VLSI Physical Design with Timing Analysis

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Lecture 56

Open-Source Tool Installation and Qflow

 Welcome to the course on VLSI Physical Design with Timing Analysis. In this lecture, we will discuss about open source tool installation and Q-Flow. So, we will first of all discuss about installation of open source tools, then we will go about the Q-Flow, then we will do a demonstration of Q-Flow in this lecture. So, for installing the open source tool, we have two options available, but the operating system needed is Linux Ubuntu 22.04.3 version. So, basically the Ubuntu Linux is essential for installing these open source tools. So, either you can install standalone as your operating system or if you have a Windows machine then you install the Oracle VirtualBox and install the Ubuntu inside that VirtualBox. Then we have some Linux command is essential for doing the installation. For example, PWD is the Present Working Directory. This is first command basic commands I am telling. One the CD is basically change directory the second command and the third one is the move files or the directory. Basically you can move or rename the directory. MV stands for move rename the directory. Then creating a new directory we have mkdir make new directory.

Then the fifth one is basically listing all the files and the folder ls is a command for that. So, these are the commands I am just circling out is essential for doing the installation. Then we have to follow this flow sudo apt-get upgrade sudo apt update we need to do and we follow the steps mentioned here for installing the tools. So, this is a saying about the Qflow installation and YOSYS is part of this installation. So, you have to go these steps to do the Qflow installation. Similarly, for Open Road and OpenSTA installation, you have to do these steps to install the Open Road or OpenSTA installation. Then there is some differences between Qflow and Open Road flow. So, for Qflow we have basically YOSYS engine there for logic synthesis. Then we have a gray wolf is the tool used for placement. Then placement steps include floor plan, power plan, placement plus CTS. And in case of Qflow we have basically static timing analysis tool which is Vesta is used and for routing we have a Q router and basically post route STA this Vesta is alSo, used. Then we do the basically migration of the use of the GDS file we use basically GDS file

in magic. So, this is basically magic is a layout editor tool open source layout editor tool which does migration, DRC check, LVS check and opening the GDS file for viewing. All these are done. This is related to Qflow.

In case of Open Road flow, we have this is done by logic synthesis tool YOSYSIS. Then it uses OpenSTA for doing static timing analysis and this is the only tool which does all the steps this is Open Road. Then again STA is done in OpenSTA. Similarly this all the four steps are done by open source layout editor tool magic. Magic is an open source layout editor tool. Before going to the demo of Qflow which is a digital synthesis flow, we will discuss about what are the things and done in different steps. Basically we have a synthesis which is done using YOSYSIS. It uses a wrapper synthesize dot sh. We can run this one like this also. Then we have basically the gray wool which is used for all the things like placement, flow plan, power plan, placement and clock tree synthesis.

We have a wrapper file placement dot sh. We can invoke this one using this in the command prompt. We can use the command prompt to do this also. Then alSo, there is a STA tool which is Vesta dot sh file and we can run this using this command in the command prompt. This is very useful. If somebody wants to modify some of the parameter inside the file, they can do it to do different analysis. Then the router used here is q router and the script is basically router dot sh and you can run this script using this command prompt. Then similar to previous thing STA you can do. Then all the four steps 1, 2, 3, 4 are done using magic tool and we have migrate dot h. You can run using this command drc dot sh. This is the command lvs dot sh. Basically tool is used is netgen and gds2 dot sh. This is used by this. That sh is basically is the shell command actually stands for dot sh stands for shell scripts. So, in this lecture we will discuss about open source tool Qflow.

How we can do the complete VLSI design using this tool Qflow. So, to open this tool, you have to type Qflow GUI ampersand, then the Qflow GUI will open. So, the Qflow GUI will open and if you can see here is that we are using OSU 035 technology library, but there are other options are there, but we have chosen OSU 035 technology library and if you can see here this map 9v3.v file is used. And this is the top level module. Then we will go step by step. The first part is basically the preparation phase, preparation of the files all the initialization of the files. So, first of all, we will need to press the set stop, then we will do the run. So, this step is completed.

So, here you can see that the technology is set to OSU 035 and this is the initial steps. Then we have second step, which is the synthesis. Here Qflow is invoking a tool called YOSYSIS, what we discussed in the other lecture. So, YOSYSIS is used to do the logic synthesis. So, we can run this tool to do the synthesis. We can do this to run the synthesis. So, this is the synthesis is done for this case. And then the next step is your placement. In case of open road, we have did all the things through a command prompt, but all the

things are done in one click in this GUI using this placement whatever it is there. So, the placement step will include basically floor planning, power planning and placement and the clock tree synthesis. So, all the things are done together in a single step using a open source tool called Gray Wolf. So, the Gray Wolf is used to do this all the steps actually. So, we will run this one. So, it has done all the steps starting from placement, floor planning, power planning and clock tree synthesis.

All the things are done in this step. Then we will do the static timing analysis which is another step of what we did in the previous flow open road also. So, this will be done using a tool called Vesta. It is done. So, these are the reports coming out from the tool. Then we have routing which is done using a Q router. This is done using a tool called Q router. You can see graphically how the routings are done. Then we can do a post route STA because after the routing the timing is changed. So, we need to check the timing again. So, again it will invoke that Vesta to do the static timing analysis. So, this is the static timing analysis flow is over. Now we will do the migration to magic. You can use the magic tool to do the DRC-LVS check.

So, we can go to the magic tool. Then we can check the DRC. Then we can do the design rule check. So, there is no DRC violation in this design. So, DRC is zero. Similarly you can run the LVS layout versus schematic. So, in this step what it is happened is that we have a verilog file which is acting as your schematic and the layout generated from the physical synthesis tool like Qflow or Open Road both are compared. So, basically in this LVS we have two things. One is called the layout, one is called the schematic. The schematic is how we can generate the schematic.

You have a verilog file. That verilog file will be used to generate the schematic netlist using the tool called netgen and the layout netlist is generated as the GDS file from the physical synthesis tool. Both are compared. If both are logically or basically all the nets are matched then the LVS will be clean. Then finally what we have the generating the GDS. So, it will dump the GDS to a file. You can check the layout in the magic. This is a complete design in the magic and this is basically the different layers used in the design and is a complete top level what is implemented using the basically Qflow design tool.

So, in this lecture we discussed about the installation of open source tool and we discussed about the demonstration of open source tool Qflow. Thank you for your attention.

 Thank you.