

Different approaches for the SystemC modeling

Valentin Olenev,
post-graduate student

A decorative graphic consisting of several horizontal lines of varying lengths and colors (teal, white, and light blue) extending from the right side of the slide towards the center.

Outline

- Two general approaches
- System of devices modeling
- Modeling per layers
- SystemC modeling
- SystemC modeling of each approach

Two basic approaches

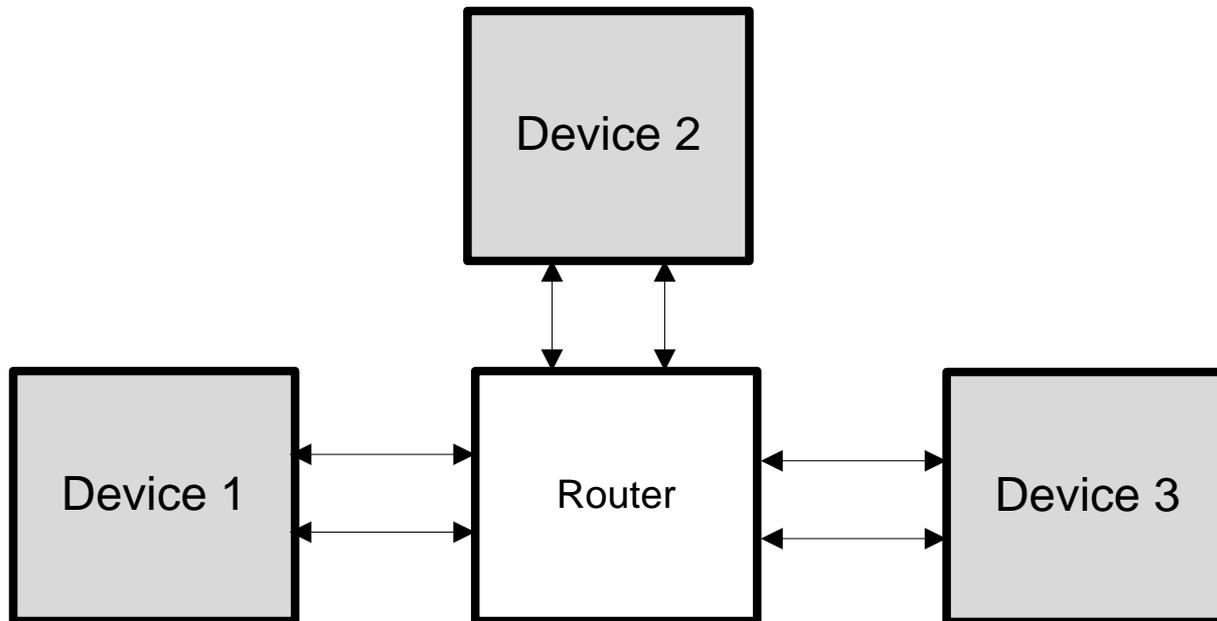
- the modeling of the protocol per layers
 - to check the presence of errors in specification
 - to check the packets generation
 - to check all internal mechanisms
- system of devices modeling
 - to check the data transmission
 - to check the routing correctness

When you choose the approach at the very beginning of the modeling it is necessary to know:

- what method is better to use
- for what purposes these methods approaches at most
- with what difficulties the developer can face

System of devices modeling

Example: if you need to simulate the communication of network devices and packets exchanging.



System of devices modeling

We can not consider:

- the protocol layers
- the interaction between protocol layers
- the forming of packets
- the working of device with applications

The real interest represents here only the mechanisms of devices communications in the network.

Modeling per layers

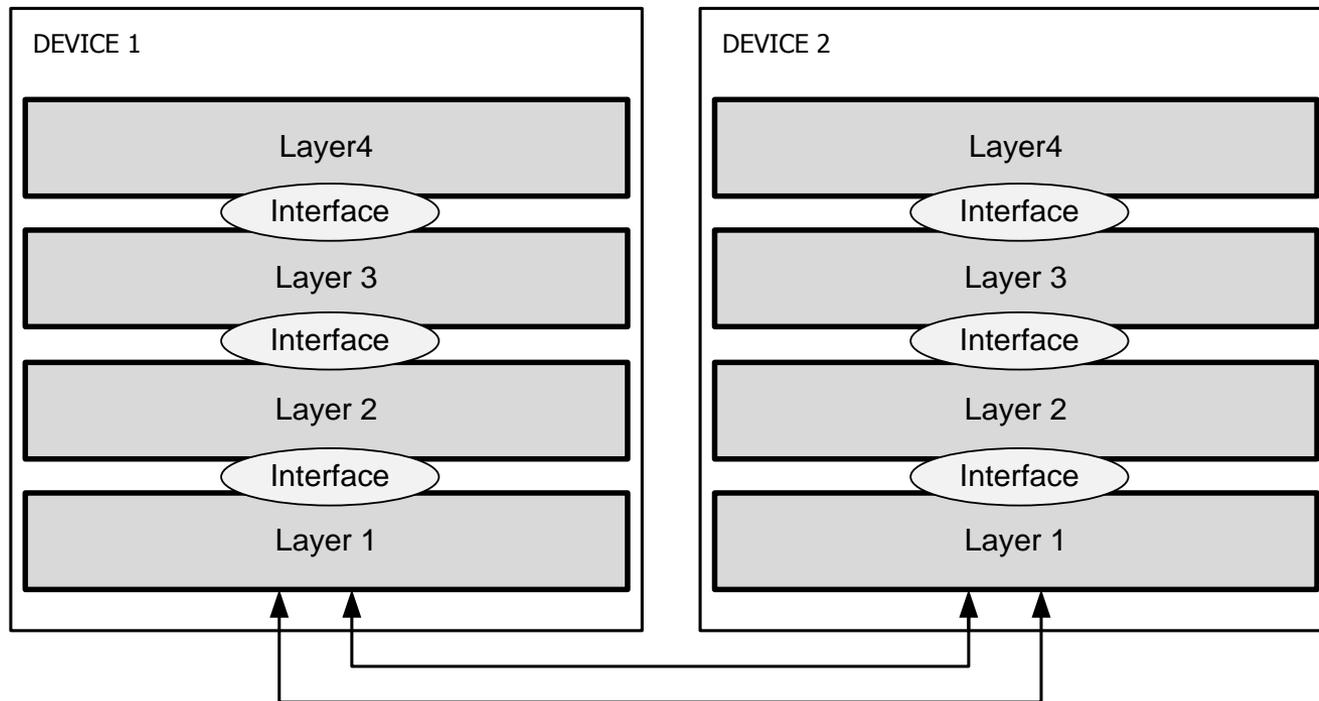
For this method the decomposition of one task into a set of simple tasks or modules is used.

Decomposition procedure includes accurate definition of functions of each module solving a separate problem, and interfaces between them.

The result is:

- a logic simplification of a problem
- a possibility of updating of these separate modules without changing of other parts of system

Modeling per layers



The set of modules breaks into the layers forming hierarchy. Every layer communicates only with directly adjoining layers.

Decomposition

Thus during the modeling of a stack of protocols it is necessary to operate as follows:

1. define the basic layers of this protocol
2. consider each layer separately
3. define its functional mission and communications with the other layers.
4. divide layers into the smaller blocks
5. start the realization from simple blocks to the difficult ones.
6. implement the interaction between them

SystemC Modeling

It is often the best approach for studying, analyzing and building complex systems such as:

- complete stack of protocols
- multi-node networks
- multi-core systems-on-chips
- networks-on-chips

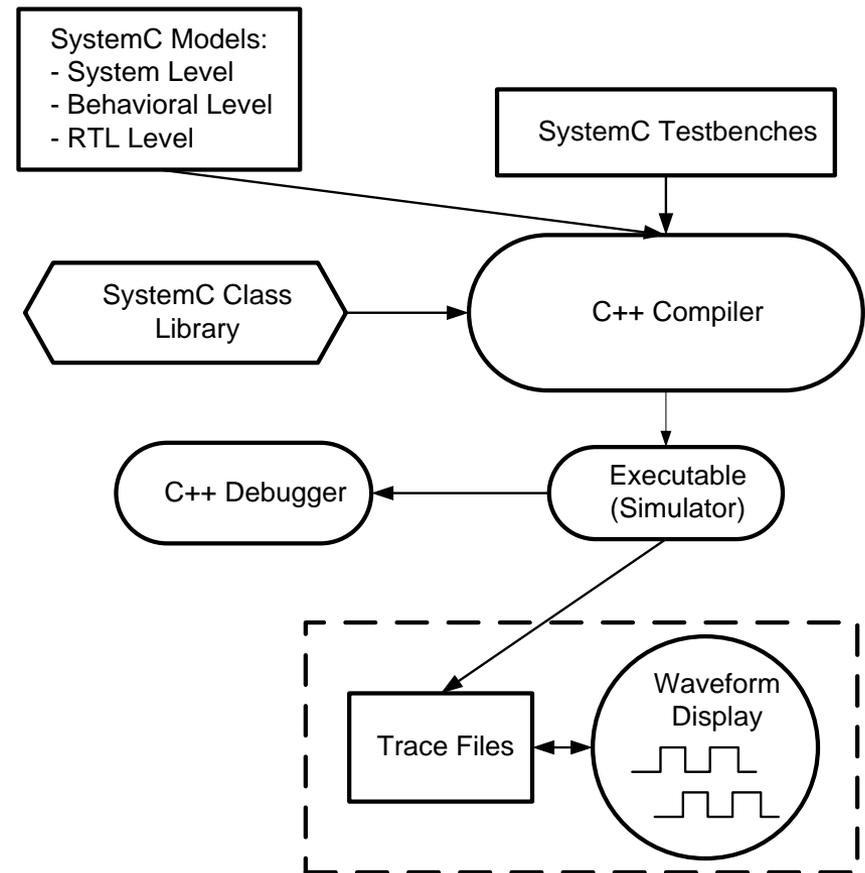
SystemC Library

In contrast to pure C++, SystemC has following additions and benefits:

- 1) Processes
 - 2) Events
 - 3) Ports and channels
 - 4) Timers and delays
 - 5) Signals
 - 6) FIFO
 - 7) Special data types
- and so on...

Simulation Methodology

- + The program development infrastructure available for C/C++ can be used also for the SystemC tasks
- + The simulation of data can be shown in the form of waveforms
- + hardware, software and test-bench parts of the design can be simulated in one unified environment



SystemC modeling of devices: Pluses and minuses

- + more clear method for the foreign user of the model
- + the network will use the homogeneous blocks:
 - It will accelerate and will facilitate process of writing of model and actually modeling itself
- doesn't give the full interaction picture
- the results can be too approximated

SystemC modeling per layers:

Minuses

- each layer is individual and carries out the different various functions
- communications between the layers can be very difficult for realization too
- This method is more difficult for realization, it is more resource-intensive
- the programmer can't experiment in realization of mechanisms as they are already clearly described in the protocols specification

SystemC modeling per layers: Pluses

- + it is perfect for the closely approached to the reality modeling
- + it is possible:
 - to see all possible delays
 - to count up all hardware and resource expenses
 - to experience all mechanisms of interaction

Distinctive features of both methods

Feature	Modeling per layer	Modeling of devices
Objects of modeling	Layers of the protocol	Devices
Appointment of the model	Checking of applied processes work inside the device	Checking of the device's working capacity during interaction with other network devices
Size of the model	The small number of devices needed (two is enough)	Large number of devices needed
Types of devices	One abstract device is modeled	Concrete realizations of devices are modeled



Thank you