

Assignment 1: Virtual Prototyping

This assignment will give you experience on how to virtually *prototype* a SoC Design using cycle accurate software models directly from RTL. Virtual prototypes enable a parallel approach to SoC design; enabling designers to validate their custom hardware (IP blocks) and debug necessary software as well at the pre-silicon stage.

We will use a set of industry-standard tools in this class (provided under NDA) from Carbon Design Systems (<http://www.carbondesignsystems.com/>).

-The first tool is *Carbon SoC Designer* (earlier called ARM Realview SoC Designer) is a system modeling toolset, which allows users to quickly construct and debug SoC designs. Platforms created using SoC Designer are completely cycle accurate and execute quickly.

-The second tool is *Carbon Model Studio* which can generate software models directly from RTL. These software models can then be dragged and dropped into the SoC Designer canvas and used to perform architectural profiling and hardware/software debugging.

SoCDesigner and *ModelStudio* are GUI based software. They have been installed on a TAMU server: `cse-codesign.tamu.edu`

To access the tools, you will need to use an ssh client (example Putty). To view the GUI, you will need to setup an X11 server on the client end. On Windows – you can install Xming. More information here - https://wiki.cse.tamu.edu/index.php/Using_Xming_with_PuTTY. On Linux or Mac – it will work natively with ssh -X `cse-codesign.tamu.edu` (the X11 server is bundled by default)

Machine Name: `cse-codesign.tamu.edu`

(Note this machine does not belong to the .cs sub-domain)

(Note – To access this machine from home, you should be within CS VPN)

username: userxxx (please get it from instructor)

password: xxxxxxxx (please get it from instructor)

The software has been installed in `/opt`. They are accessible from:

`/opt/carbon/bin/modelstudio` - Carbon ModelStudio

`/opt/SoCDesigner/bin/sdcanvas` - Carbon SoCDesigner

The login scripts source these paths and various other environment variables, so you can invoke `modelstudio &` or `sdcanvas &` directly from your home directory.

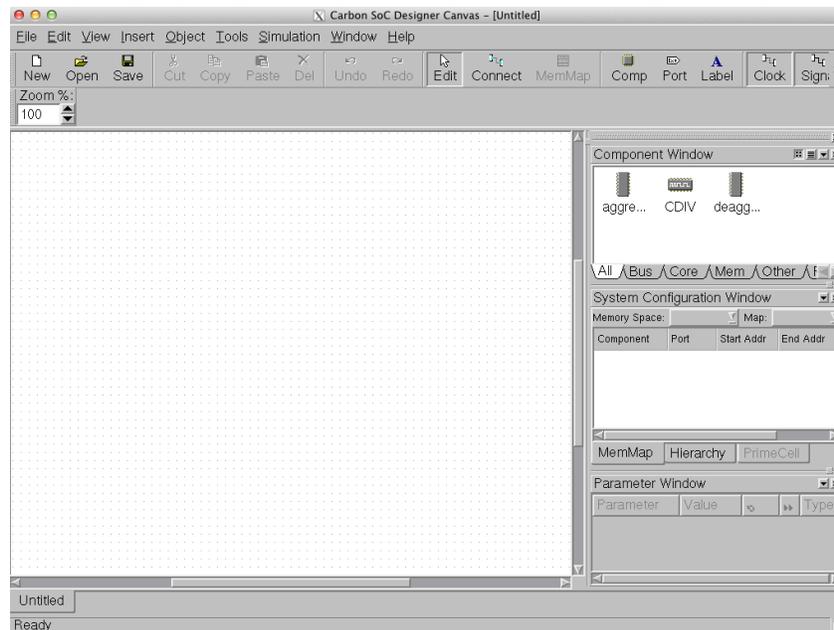
The objective of this assignment is to become familiar with these tool-chains through simple examples. The tutorials are in: /opt/carbon_tutorials/ (Please download them to your computer from this location using WinSCP/SFTP clients)

1. Using-Socd-basic-workbook.pdf
2. Platform-integration-SoCD-workbook.pdf
3. CoSimulation-workbook.pdf

Carbon Performance Analysis Kits (CPAK) are pre-built virtual reference platforms, complete with bare-metal and/or OS software which enable designers to analyze SoC design activity and architectural analysis. They contain 100% accurate models compiled directly from RTL and instrumented for interactive design, debug and analysis. The tutorials make reference to a CPAK installation directory. It is /opt/cpak on cse-codesign.tamu.edu.

Example (SoC Designer):

```
regulus:~ aalap$ ssh user001@cse-codesign.tamu.edu
Password:
Last login: Mon Feb  4 20:12:49 2013 from sol10cluster.cs.tamu.edu
Setting CARBOND_LICENSE_FILE to point to 1717@license2.cs.tamu.edu
Setting MAXSIM_HOME to point to /opt/SoCDesigner/
Setting MX_CDP_HOME to point to /opt/SoCDesigner/CDP/Linux/4.1.0/
SoC Designer Cosimulation setup completed.
Setting MAXSIM_PROTOCOLS to /opt/SoCDesigner/Protocols
SoC Designer setup completed.
user001@cse-codesign:~> sdcanvas &
[1] 20939
user001@cse-codesign:~> █
```



What to Turn in:

1. Execute the steps in the tutorial – “Using SoCDesigner Workbook” (Using-Socd-basic-workbook.pdf). Submit a screenshot of the final view of the A9 MP1 AXI System on the SoCDesigner Canvas (10 points)
2. Answer the following questions with reference to the example system, also make specific reference to the ports used for each component in the example system, what do they do? (10 points)
 - a. What is the role of *CarbonSemiHost* model in this design? (1 point)
 - b. What is the role of *MxAXIv2* model in this design? (1 point)
 - c. What is the role of the *Vic_pl190* component in this design? (1 point)
 - d. What is the role of the *AXIv2_Mem* component? (1 point)
 - e. What is the role of *CM_Resize_Zxi_64_32* component? Why two instances? (2 points)
 - f. What is the role of *AHBc2LiteToAHBv2SS*? Why two instances? (1 points)
 - g. What is the role of *CM_Bridge_Axi_Apb* in this design? (1 point)
 - h. What is the role of *CM_Timer_Apb* in this design? (1 point)
 - i. What is the role of *intVector* in this design? (1 point)
3. What are the values of cycle counter (Page 20):
 - a. Before it requires values from the user?
 - b. When the execution terminates (assuming 10 strings sorted)?

References:

1. Vectored Interrupt Controller (PL190) - <http://infocenter.arm.com/help/topic/com.arm.doc.ddi0181e/DDI0181.pdf>
2. Relevant component user-guides are present in /opt/documents

Notes (“Using SoCDesigner Workbook”:Using-Socd-basic-workbook.pdf):

- (1) The RealView Development Suite is not installed on cse-codesign.tamu.edu, please skip the section “Connecting with Real View Debugger (RVD)” on pages 25-27 in Using-Socd-basic-workbook.pdf
- (2) RAM parameter “Memory Size” need not be set (Page 16) in Using-Socd-basic-workbook.pdf
- (3) Adding Additional components (Page 16) – There is only one instance of AHBv2LiteToAHBv2SS. Its parameters are (parameter names have changed since tutorial was written):

Parameter	Value
AHB region size	0x1000
AHB region base	0x13080000

- (4) Component MxAHBv2 is not required (Page 16) in Using Socd-basic-workbook.pdf
- (5) For Using Carbon SoC Designer Part 2, please use the system created by you in your home directory instead of the reference system.
- (6) In case Simulate System does not work from within the SoC Designer Canvas menu bar, please recheck your X-server connectivity. It may have been interrupted. For example you may see an error such as:
socdesigner: cannot connect to X server
localhost:10.0. In such a situation, please reconnect you ssh connection again.

Contact: Aalap Tripathy (aalap@cse.tamu.edu) for tool-related issues.