

Cadence Tutorial: Generating Layout

EE 247B/ME 218

Kieran Peleaux

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1 Accessing EECS Instructional Machines

1.1 Activating EECS Instructional Account

To activate your EECS instructional account, visit <https://acropolis.cs.berkeley.edu/~account/webacct/>. Click “Login using your Berkeley CalNet ID” and after logging in you should see a list of accounts. Find the one with “cs199” listed under **Purpose** (it should say “no cs199 account” under **Account Name** if you haven’t set yours up yet) and click the “Get a new account” button under **Account Services**. You will then be given an account name of the form cs199-abc where “abc” will be replaced with your account’s letters. The password will be set automatically for you, which you can then change.

1.2 Installing Remote Access Software

There are two common approaches to remotely accessing the instructional machines. The first and preferred method is to use a remote desktop client such as X2Go [download link] which opens up a remote desktop session within a window on your local machine that gives you access to the instructional machine you’ve connected to. More info on using X2Go on EECS instructional machines can be found at <http://inst.eecs.berkeley.edu/cgi-bin/pub.cgi?file=x2go.help>.

Connecting with X2Go

1. Download X2Go [download link] on your computer and run it.
2. Go to **Session > New Session** to open the session preferences dialog for a new session.
3. Under the **Session** tab, you can enter a name for this session for future reference in the “Session name” field. Then enter any of the following addresses in the “Host” field.

```
eda-1.eecs.berkeley.edu
eda-2.eecs.berkeley.edu
eda-3.eecs.berkeley.edu
eda-4.eecs.berkeley.edu
eda-5.eecs.berkeley.edu
eda-6.eecs.berkeley.edu
eda-7.eecs.berkeley.edu
eda-8.eecs.berkeley.edu
```

4. Under the **Session** tab, enter your instructional account name (i.e. cs199-abc) in the “Login” field and click “OK”.
5. Click the box for your new session on the right side of the X2Go Client, and you should get a login window prompting you to enter your password. Use your EECS instructional account password generated in step 1.1 above. Click “Ok” and after some time a remote desktop session should pop up. Note that this can sometimes take a little while.
6. Once the remote desktop environment loads you can open up Terminal under **Applications > System Tools > Terminal** and skip to **Section 2: Cadence Setup**.

Connecting with ssh

The second is to use ssh, either through the command line or a client, alongside an X server. You may use whichever you’re more comfortable with. The instructions below will walk you through the setup of this second method.

Windows Users

1. Download PuTTY [download link]. This is a free tool that allows you to configure SSH sessions quite easily on Windows.
2. Download an X server. This is another free piece of software that you must run in the background before attempting to open any graphical software on the remote machine. Without it, your PC will not be able to display the windows for Cadence or any other non-command line software interface that you try to run. Xming [download link] is one option. Make sure that you also download xming-fonts (can be found at the same link).
3. Open PuTTY. In the “Host Name (or IP address)” box, type any of the following hostnames:

```
eda-1.eecs.berkeley.edu
eda-2.eecs.berkeley.edu
eda-3.eecs.berkeley.edu
eda-4.eecs.berkeley.edu
```

```
eda-5.eecs.berkeley.edu
eda-6.eecs.berkeley.edu
eda-7.eecs.berkeley.edu
eda-8.eecs.berkeley.edu
```

Make sure the “Port” box is set to 22 and the Connection type is set to SSH.

4. In the **Category** pane on the left-hand side of the PuTTY window click the plus icon next to **SSH** and click the **X11** option that appears in the drop down menu. Check the box that says “Enable X11 forwarding”.
5. Click the **Session** option in the **Category** pane to return back to the initial screen. Ensure the info you entered previously is intact and click “Open”.
6. A PuTTY terminal should open and prompt you with “login as: ”. Enter your “cs199-abc” username and replace “abc” with the letters you were assigned. It should then prompt you for with “cs199-abc@eda-#.eecs.berkeley.edu’s password: ” where “abc” will be your username’s letters and “#” will be the machine number (1 - 8) you entered as the hostname. Enter the password that was assigned to you when you generated your instructional account (you won’t see any indication of what you’ve entered, so be careful when typing your password).
7. You should now be connected. Make sure to run Xming on your PC (it will run in the background, but you can check in the tray on the bottom-right of your screen to see if it’s running).

Mac Users

1. Download XQuartz [download link]. This is essentially the equivalent of Xming, it’s an X server that will allow your computer to display graphical windows for software running on the remote machine.
2. Start XQuartz and open Terminal.
3. Type the following command, replacing “abc” with the letters you were assigned and # with 1 - 8 as shown in step 3 above:

```
ssh -Y cs199-abc@eda-#.eecs.berkeley.edu}
```

4. You should be prompted for your password. Enter the password that was assigned to you when you generated your instructional account.
5. You should now be connected. XQuartz should automatically run on your Mac.

2 Running Cadence

2.1 Setup

1. Making a Cadence directory

Cadence generates a lot of files and directories, so it is recommended that you make a separate directory in your home directory (i.e. `~/cadence`) using the command

```
mkdir cadence
```

2. Set the executable and license paths

Run the command

```
/share/b/bin/cadence-setup.csh
```

You will then be asked which directory you'd like to set Cadence up in. If you created the directory as instructed above, you should enter `~/cadence`.

2.2 Starting Cadence

Go to your cadence directory

```
cd cadence
```

type the command

```
source /share/b/bin/cds6
```

then use the command

```
virtuoso &
```

to start Cadence 6.1.7. Again, note that it may take some time for the window to open.

The Cadence “log file” window should pop up on your screen, and you can start using Cadence. Note: If you encounter a pop-up about a license not being available, click “Yes” to try the next license until the pop-up closes.

The main window that opens when you first start Cadence is the Command Interpreter Window (CIW). The CIW will be used frequently moving forward. The other main window you will want to use is the Library Manager, which you can open by navigating to **Tools > Library Manager** in the CIW.

2.3 Creating a Technology Library

Cadence requires that you have both:

- A design library that will store the imported file
- A technology file/library, which defines the layers

The design library and technology library can be the same library, or they can be different libraries.

Since we don't have a technology library, we need to create a new one:

CIW > Tools > Technology File Manager > New

Name your library in the "Technology Library Name" field. You can create a new technology by copying from an existing library ("Copy From Existing Technology Library") or by loading a technology file ("Load ASCII Technology File"), which is what we will do.

Once you've named your library and selected "Load ASCII Technology File", browse to the provided techfile (you will need to download it from the course website) **hw5_techfile.tf** and click "OK". Make sure you receive confirmation that the techfile has loaded successfully.

2.4 Editing or Importing Layer Appearance

If your imported file has layers that were not previously included in your technology file, or if you created a new technology library, you might want to define or edit the color and stipple pattern of the layers. In our case we will import existing layer appearances. To open the Display Resource Manager:

CIW > Tools > Display Resource Manger > Edit

In the third drop-down menu on the left, select the library you created earlier. You should then see the layers associated with the imported techfile in the **Layer Purpose Pair (LPP)** window. From here you can edit the appearance of each layer if desired. Since we already have layer appearances defined, you can import them:

Display Resource Manager > File > Load

Browse to the provided techfile (you will also need to download this from the course website) **display.drf** and click "Open". Now you should see new colors and stipple patterns for the layers in your library. Before exiting the Display Resource Manger, save your imported appearance:

Display Resource Manager > File > Save

Make sure to save the file in the directory you created at the beginning of this tutorial. There should already be a **display.drf** file in that directory, which you can overwrite.

2.5 Generating Layout

In the Library Manager, highlight your new library and create a new cell:

File > New > Cell View

For **Type** choose “layout” and click “OK”. Once again if you encounter a pop-up about a license not being available, click “Yes” to try the next license until the pop-up closes. A Virtuoso layout window should then open.

First, adjust the grid snap spacing so that it matches the minor grid spacing. You can do this by opening the Display Options using the hotkey **E** or by using the **Options** menu in the toolbar.

Options > Display

Under **Grid Controls** change “X Snap Spacing” and “Y Snap Spacing” to **1** and click “OK”. Now you can start to draw your layout.

To draw a layout for a mask, first choose the corresponding layer in the LSW window by clicking on the layer. Then move your cursor into the layout window where you want to draw the layer and press **R** to enter “Create Rectangle” mode. Click once to place the first corner of your rectangle, then move your mouse and click again to generate the rectangle in the selected layer.

If you later want to change the dimensions of your rectangle, press **S** to enter “Stretch” mode and move your cursor to the side or corner that you want to extend or shorten. Once you see that the side is highlighted, click once and move your mouse to modify the shape. Click again to finalize the new dimensions.

In order to check that your dimensions are correct when drawing, press **K** and click on the layout where you would like to start measuring from, then move the mouse to the end point and click again to place the ruler.

To zoom in, press **Z** and draw a window that you would like to zoom in on. At any point you can press **F** if you want to change your view to fit your entire layout to the window.

Oftentimes you need to array duplicates of the same shape across your layout. To do this, press **C** then click on the shape you want to copy. Click again to place the duplicate shape. Alternatively, you can first select the shape or shapes you’d like to copy, then press **C**, then click anywhere to place the copy(s). Most of the commands outlined above can be done in either order (i.e. hotkey, then select vs. select, then hotkey). For a more comprehensive list of commands and their associated hotkeys, see “Cadence Hotkeys” on the course website.

2.6 Exporting Layout to GDS

To export your final layout to a GDS file, navigate to the export menu:

CIW > File > Export > Stream

Name your stream file something with the extension **.gds** choose the export location. Select your library and cell names and layout view, and choose your technology library from the drop-down menu. Click “Translate” to begin the export process. When complete you should see window that says “Stream out translation complete” with zero errors.

You may then use any file transfer protocol (e.g. SCP) or use email or the cloud to obtain your GDS file from the remote machine.