

## Chapter 04 - OpenROAD first run - TRAINING - Common

Course authors (Git file)



1 gcd example

2 ibex: RISC-V



## gcd example

Start the OpenROAD flow scripts for the gcd example. ORFS shall create a GDS in this run.



# Makefile

## Task: Enable the gcd design in the Makefile

- Navigate to the `/flow` folder
- Edit the Makefile:
  - Uncomment the line with `DESIGN_CONFIG` from `ihp-sg13g2` for the gcd example:

```
1 | DESIGN_CONFIG=./designs/ihp-sg13g2/gcd/config.mk
```

- Re-comment the previous uncommented line with `DESIGN_CONFIG`.
- The line with the default design does not need to be commented. This only applies when no previous line with `DESIGN_CONFIG` is set.



# Run

## Task: Run ORFS with the design

- Run `make` from inside the `/flow` folder.



# Success

- The chosen design should finish after a while with a table (time/memory) like this:

|    | Log                    | Elapsed seconds | Peak Memory/MB |
|----|------------------------|-----------------|----------------|
| 1  |                        |                 |                |
| 2  | 1_1_yosys              | 0               | 24             |
| 3  | 1_1_yosys_canonicalize | 0               | 17             |
| 4  | 1_1_yosys_hier_report  | 0               | 12             |
| 5  | 2_1_floorplan          | 0               | 110            |
| 6  | 2_2_floorplan_io       | 0               | 106            |
| 7  | 2_3_floorplan_tdms     | 0               | 98             |
| 8  | 2_4_floorplan_macro    | 0               | 106            |
| 9  | 2_5_floorplan_tapcell  | 0               | 105            |
| 10 | 2_6_floorplan_pdn      | 0               | 108            |
| 11 | 3_1_place_gp_skip_io   | 0               | 108            |
| 12 | 3_2_place_iop          | 0               | 107            |
| 13 | 3_3_place_gp           | 0               | 320            |
| 14 | 3_4_place_resized      | 0               | 289            |
| 15 | 3_5_place_dp           | 0               | 112            |
| 16 | 4_1_cts                | 1               | 379            |
| 17 | 5_1_grt                | 0               | 340            |
| 18 | 5_2_route              | 93              | 899            |
| 19 | 5_3_fillcell           | 0               | 111            |
| 20 | 6_1_fill               | 0               | 113            |
| 21 | 6_1_merge              | 1               | 368            |
| 22 | 6_report               | 1               | 292            |
| 23 | Total                  | 96              | 899            |

# The flow steps

## Task: Match the shell output

- Scroll the shell output from the command to the (successfull) end,
- Identify the flow steps in the shell output
- Try to match your findings to the flow steps and flow components from chapter 2
- Can you identify single open-source tools in the output of the flow? Name the ones you identified.



# The GDS

## Task: Examine the GDS

- See the GDS with the command `make gui_final`

## Task: Save an image from the GDS

- In the TCL console at the bottom of the GUI:
  - `save_image <imagename>.png`
  - Find the saved image in your directories.





## Task: Create a GDS of the ibex design

- Do the same as with the gcd example, but now for the ibex example.
- Do the steps from above:
  - Makefile: Enable ibex design
  - Run ORFS with `make`
  - Examine the shell output
  - See the GDS with `make gui_final`
  - Save an image of the GDS.

**Be aware:** This ORFS run will take more then 30 minutes to finish!

