

Synthesis Tutorial

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1 Objective

The goal of this tutorial is to explain how to build a bitstream and download the bitstream to the FPGA via the FPGA-Session tool. It is assumed you have built a base system and added an application. If not, refer back to the respective tutorial.

2 Generating A System Tutorial

Now we will use the tool to start to generate the hardware and software parts of our system.

Hardware The normal flow for hardware generation is synthesis to a netlist, mapping, place-and-route, and then bitstream generation. This is accomplished with two commands in XPS. Under the Hardware menu at the top of XPS select the “Generate Netlist” option. Generating the netlist will do several things. First, the top-level synthesis files, necessary wrappers, and signals needed build the system shown in the system information window are generated. Next, these and any peripheral cores are synthesized. Depending on the complexity of the base system (if you have a lot of IP Cores) this may take anywhere from 5 minutes to hours!

After the Netlist is successfully generated, click on the Hardware menu and select the “Generate Bitstream” option. Again, depending on the complexity this could take minutes to hours. If there are no errors a bitstream (.bit) will be created in the `implementation` subdirectory created by XPS.

Software To compile this program locate the “Generate Libraries and Drivers” option under the Software Menu. This compiles software libraries and peripheral device drivers needed for this application. Then you must build the application which is also under the Software Menu. Alternatively, you could select the **Applications** tab, right click on your application and select **Build Project**. The final executable will be located in the Application’s subfolder (for example HelloWorld/executable.elf).

Now we need to combine the hardware and software. Since our main memory is in BRAMs, we modify the bitstream (`helloworld.bit`) so that when the FPGA is configured, the BRAM’s initial contents is our application (*executable.elf*). This is called BRAM Initialization (in **Device Configuration** menu select **Update Bitstream**); XPS will create a new bitstream in the implementation directory called `download.bit`.

At this point, one could power-on an ML-310 board and use a JTAG programmer to configure the FPGA with the `download.bit` file. However, we will use a spare slot (7) on the compact flash so that we can configure over the Internet.

3 Creating an ACE File

To use the compact flash, we need to create an ACE file. This is done with the `xmd` command in a terminal window (not through XPS).

- From the project directory, go the implementation directory:

```
cd implementation
```

- Run `xmd` with a `genace` script:

```
xmd -tcl $XILINX_EDK/data/xmd/genace.tcl -jprog \  
-hw download.bit -ace lab01.ace -board ml310
```

The message

SystemACE file 'lab01.ace' created successfully.

indicates that you have built a base system.