



Exercise 2: Getting Started with Cadence

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Logging in...

- Log in on the CIP Pool with your university account
 - Systemanwendungen → MATE terminal
- Start a remote session with the provided user name:
 - `ssh -X name@susnx.ziti.uni-heidelberg.de`
(accept the RSA fingerprint once with `yes`)
- Change the password with command `passwd`
 - ≥ 8 characters, 3 from 4 types (normal, capital, number, special)



Preparing Cadence...

- If you start for the first time:
- Create a new directory 'cadence' in your home directory

```
mkdir -p ~cadence
```
- Copy the files required to run cadence from our 'template' directory into a (newly created) subdirectory `umc`

```
cp -r /shares/designs/UMC/OA/018_1P6M/workdir_template/ ~/cadence/  
umc
```

(note the 'blank' before '~/cadence')
- Change to the cadence directory and have a look...
 - `cd cadence/umc`
 - `ls -al`
- Your working directory now contains (mainly) a start script `start.sh`, a configuration file `.cdsinit`, a file with library paths `cds.lib`

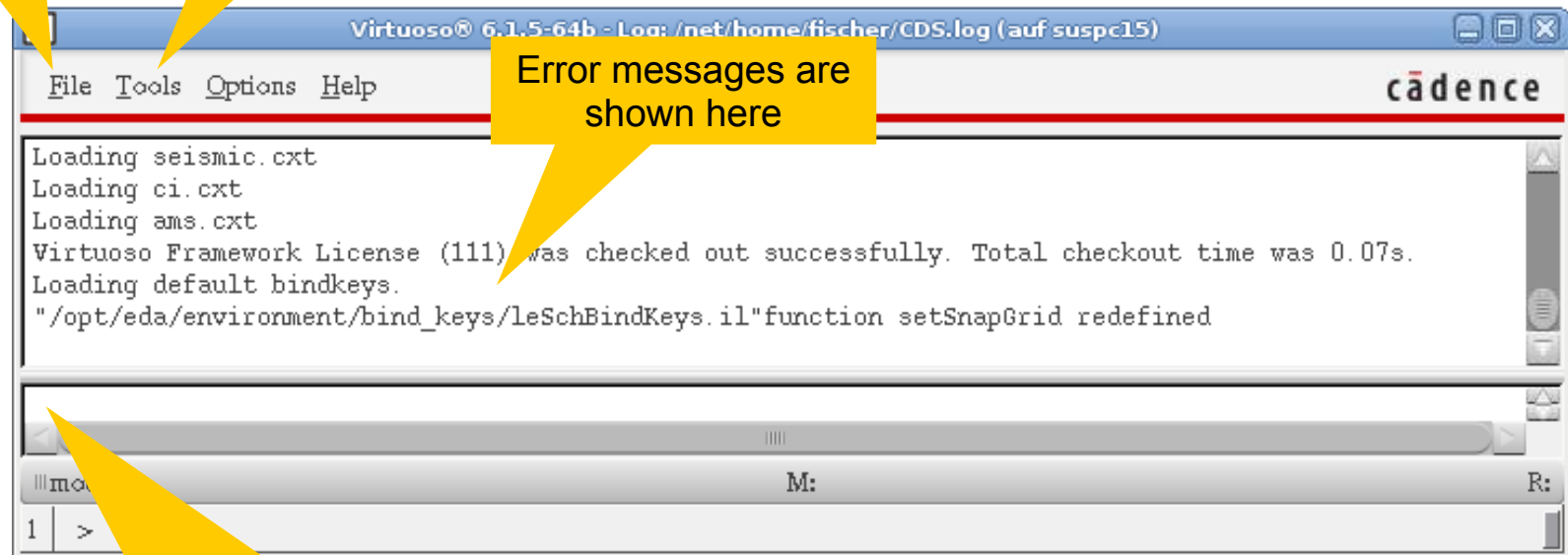


Starting Cadence

- Start cadence with
 - `./start.sh &`

The usual file menu
(with 'exit')

Start more stuff from
here



Error messages are
shown here

Can type in commands /programs here.
The language 'skill' is very close to LISP
Try **(plus 3 4)**
or **(sqrt 10)**



Opening the Library Manager

- Open the library browser under **Tools** → **Library Manager...**

The screenshot shows the Cadence Library Manager window with the following components and annotations:

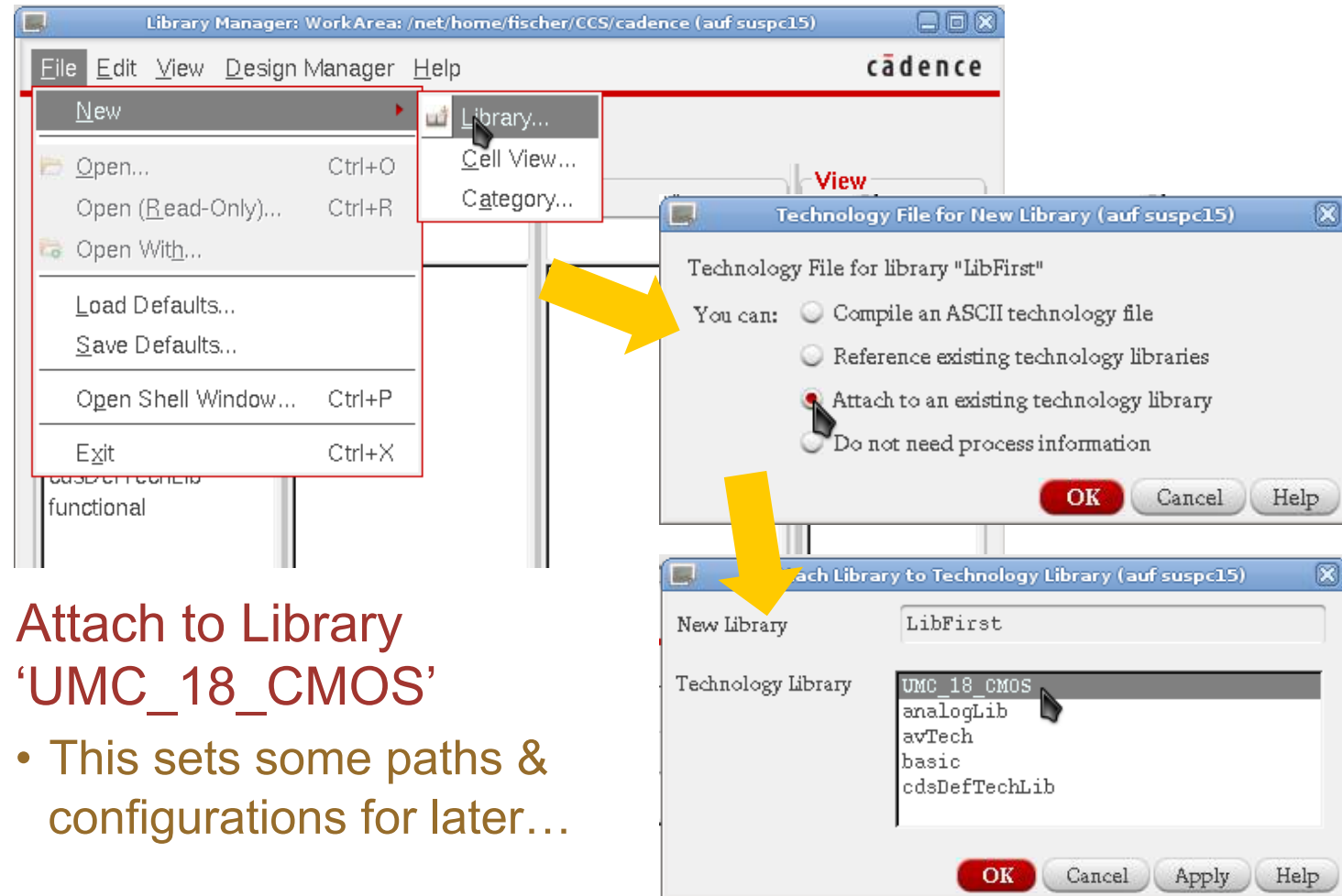
- Enable this!**: Points to the **Show Categories** checkbox.
- Transistors... (later)**: Points to the **SUSLIB UMC018** and **UMC 18 CMOS** entries in the Library list.
- Basic components are here**: Points to the **analogLib** entry in the Library list.
- Some more stuff here**: Points to the **basic** entry in the Library list.
- Categories**: Points to the **Everything** category in the Category list.
- Cells (in category)**: Points to the **cap** cell in the Cell list.
- For now: Only symbol**: Points to the **symbol** view in the View list.
- Preview area**: Points to the small schematic diagram in the bottom right corner.

The interface includes a menu bar (File, Edit, View, Design, Manager, Help), a toolbar with Show Categories and Show Files, and a Messages pane at the bottom left showing: "Log file is "/net/home/fischer/CCS/cadence/libManager.log".



Creating a library

- Create an empty library from the Library Manager under **File → New → Library**

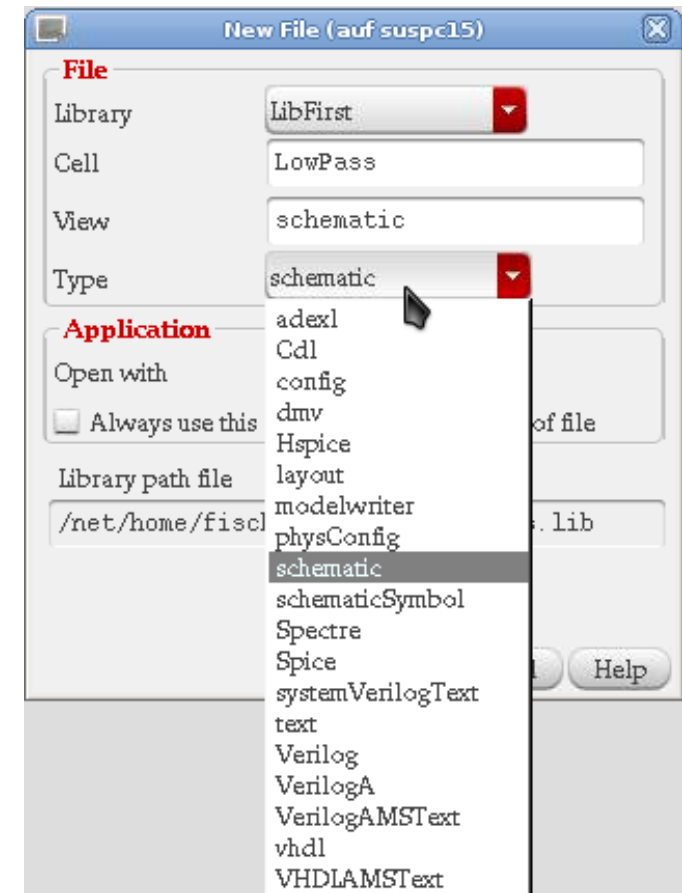


- Attach to Library 'UMC_18_CMOS'
 - This sets some paths & configurations for later...



Creating a new Schematic

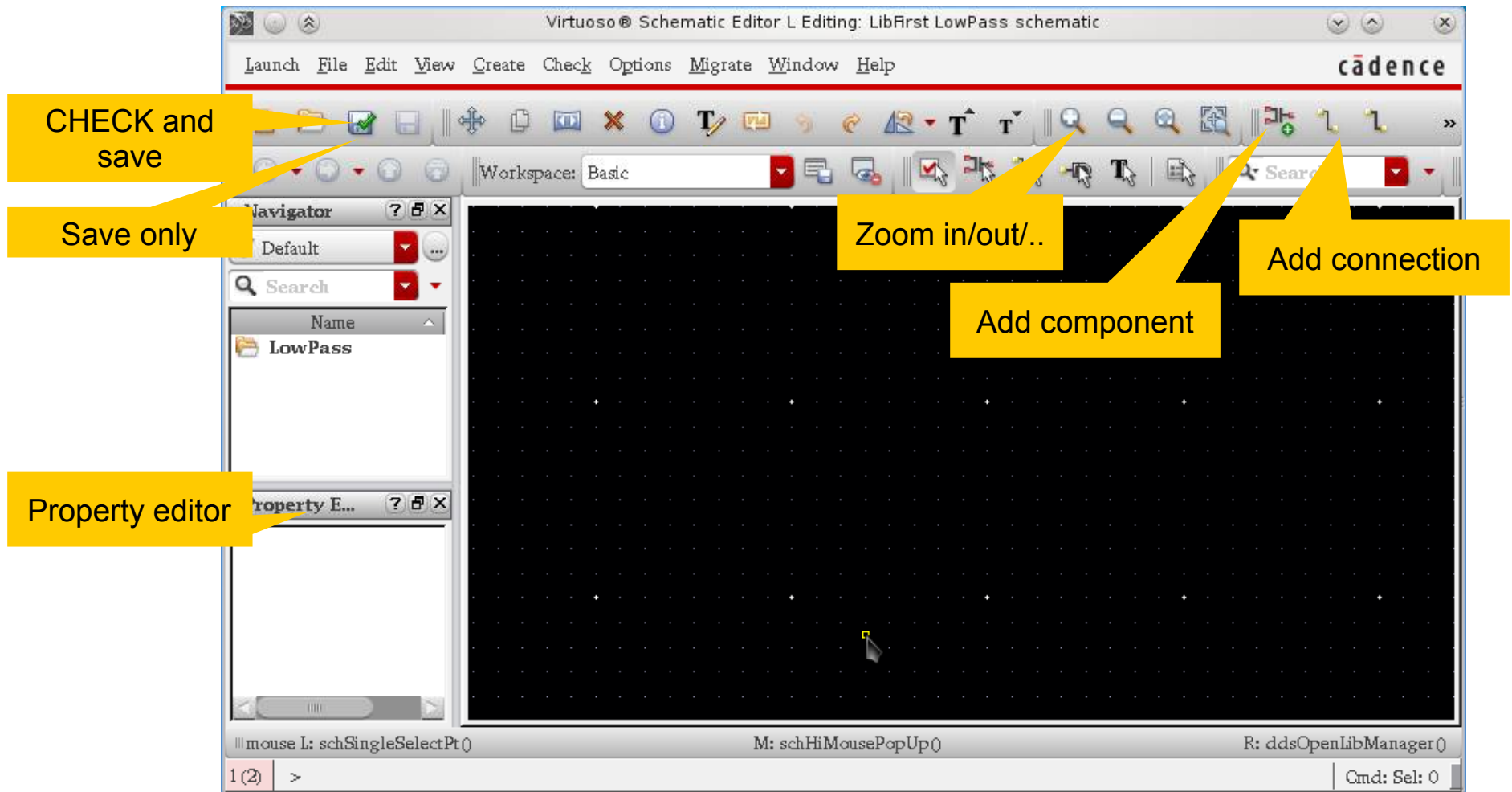
- Select your library
 - Create a new schematic with **File → New → Cell View...**
 - Select type 'schematic' by selecting from the drop down list
 - Give the cell a name
 - The schematic editor opens
 - Save the cell!
-
- Check that the cell is now in your library
 - If you select the cell, you should see the view 'schematic'
 - (You can create cell categories to sort your stuff with **File → New → Category**)






Opening the Schematic

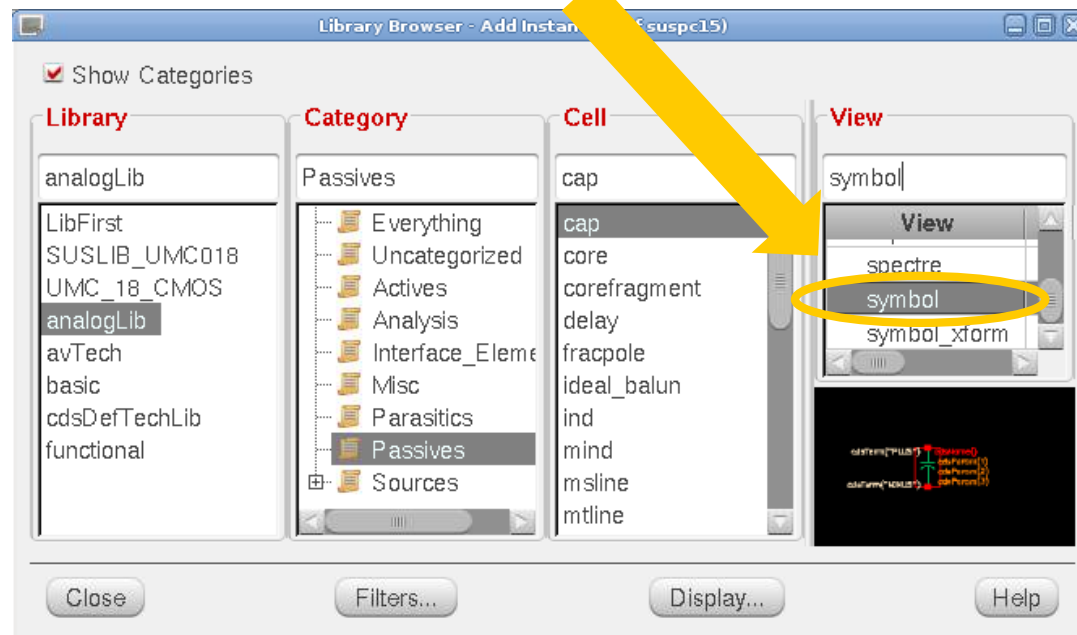
- Double click on the 'schematic' entry (or right click & open)
 - The schematic editor of 'virtuoso' comes up:





Adding a component (1)

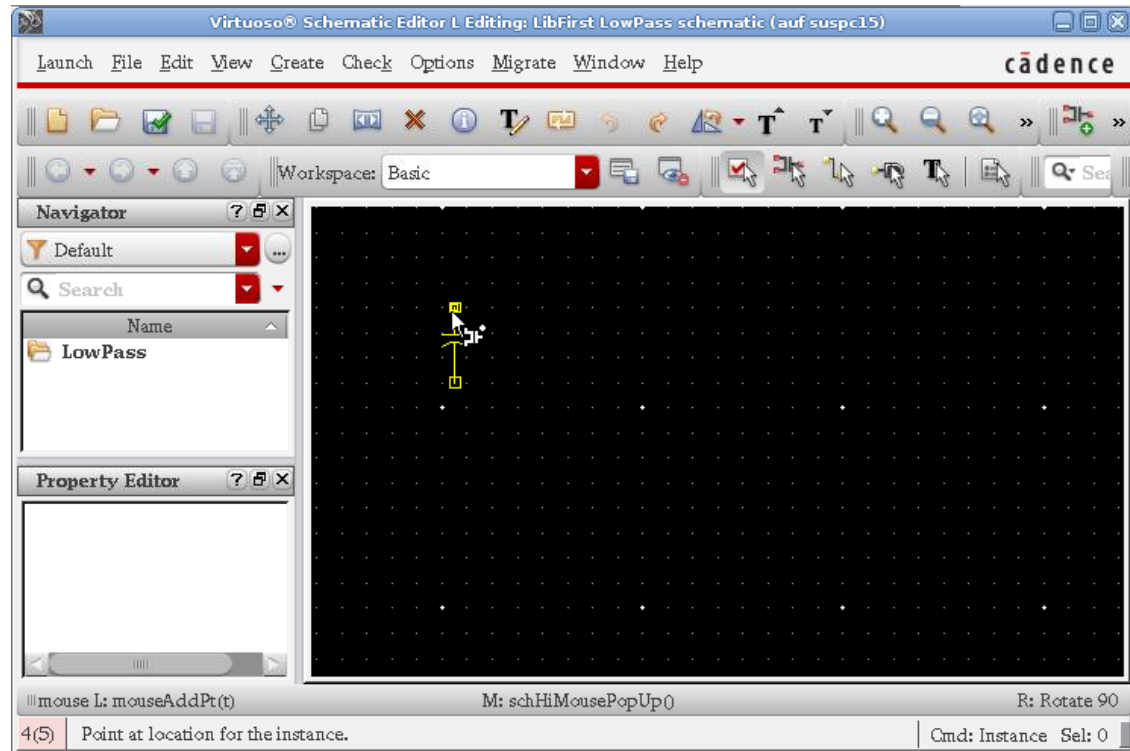
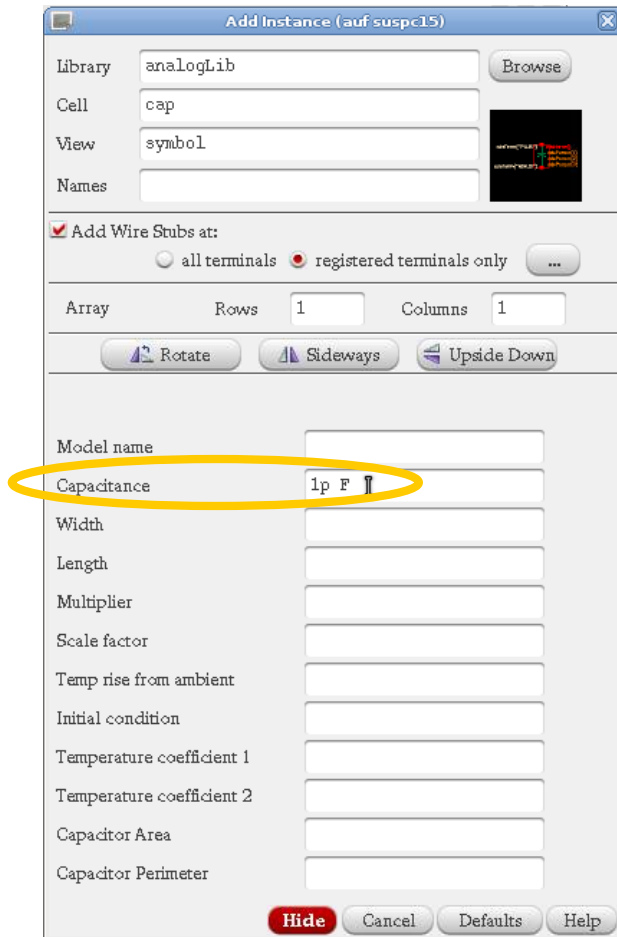
- To add a component ('instance')
 - Press the 'Create Instance' button  or
 - select **Create** → **Instance** or
 - press 'i'
- **Browse** to the correct library (for now: **analogLib**)
- **Choose** a cell from the library browser.
 - Make sure View '**symbol**' is selected!





Adding a component (2)


- Set the parameters (values) of the instance
 - For instance the resistance of a resistor
- Place the instance on the sheet (mouse click)



Press ESCAPE to finish.



Changing Parameters

- To change an instance
 - Press the 'Edit Properties' button  or
 - select **Create** → **Properties** → **Object** or
 - press 'q' or
 - use the **Property Editor Panel**

- For values, use the suffixes
 - **m** for milli = 10^{-3}
 - **u,n,p,f,a** for micro = 10^{-6} , nano, pico,...
 - **k** for Kilo = 10^3
 - **M** for Mega = 10^6 (**m** ↔ **M**!)
 - **G** for Giga = 10^9

- There is no need to supply the unit!
 - It is clear from the context





Executing Commands

- Two possibilities for most commands:

- Execute command once:
 - Select objects(s)
 - Press command key
 - Execute command (once)

- Multiple execution:
 - Press command key → switch to command mode (new cursor)
 - Select objects to execute commands on them
 - Press **ESC = escape** to end

- Example:
 - **Select – delete** delete one instance
 - **Delete – click – click ... - click – escape** delete multiple




Getting more command options

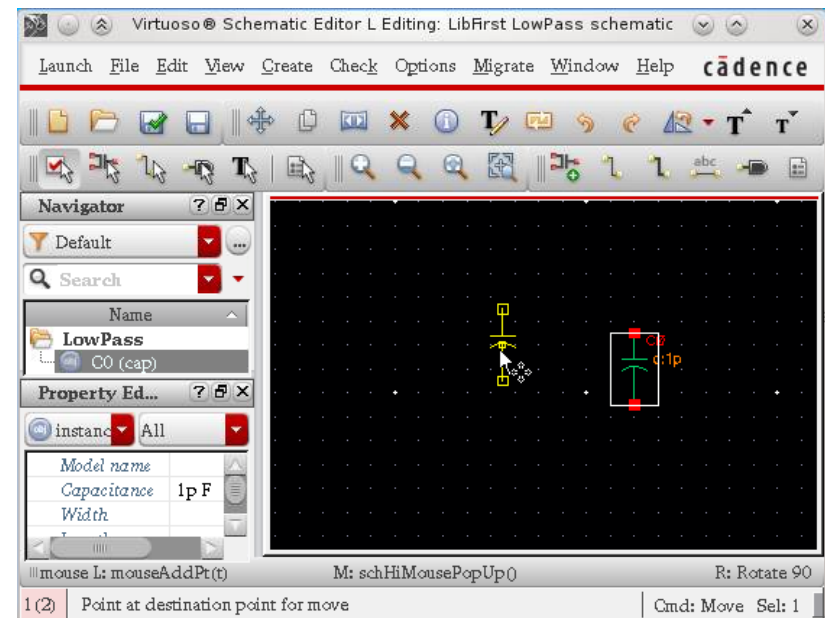
- In general, pressing **F3** while executing a command opens a window with more options.
 - rotate, flip
 - allowed routing angles
 - colors
 - ...

- Sometimes need to press **F3** twice




Moving an Instance

- Select the instance with the mouse
 - leftclick to select individual instances
 - shift – leftclick to add instances to selection
 - ctrl – leftclick to remove instances from selection
 - drag rectangle select instances in area
- To move
 - Press 'Move' button  or
 - select Edit → Move or
 - press 'm'
- Alternative:
 - First press 'm'
 - select – move – drop, ...ESC
- Alternative:
 - click – drag – drop
- For options (rotate, flip,...): F3 or right mouse

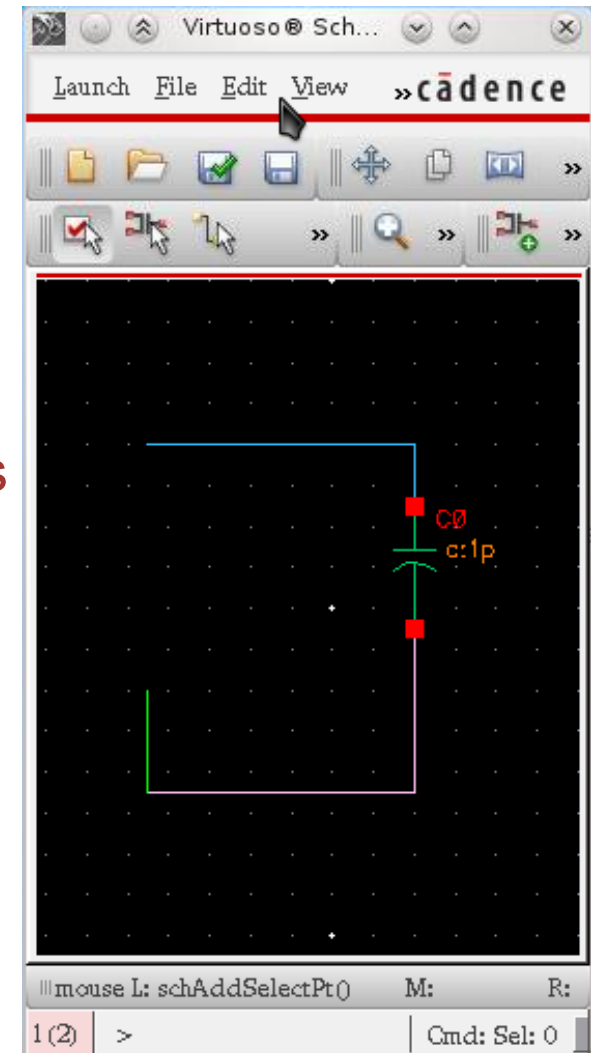




Adding Wires

- Wires connect the pins of instances
- To add a (narrow) wire ('path')
 - Select the  button
 - select **Create** → **Wire** or
 - press 'p'
- to change to 'path mode'
- Connect pins by multiple mouse clicks
- Finish with **ESC**

- Changing behavior: press **F3**
 - change angle
 - change color
 - ...







Zooming ...

- show everything: 'f' (fit)
- scroll: arrow keys
- zoom in: ctrl-z or]
- zoom out: shift-z or [
- zoom area: right mouse – drag
- pan selection: tab

- See menu **View**→ ...



Adding net Names

- To identify nets, you can
 - assign names (labels) to nets or
 - connect them to pins.
- To assign a label:
 - Press the  button or
 - Select **Create** → **Wire Name** or
 - Press **'l'** (label)
- Type in the label name and click on the net
- Continue with further labels
- End with **ESC**.
- To add a pin:
 - Press the  button or press **ctrl-p** or **Create** → **Pin**
 - Select **input / output** and place pin

Nets with the same names (labels) are automatically **connected!**

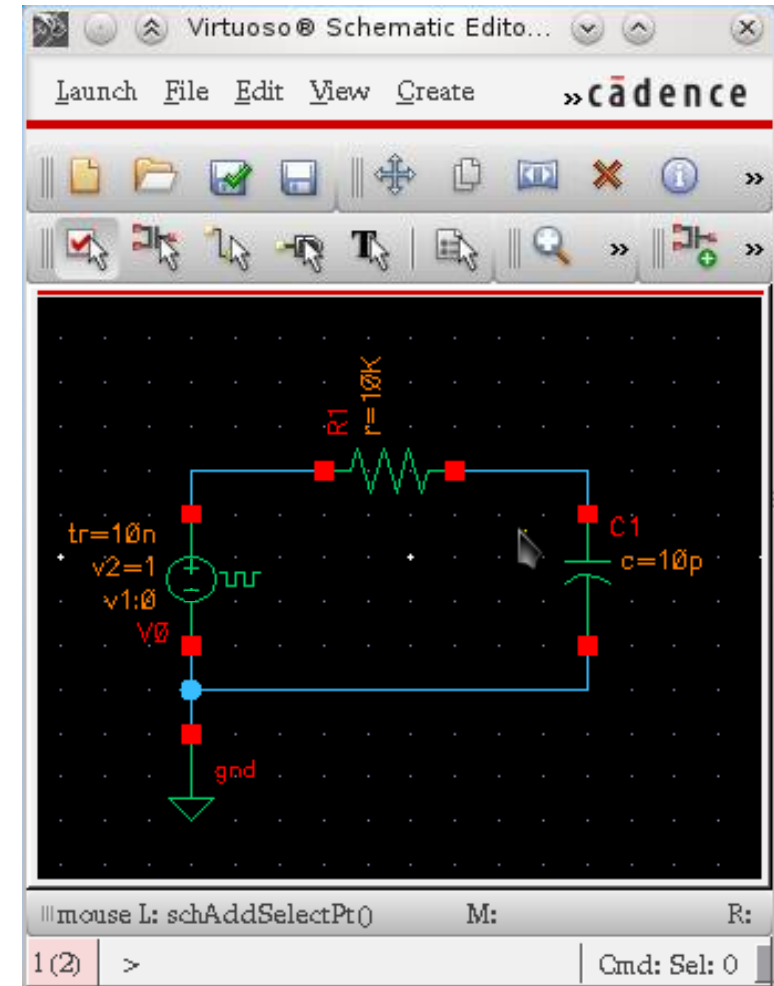


EXERCISE 1



Exercise 2.1

- Create a schematic 'LowPass'
- Draw a Low pass filter with
 - A resistor ('res') of 10 k Ω . (name it 'R1')
 - A capacitor ('cap') of 10 pF (name it 'C1')
 - A ground symbol ('gnd')
 - A pulse generator ('vpulse') which generates rectangular pulses from 0 \rightarrow 1V (voltage 1 / voltage 2) at a frequency of 1 MHz with rise / fall times of 10 ns
 - Set 'AC Magnitude' to 1
- Save the design





Exercise 2.2

- Save the design under the name 'HighPass'
 - Use **File** → **Save a Copy**
- Open the new schematic and modify it to give a High Pass Filter with RC time constant $10\mu\text{s}$