

SystemCrafter SC: Technology

There are many advantages in using C++ to design hardware and systems, but until recently the language has lacked some vital constructs for describing key hardware concepts. The advent of SystemC has provided an industry standard that is widely supported and well documented.

SystemCrafter SC is a software tool that synthesizes SystemC automatically to hardware. Engineers and programmers can design, debug and simulate hardware and systems using their existing C++ development environment. Hardware and software are simulated in the same framework. Then the hardware is synthesized to RTL for implementation using a standard VHDL design flow. SystemCrafter SC also writes a structural SystemC description of the synthesized circuit for verification.

This design flow can be used for synthesizing SystemC to hardware, for co-design, or for hardware acceleration.

Compiling C++ to Hardware and Systems

For many years people have been using C or C++ as a starting point for developing their hardware and systems. This is because these languages are widely known, quick to write, and give an executable specification, which allows very fast simulation. C or C++ versions of standard algorithms are widely available, which allows easy reuse of legacy and publicly available code. For system-level design, they allow hardware and software descriptions to be described in a single framework.

However there have been two drawbacks. Firstly, C and C++ don't support the description of some important hardware concepts, such as timing and concurrency. This has led to the development of proprietary C-like languages, which haven't been popular because they tied the user to a single software supplier. Secondly, C and C++ have to be translated manually to a hardware description language, such as VHDL or Verilog, for hardware implementation. This step requires specialist resources, is time-consuming, and often introduces errors that are difficult to find.

The first of these problems was solved by the development of SystemC, which is now a widely-accepted industry standard that adds hardware concepts to C++.

The second of these problems is solved by the development of tools like SystemCrafter SC, which allows SystemC descriptions to be automatically translated to VHDL.

SystemC

SystemC provides an industry standard means of modeling and verifying hardware and systems using standard software compilers. All the material required to simulate SystemC using a standard C++ compiler, such as Microsoft Visual C++ or GNU GCC, can be downloaded free of charge from the SystemC website (www.systemc.org).

SystemC consists of a set of class libraries for C++ that describe hardware constructs and concepts. This means that you can develop cycle-accurate models of hardware, software and interfaces, which can be simulated and debugged within your existing C++ development environment.

SystemC allows the initial design, debugging and refinement to be performed using the same test benches, which eliminates translation errors, and allows fast, easy verification.

Since SystemC uses standard C++, the productivity benefits offered to software engineers for years are now available to hardware and system designers. SystemC is more compact than VHDL or Verilog and, as a result, is faster to write and more maintainable and readable. It can be compiled into a fast, executable specification.

SystemCrafter SC Design Flows

SystemC was originally developed as a system modeling and verification tool, and still required manual translation to a hardware description language to produce hardware.

SystemCrafter SC automates this process, by quickly synthesizing SystemC to RTL VHDL. It will also generate a SystemC description of the synthesized circuit, which can be used to verify the synthesized code using your existing test harness.

SystemCrafter SC gives the designer control of the critical steps of scheduling (clock cycle allocation) and allocation (hardware reuse). Thus, the results are always predictable, controllable and match the designer's expectations.

SystemCrafter SC allows you to develop, refine, debug and synthesize hardware and systems within your existing C++ compiler's development environment. You can run fast, executable SystemC specifications to verify your design. You can configure your compiler so that SystemCrafter SC is automatically run when you specify that you want to generate hardware. There is no new GUI to learn.

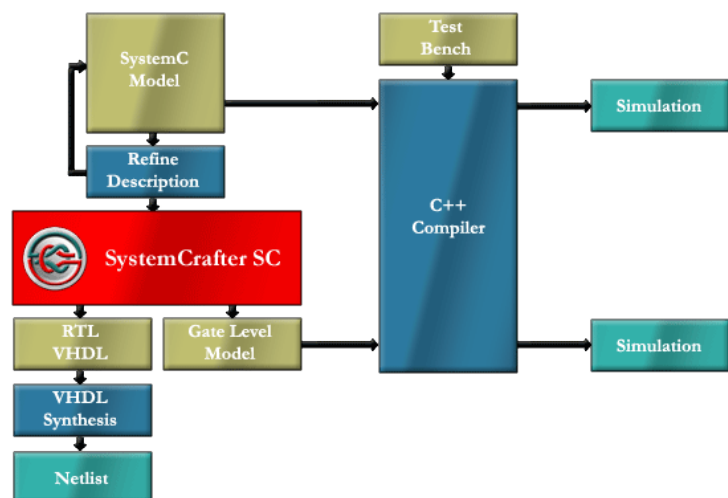
SystemCrafter SC can be used for:

- Synthesizing SystemC to Hardware
- System-level Design and Co-design
- Custom FPGA Co-processing and Hardware Acceleration

Synthesizing SystemC to Hardware

A typical development process is:

- Use your existing C++ development environment to:
 - Develop an initial SystemC description.
 - Write a test bench.
 - Debug, simulate and verify your description.
 - Refine it to describe more efficient hardware.
 - Experiment with trade-offs.
 - Verify the refined description using your test bench.
- SystemCrafter SC will synthesize your SystemC description to RTL VHDL, and a SystemC description of this VHDL.
- Verify the synthesized SystemC model.
- Use your existing VHDL synthesis tool and hardware flow (such as Xilinx XST and Project Navigator) to:
 - Synthesize the generated VHDL to working hardware.



System-level Design and Co-design

The additional advantage of SystemCrafter SC for co-design is that you can simulate the hardware and software partitions in the same framework.

A typical development process is to:

- Use your existing C++ development environment to:

- Develop an initial SystemC description.

- Write a test bench.

- Debug, simulate and verify your description.

- Partition the design into hardware, software and interfaces.

- Verify the partitioned description using your test bench.

- Refine it to describe more efficient hardware.

- Experiment with trade-offs.

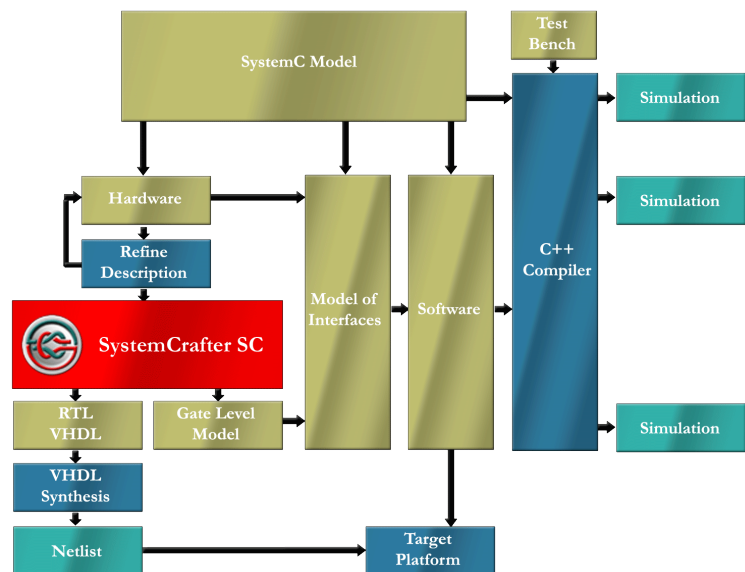
- Verify the refined description using your test bench.

- SystemCrafter SC will synthesize the hardware parts of your SystemC description to RTL VHDL, and a SystemC description of this synthesized circuit.

- Verify the synthesized SystemC model.

- Use your existing VHDL synthesis tool and hardware flow (such as Xilinx XST and Project Navigator) to:

- Synthesize the generated VHDL to working hardware.



Custom FPGA Co-processing and Hardware Acceleration

Using SystemC and SystemCrafter, you can easily develop hardware coprocessing and software acceleration units. Using FPGA hardware with SystemC flows enables powerful new computing applications.

You can use your existing C++ compiler to develop a SystemC description of your application, and experiment with implementing parts of the code in different coprocessors and hardware accelerators. You can use your compiler's facilities to profile candidate architectures, and simulate the whole system. Then SystemCrafter will automatically produce RTL VHDL descriptions of the hardware, which you can implement in your FPGA.

The SystemCrafter SC Software Tool

Benefits

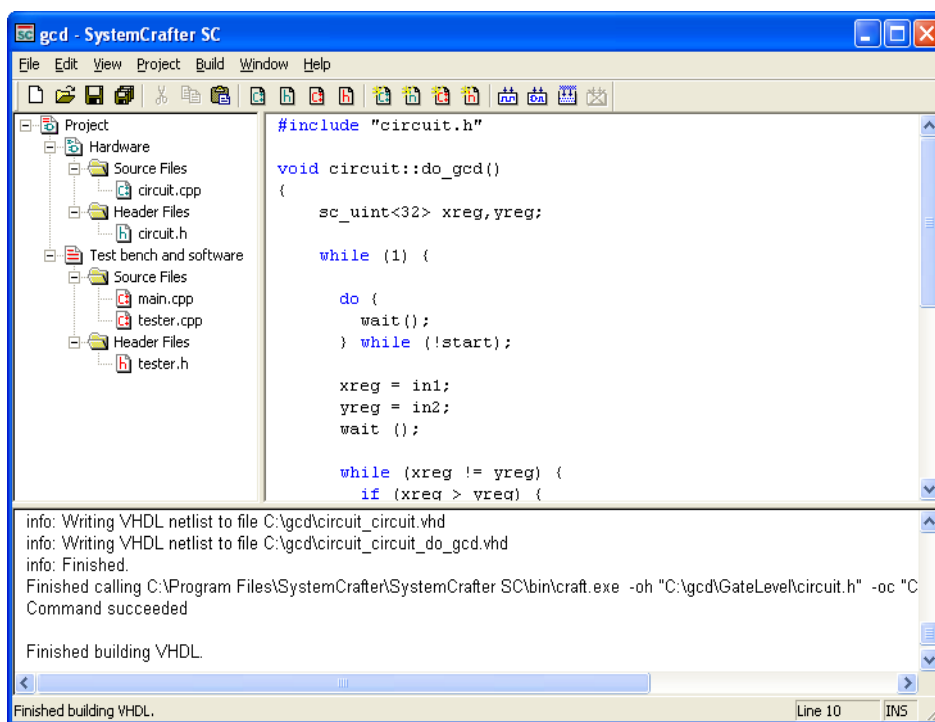
- Allows you to design, debug and simulate hardware and systems using the SystemCrafter GUI or your existing C++ development environment.
- Allows you to develop hardware and software in the same framework.
- Descriptions are fast to write, fast to simulate, maintainable and readable, improving time to market.
- Eliminates time-consuming and error-prone manual translation of SystemC to HDLs.

Compatibility

- is fully compatible with major C++ compilers, such as Microsoft Visual C++ and GNU GCC;
- is fully compatible with the Xilinx XST synthesis tools;
- runs on Windows 2000 and Windows XP.

The price includes

- A perpetual license, node-locked to one PC.
- New minor-version releases for the lifetime of the product (if you buy Version 2.0, you will be upgraded to new Version 2.x releases free).
- Support through our online support pages, including online forum and Knowledge Base.



The optional GUI simplifies management of system and gate level simulation, and synthesis to hardware.

How to Get Further Information

Full SystemC documentation and C++ libraries are free, and can be downloaded from the OSCI website (www.systemc.org).

For more information on SystemCrafter SC, you can download a free evaluation version, and have a look at the manual and a sample design. The evaluation version can be downloaded from our website (www.systemcrafter.com).

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