SystemC – Processes (02A)

SystemC

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Please send corrections (or suggestions) to youngwlim@hotmail.com.

This document was produced by using OpenOffice and Octave.

Based on the following original work

[1] Aleksandar Milenkovic, 2002
CPE 626 The SystemC Language – VHDL, Verilog Designer’s Guide
http://www.ece.uah.edu/~milenka/ce626-02S/lectures/cpe626-SystemC-L2.ppt

[2] Alexander de Graaf, EEMCS/ME/CAS, 2010
SystemC: an overview ET 4351
ens.ewi.tudelft.nl/Education/courses/et4351/SystemC-2010v1.pdf

[3] Joachim Gerlach, 2001
System-on-Chip Design with Systent of Computer Engineering
http://www2.cs.uni-paderborn.de/cs/ag-hardt/Forschung/Data/SystemC-Tutorial.pdf

[4] Martino Ruggiero, 2008
SystemC
polimage.polito.it/~lavagno/codes/SystemC_Lezione.pdf

[5] Deepak Kumar Tal, 1998-2012
SystemC Tutorial
http://www.asic-world.com/systemc/index.html

SystemC Processes (1)

- Basic unit of concurrent execution
- Encapsulates functionality
- Have sensitivity lists
- Triggered by events on sensitive signals

- Member functions are registered as processes
  by a process declaration in **SC_CTOR**
- No input arguments, No output

SystemC Processes (2)

- Expressing concurrency and parallel activities in the system
- Contained in modules
- Access external channel interfaces through the ports
- Not hierarchical → cannot call another process directly
- Can call methods and functions that are not registered as processes

Types of Processes

- Method processes
- Thread processes
- Clocked thread processes (deprecated)

SC_METHOD

- Executed repeatedly
- Run completely and then return
- Cannot be suspended : wait() X
- Should avoid using calls to blocking methods

Registration →

```
SC_METHOD(process_name);
sensitivity << signal1 << signal2 << .... ;
```

SC_THREAD

- Executed only once and only once by the simulator
- Have complete control on the simulation
  until return to the simulator
- exit(): the process is terminated for the rest of simulation
- wait(): suspend process execution until a next trigger
  (continue execution until the next wait())

Registration

```
SC_THREAD(process_name);
sensitivity << signal1 << signal2 << .... ;
```

SC_THREAD v.s SC_METHOD

SC_THREAD

- most general process
- used to model nearly anything
- slower than a SC_METHOD
  - (→ wait() induces a context switch)

SC_METHOD

- faster

Static Sensitivity

- Static sensitivity provides the parameters, which would trigger a process statically
- Specified during design.

```
SC_METHOD(add);
sensitive << A << B << Cin;
```

Dynamic Sensitivity for SC_METHOD

next_trigger(event);

next_trigger(event$_1$ | event$_i$, ...);

next_trigger(event$_1$ & event$_i$, ...);

next_trigger(timeout, event);

next_trigger(timeout, event$_1$ | event$_i$, ...);

next_trigger(timeout, event$_1$ & event$_i$, ...);

next_trigger(timeout);

Dynamic Sensitivity for SC_THREAD

```
wait(event);
```

wait(event$_1$ | event$_i$, ...);

wait(event$_1$ & event$_i$, ...);

```
wait(timeout, event);
```

wait(timeout, event$_1$ | event$_i$, ...);

wait(timeout, event$_1$ & event$_i$, ...);

```
wait(timeout);
```

Process Communications

Communication with other processes in the same module

(a) Processes may communicate with other processes via **channels**

(b) Processes may be synchronized with other processes via **events**.

Communication with other processes upward in the hierarchy

(c) Processes may communicate with processes outside the local design module through **ports** bound to **channels** by way of **interfaces**.

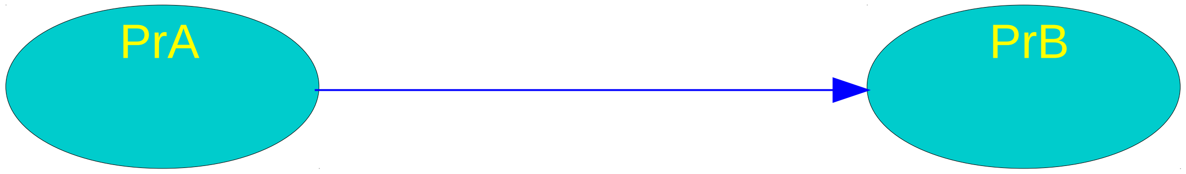
Communication with other processes in the submodule

Processes may also communicate with processes in sub-module instances
(d) via **interfaces** to **channels** connected to the sub-module **ports** or
(e) via **interfaces** to **sub-module channel** connected to its **sc_export**.
(f) via **interfaces** of the module itself (**hierarchical channel**).

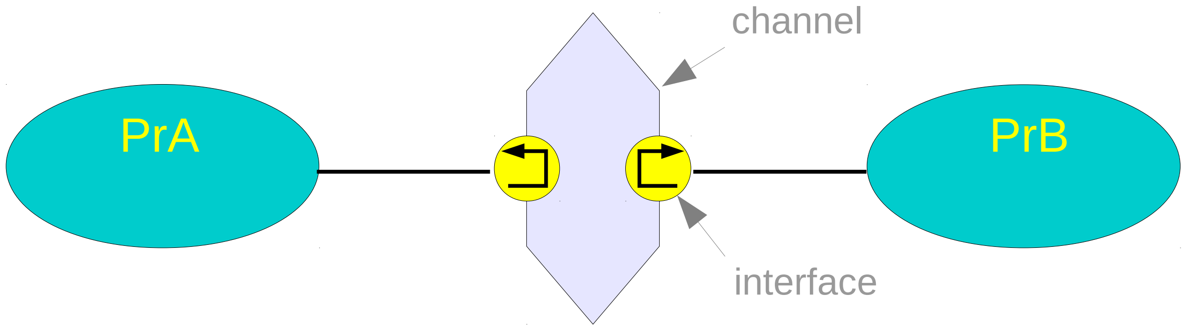
Communication with Processes

SC_METHOD (PrA) or SC_THREAD(PrA)
SC_METHOD (PrB) or SC_THREAD(PrB)

Communication at the same level
*(a) via **channels***
*(b) via **events**.*

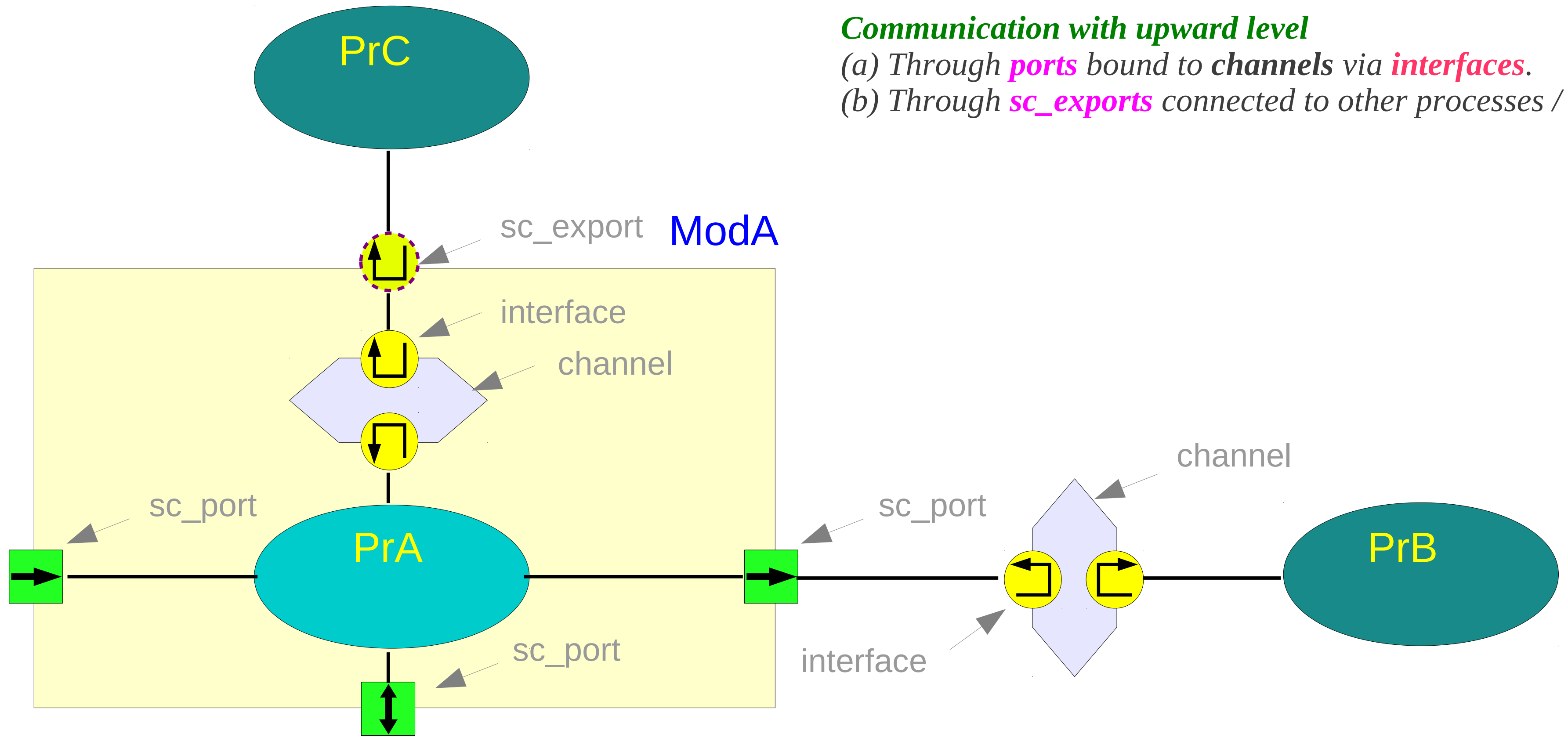


sc_event	ev1;	trigger(ev1), sensitive << ev1, wait(ev1), next_trigger(ev1),



sc_signal	sig1;	sig1.read(), sig1.write(),
sc_fifo	fifo1;	fifo1.read(), fifo1.write(), …
sc_mutex	mu1;	mu1.lock(), mu1.unlock(), …
sc_semaphore	sema1;	sema1.wait(), sema1.post(), ...

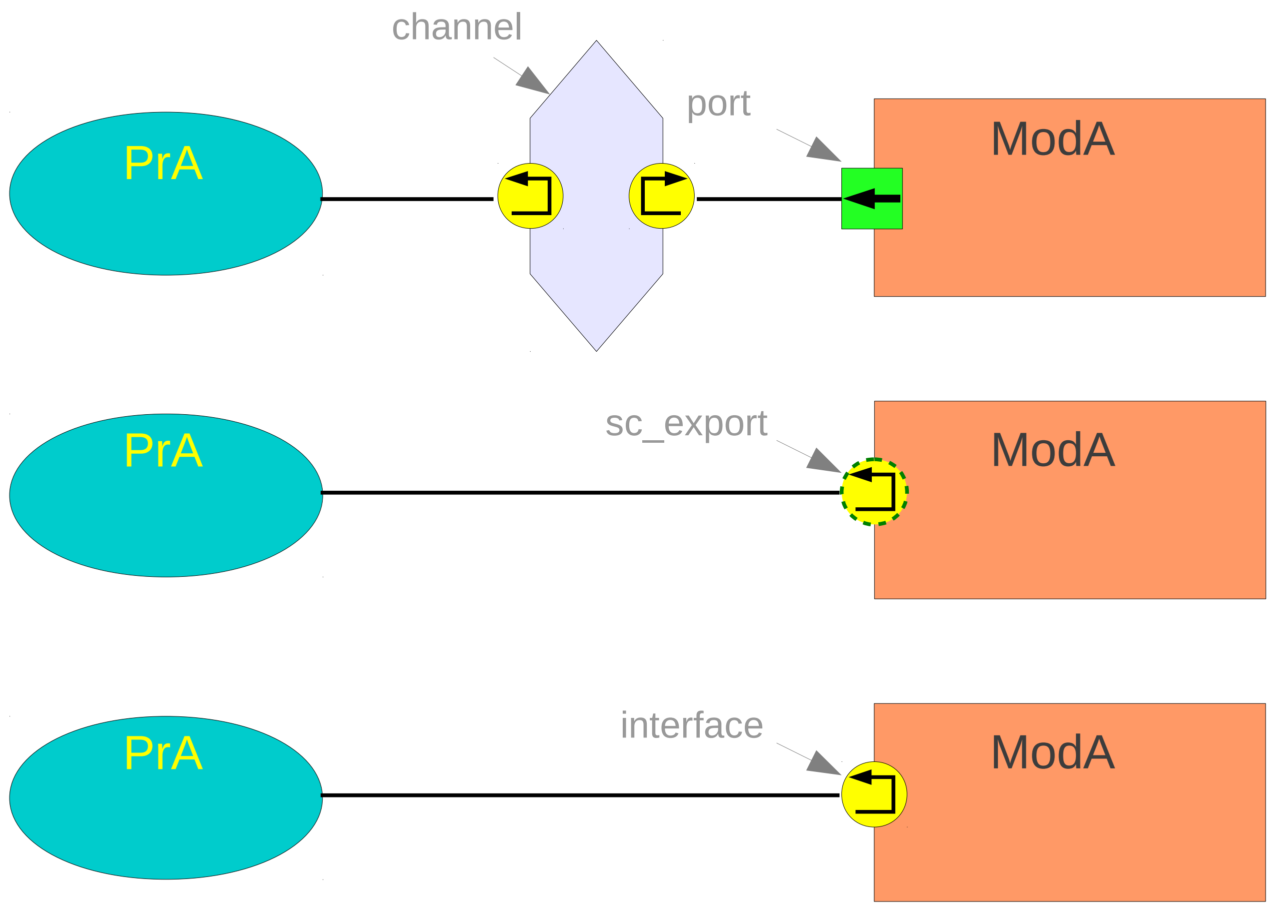
Communication with Outside Modules



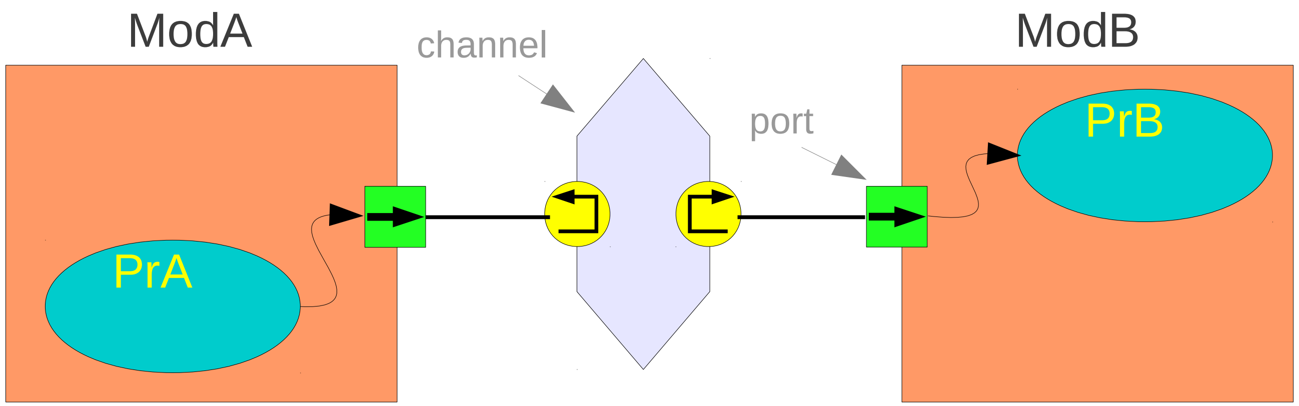
Communication with upward level
*(a) Through **ports** bound to **channels** via **interfaces**.*
*(b) Through **sc_exports** connected to other processes / ports.*

Communication with Sub-Modules

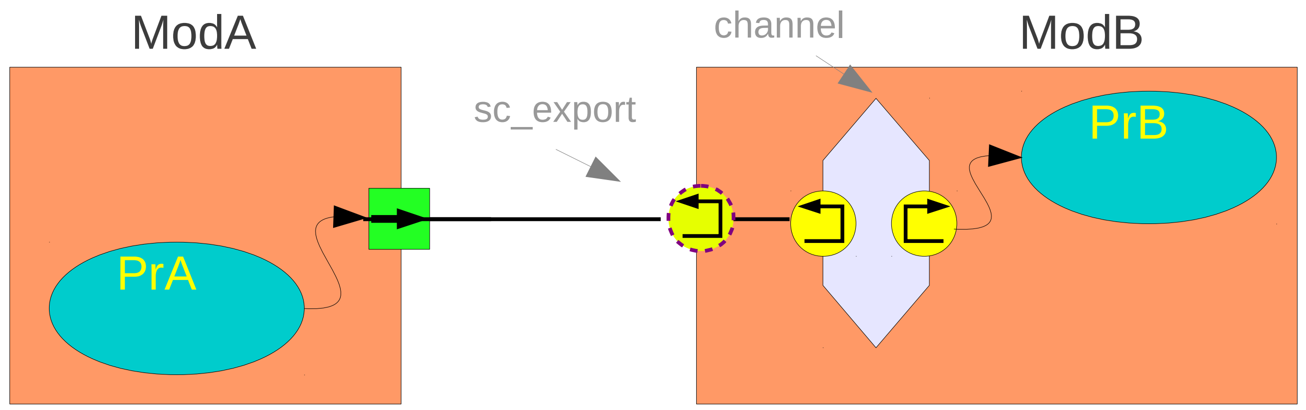
Communication with submodules
(a) via ***interfaces*** *to channels of submodule ports*
(b) via ***interfaces*** *to submodule* ***channels*** *of its* ***sc_exports***
(c) via ***interfaces*** *of the submodule itself (****hierarchical channel****)*



Communication via sc_ports



Communication via sc_exports



References

[1] Aleksandar Milenkovic, 2002
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[5] Deepak Kumar Tal, 1998-2012
SystemC Tutorial
http://www.asic-world.com/systemc/index.html

[6] D. C. Black and J. Donovan, 2007
SystemC: From the Ground Up