SystemC XOR

MICROELECTRONIC SYSTEMS DESIGN RESEARCH GROUP

FPGAHS Lab - SystemC XOR
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Goals

- Get started with SystemC.
- Understand modules, ports, constructors, port mappings, and the basic setup of a SystemC file.
- Run a SystemC binary and see the output.
- Implement an untimed 2-input NAND module in a pre-defined SystemC module.
- Build a new SystemC module that models a 2-input XOR gate based only on 2-input NAND modules.

Setup

A template code is provided on the GitHub system in the repository:

```
xor.systemc
```

Please clone this repository to a working directory. You will find template code for this task and a Makefile there. The files contain the following:

- `nand2.h` implements the 2-input NAND model.
- `exor2.h` implements the XOR gate based on 2-input NAND modules.
- `stim.h` generates the stimuli for the test run.
- `mon.h` reads the stimuli and the output of the XOR gate and displays the results.
- `main.h` specifies the executable program that combines all modules to a complete simulation.
- `xor.systemc.pro` is a project file for QT creator. Open it with: `qtcreator xor.systemc.pro &`
- `Makefile` is a pre-defined config file for the make command that holds the settings for building this project (alternative to the QT Creator project file).

Task Description

1) In `nand2.h`, you will find a `TODO` tag where you should place your implementation of the NAND functionality. Please specify only functionally the result of the 2-input NAND there.
2) `exor2.h` is a template file for placing your 2-input XOR implementation. Please insert a new SystemC module there with Boolean inputs `A` and `B` and a Boolean output `F`. Build your XOR implementation only based on connected instances of the 2-input NAND from `nand2.h` (no additional logic!).

3) Build your project by execution `make` on the command line. If successful, run the generated binary by executing `./main`. The correct output of your simulation should be:

```
        SystemC 2.3.1-Accellera --- Dec  1 2014 20:17:56
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        ALL RIGHTS RESERVED

time    A       B       F
10 ns   0       0       0
20 ns   0       1       1
30 ns   1       0       1
40 ns   1       1       0

Info: /OSCI/SystemC: Simulation stopped by user.
```

Questions

- What is the difference between an `SC_METHOD` and an `SC_THREAD`?
- What is the purpose of the sensitivity list?
- How are SystemC modules instantiated and connected?