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Exercises to
Cyber-physical System Fundamentals
Summer term 2016

Assignment 2

(10 Points)

To be solved in the weeks starting on Monday, May 23, 2016

Hint: It's a good idea to verify your design in the simulator prior to flashing the boards.

Notes:

- If the Windows 7 virtual machine isn't running, select **CPSF** from the VM selection menu.
- To log in, use the right Control key (Strg) and Del (Entf) instead of Control+Alt+Del
- The template zip files as well as a PDF of this assignment are stored on the network server. To access it, enter `\\pdc\cpsf` in the Windows start menu and hit the enter key.
- Make sure to unpack the template zip files to the desktop - DO NOT open the files directly from the zip file, this will result in data loss!

2.1 Wrap-Around Counter (4 Points)

Create a "wrap-around" counter that can count from 0 to 9 upwards as well as downwards from 9 to 0. If either 9 or 0 is reached, counting further in the given direction shall wrap to the other end of the scale (i.e. counting up from 9 should result in 0 and the other way around). In addition, it must be possible to reset the counter to 0 at any time. Make use of the three buttons on the board and use the function *writeLine0(VS_INT number)* to output the current number.

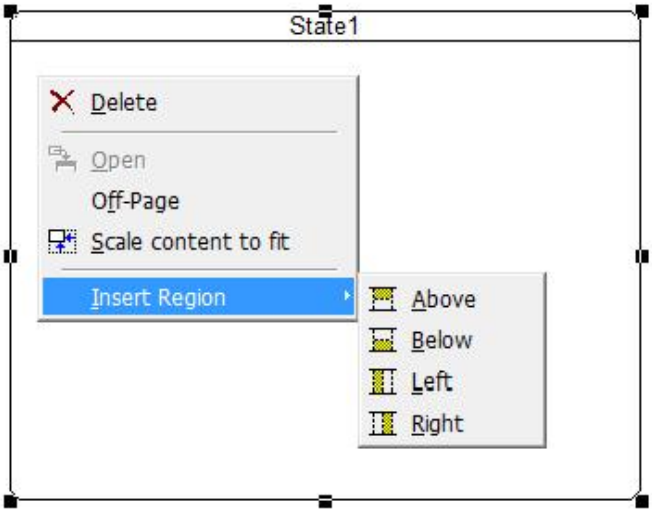
2.2 Fan Control (6 Points)

Implement the control software for a desk fan. The device shall feature three buttons:

- Power on/off
- Speed level
- Head rotation on/off

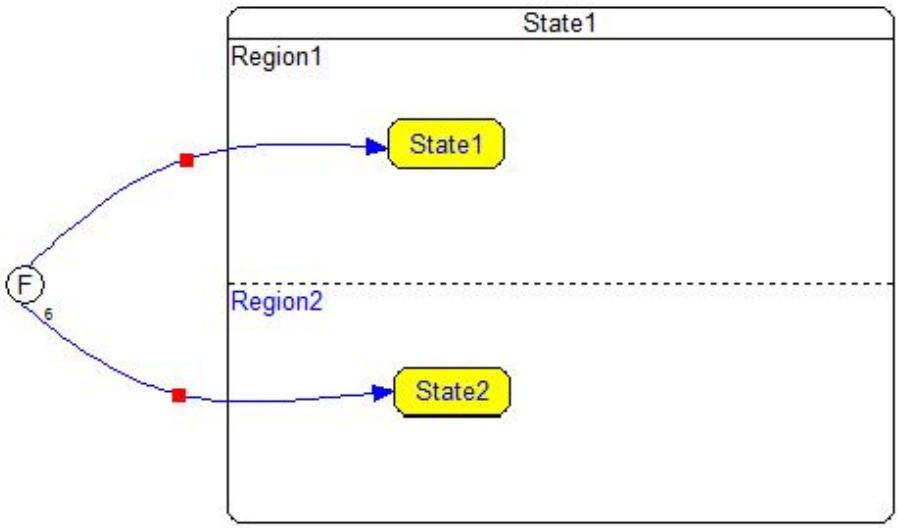
Three speed levels shall be supported (*slow, med, fast*). The speed level is a wrap-around logic. The next level beyond "fast" is "slow". If the device is turned off, the state of the speed level as well as the head rotation shall be preserved and restored once it is turned back on. The device shall be turned off by default (system reset). Since using string arguments in Visual State is a bit too complicated, the template for this assignment was prepared by us to output certain messages according to the numeric argument that you give to it:

- *writeLine0(-1)* prints "Off"
- *writeLine0(0)* prints "Speed: slow"
- *writeLine0(1)* prints "Speed: med"
- *writeLine0(2)* prints "Speed: fast"
- *writeLine1(0)* prints "Moving: yes"
- *writeLine1(1)* prints "Moving: no"



Hint: To create an *AND super state*, insert a composite state. Click the state with the right mouse button and select "Insert Region" (see screenshot).

In Visual State, to activate sub-states in *AND super states* it is not sufficient to draw a direct arc into the sub-states. Instead an explicit *fork node* must be used to "split" control prior to drawing parallel arcs into the sub-states (see screenshot). Leaving the sub-states can be done directly without explicit *join nodes*.



General notes:

Dates and additional information can be found on the lecture website. The assignments will be typcically be published **Tuesdays** on a weekly basis and have to be solved in the lab session of the following week. To pass the labs, a minimum of 50% of the total points must be achieved in the first half and the second half, respectively.