpp.so.2.0"
ln -s "/usr/local/lib/libdxl_x86_cpp.so" "/usr/local/lib/libdxl_x86_cpp.so.2.0.0
"
cp -r ../../include/* /usr/local/include/
ldconfig
```

- If there is an error:

```
$ sudo make uninstall && sudo make install
```

OR

```
$ sudo make reinstall
```

- To delete the library file from the root directory:

```
$ sudo make uninstall
```

```
leon@leon: ~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32
leon@leon:~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32$ sudo make reinstall
rm /usr/local/lib/libdxl_x86_cpp.so
rm /usr/local/lib/libdxl_x86_cpp.so.2
rm /usr/local/lib/libdxl_x86_cpp.so.2.0
rm /usr/local/lib/libdxl_x86_cpp.so.2.0.0
rm /usr/local/include/dynamixel_sdk.h
rm -rf /usr/local/include/dynamixel_sdk*
mkdir -p ./.objects/
g++ -shared -fPIC -m32 -o ./libdxl_x86_cpp.so ./.objects/group_bulk_read.o ./.ob
jects/group_bulk_write.o ./.objects/group_sync_read.o ./.objects/group_sync_writ
e.o ./.objects/packet_handler.o ./.objects/port_handler.o ./.objects/protocol1_p
acket_handler.o ./.objects/protocol2_packet_handler.o ./.objects/port_handler_li
nux.o -lrt
cp "./libdxl_x86_cpp.so" "/usr/local/lib/libdxl_x86_cpp.so"
ln -s "/usr/local/lib/libdxl_x86_cpp.so" "/usr/local/lib/libdxl_x86_cpp.so.2"
ln -s "/usr/local/lib/libdxl_x86_cpp.so" "/usr/local/lib/libdxl_x86_cpp.so.2.0"
ln -s "/usr/local/lib/libdxl_x86_cpp.so" "/usr/local/lib/libdxl_x86_cpp.so.2.0.0
"
cp -r ../../include/* /usr/local/include/
ldconfig
```

- To recopy the library file to the root directory:

```
$ sudo make reinstall
```

```
leon@leon: ~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32
leon@leon:~/Desktop/DynamixelSDK-3.3.2/c++/build/linux32$ sudo make uninstall
rm /usr/local/lib/libdxl_x86_cpp.so
rm /usr/local/lib/libdxl_x86_cpp.so.2
rm /usr/local/lib/libdxl_x86_cpp.so.2.0
rm /usr/local/lib/libdxl_x86_cpp.so.2.0.0
rm /usr/local/include/dynamixel_sdk.h
rm -rf /usr/local/include/dynamixel_sdk*
```

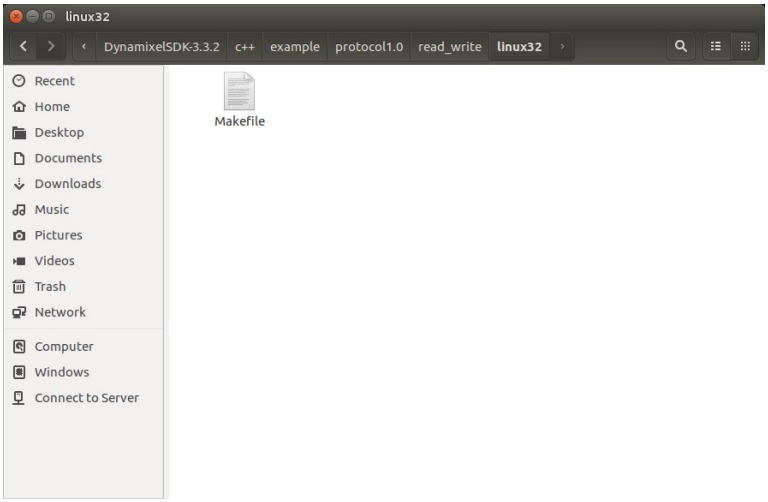
- You will see the built library file in `[DynamixelSDK folder]/c/build/[linuxXX]/libdxl_xYY_cpp.so`

3. 1. 2. Building and Running the Sample Code

The Dynamixel SDK sample code for CPP uses the library files(.so for Linux) built in CPP language.

You should build library files in `[DynamixelSDK folder]/c++/build/[linuxXX]/libdxl_xYY_cpp.so` with its own source code as shown above.

- Choose which format (32bit or 64bit) do you want to build in. The Makefile file for building source is in `[DynamixelSDK folder]/c++/example/protocol1.0/read_write/linux32` or `[DynamixelSDK folder]/c++/example/protocol1.0/read_write/linux64` folder. If you want to build example source in 32bit, for instance, you should build this library in 32bit as well.



- On the terminal, go to the Makefile located folder `/c++/example/protocol1.0/read_write/linux32`, for example, using `cd`.
- To build executable file, type:

[Terminal] $ `make`

```
leon@leon: ~/Desktop/DynamixelSDK-3.3.2/c++/example/protocol1.0/read_write/linux32
```

```
mkdir -p .objects/
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -I../../../include -m32 -g -c ../read_write.cpp -o .objects/read_write.o
g++ -O2 -O3 -DLINUX -D_GNU_SOURCE -Wall -I../../../include -m32 -g  .objects/read_write.o -o read_write -ldxl_x86_
cpp -lrt
```

If it shows some error, try `make clean` and `make` it again.

- To delete executable file, type:

[Terminal] $ `make clean`

```
leon@leon: ~/Desktop/DynamixelSDK-3.3.2/c++/example/protocol1.0/read_write/linux32
leon@leon:~/Desktop/DynamixelSDK-3.3.2/c++/example/protocol1.0/read_write/linux32$ make clean
rm -rf read_write .objects core *~ *.a *.so *.lo
```

- Make the port available to be used

[Terminal] $ `sudo chmod a+rw /dev/ttyUSB0`

```
leon@leon: ~/Desktop/DynamixelSDK-3.3.2/c++/example/protocol1.0/read_write/linux32
leon@leon:~/Desktop/DynamixelSDK-3.3.2/c++/example/protocol1.0/read_write/linux32$ sudo chmod a+rw /dev/ttyUSB0
```

- Run the source code

[Terminal] $ `./read_write`

```
leon@leon: ~/Desktop/DynamixelSDK-3.3.2/c++/example/protocol1.0/read_write/linux32
leon@leon:~/Desktop/DynamixelSDK-3.3.2/c++/example/protocol1.0/read_write/linux32$ ./read_write
Succeeded to open the port!
Succeeded to change the baudrate!
Dynamixel has been successfully connected
Press any key to continue! (or press ESC to quit!)
[ID:001] GoalPos:100  PresPos:099
Press any key to continue! (or press ESC to quit!)
[ID:001] GoalPos:4000  PresPos:099
[ID:001] GoalPos:4000  PresPos:100
[ID:001] GoalPos:4000  PresPos:100
[ID:001] GoalPos:4000  PresPos:103
[ID:001] GoalPos:4000  PresPos:105
[ID:001] GoalPos:4000  PresPos:107
[ID:001] GoalPos:4000  PresPos:110
[ID:001] GoalPos:4000  PresPos:114
[ID:001] GoalPos:4000  PresPos:117
[ID:001] GoalPos:4000  PresPos:119
[ID:001] GoalPos:4000  PresPos:125
[ID:001] GoalPos:4000  PresPos:131
[ID:001] GoalPos:4000  PresPos:135
[ID:001] GoalPos:4000  PresPos:138
[ID:001] GoalPos:4000  PresPos:141
[ID:001] GoalPos:4000  PresPos:144
[ID:001] GoalPos:4000  PresPos:148
[ID:001] GoalPos:4000  PresPos:152
[ID:001] GoalPos:4000  PresPos:155
[ID:001] GoalPos:4000  PresPos:158
[ID:001] GoalPos:4000  PresPos:162
[ID:001] GoalPos:4000  PresPos:165
[ID:001] GoalPos:4000  PresPos:169
[ID:001] GoalPos:4000  PresPos:172
[ID:001] GoalPos:4000  PresPos:175
[ID:001] GoalPos:4000  PresPos:179
[ID:001] GoalPos:4000  PresPos:183
[ID:001] GoalPos:4000  PresPos:187
[ID:001] GoalPos:4000  PresPos:190
[ID:001] GoalPos:4000  PresPos:198
[ID:001] GoalPos:4000  PresPos:201
[ID:001] GoalPos:4000  PresPos:204
[ID:001] GoalPos:4000  PresPos:208
[ID:001] GoalPos:4000  PresPos:211
[ID:001] GoalPos:4000  PresPos:215
[ID:001] GoalPos:4000  PresPos:218
[ID:001] GoalPos:4000  PresPos:223
[ID:001] GoalPos:4000  PresPos:226
```