Lab 03: Wiring switches to LEDs

In this lab, we will create our first VHDL design, connecting the switches to the LEDs on the Basys3 board

Lab Goals

- Create a simple VHDL design

The Design

Port	Direction	Width
SW0	IN	1
SW1	IN	1
SW2	IN	1
SW3	IN	1
LED0	OUT	1
LED1	OUT	1
LED2	OUT	1
LED3	OUT	1

Each of the switches on the board should be connected to the corresponding LED.

Exercise 1: Simple Connection

1. Go to `~/labs/lab03` and start Vivado
2. Create a new Vivado project, called `switches_to_leds` (RTL Project)
3. In the `Add Sources` window, click on `Add Files` and import `~/labs/lab03/src/switches_to_leds.vhd`.
4. In the `Add Constraints` window, click on `Add Files` and import `~/labs/lab03/src/Basys3.xdc`
5. In the `Default Part` select the `Basys3` from the Boards tab.
6. Click on Finish
7. Modify the file, following the comments inside it
8. Once you module is ready, click on `Generate Bitstream` to launch the workflow.
9. If everything goes well, you can now open the Hardware Manager, and load the bitstream to the board.
10. Move the switches, and check that the LEDs go on/off.

Exercise 2. Using vectors

1. Modify the VHDL entity, to use two `std_logic_vector`, `SW` and `LED` of length 4, instead of the individual `std_logic` ports.

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2. Modify the assignment in the architecture accordingly.

3. Click on Add Sources -> Add or create constraints

4. Remove `Basys3.xdc` by selecting it and clicking on the minus button.

5. Click on `Add Files` and import `~/labs/lab03/src/Basys3-vectors.xdc`

   1. In a new terminal, you can have a look at the two files to understand the differences. What changes?

6. Click on Finish

7. Regenerate the bistream and test it on the board

Optional exercise

Extend your design to use all the 16 available switches and LEDs.