

Designs ran on ASAP7 PDK Platform – Test 2

All the documentation is also drafted in my Github Forked Repository >> **7nmcontest** branch >>
7nmdesigncontest.md file.

<https://github.com/KunalKokate/OpenROAD-flow-scripts/tree/7nmcontest>

AIM:

To improve the timing parameters below by making changes in CTS script:

1. Overall Performance Elapsed Runtime
2. CPU User Time
3. CTS Elapsed Seconds to run CTS Stage

All the parameters to look are highlighted in **bold**.

Description:

In this document, the idea is to modify the OpenROAD scripts for improvement of CTS timings. I plan to improve the overall runtime for a design by modifying the Clock Tree Synthesis TCL script.

To do so, I have updated the **scripts/cts.tcl** file to improve the **Overall Performance Elapsed Runtime**, **CPU User Time**, and **CTS Elapsed Seconds to run CTS Stage**

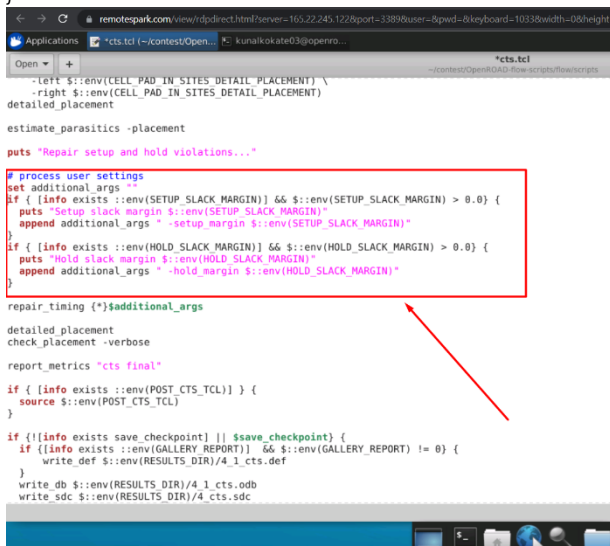
Steps taken:

- Goto OpenROAD-flow-scripts/flow/scripts
- Gedit cts.tcl
- Updated the process user settings if loop with for loop.
And saved the file.

Before:

Code –

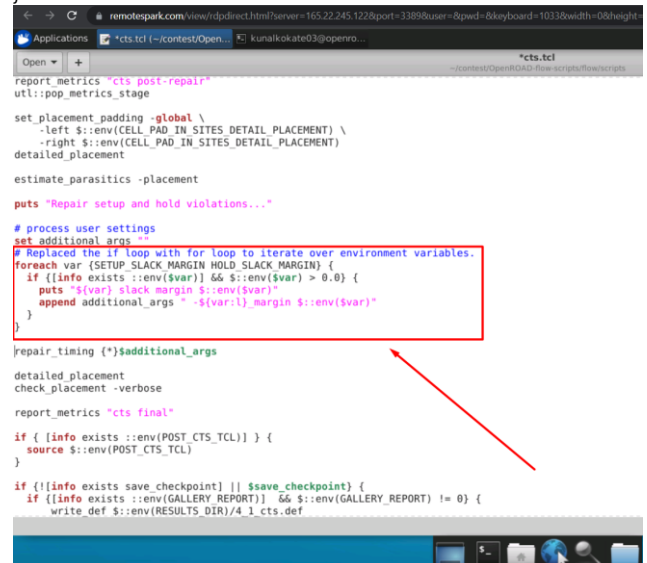
```
if { [info exists ::env(SETUP_SLACK_MARGIN)] && $::env(SETUP_SLACK_MARGIN) > 0.0 } {
    puts "Setup slack margin $::env(SETUP_SLACK_MARGIN)"
    append additional_args "-setup_margin $::env(SETUP_SLACK_MARGIN)"
}
if { [info exists ::env(HOLD_SLACK_MARGIN)] && $::env(HOLD_SLACK_MARGIN) > 0.0 } {
    puts "Hold slack margin $::env(HOLD_SLACK_MARGIN)"
    append additional_args "-hold_margin $::env(HOLD_SLACK_MARGIN)"
}
```



After:

Code –

```
foreach var {SETUP_SLACK_MARGIN HOLD_SLACK_MARGIN} {
    if {[info exists ::env($var)] && $::env($var) > 0.0} {
        puts "${var} slack margin $::env($var)"
        append additional_args "-${var:l}_margin $::env($var)"
    }
}
```



This code uses a **foreach** loop to iterate over the environment variables **SETUP_SLACK_MARGIN** and **HOLD_SLACK_MARGIN**. Inside the loop, it checks if the variables exist and their values are greater than 0.0. If they do, it prints a message and appends

their values to the additional_args variable using the append command. Note that \${var:l} converts the first letter of the variable name to lowercase and appends the string _margin to it.

This code eliminates the need for separate **if statements**, and thus simplifies the code.

After making the changes and saving the file. I ran the same designs again to see the improvement in the timings as illustrated below:

TEST 2: Runtimes of all the designs after modifying the CTS TCL Script in ORFS

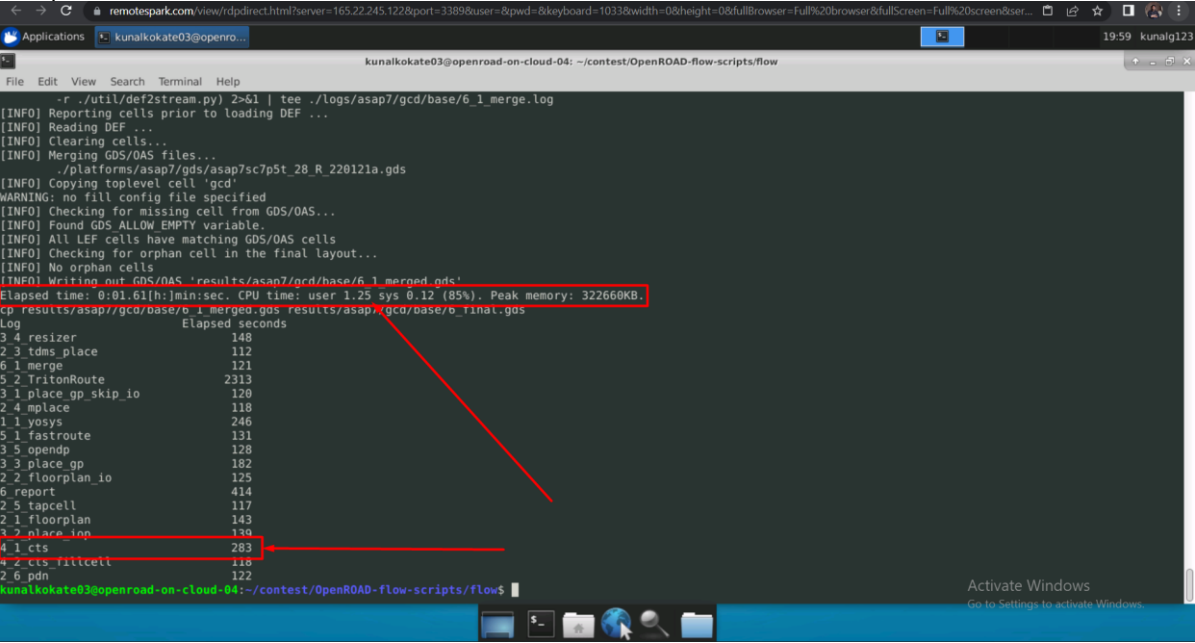
GCD Design

Overall Performance time

Elapsed time: 0:01.61[h:]min:sec. CPU time: user **1.25** sys 0.12 (85%). Peak memory: 322660KB.

cp results/asap7/gcd/base/6_1_merged.gds results/asap7/gcd/base/6_final.gds

Log	Elapsed seconds
3_4_resizer	148
2_3_tdms_place	112
6_1_merge	121
5_2_TritonRoute	2313
3_1_place_gp_skip_io	120
2_4_mplace	118
1_1_yosys	246
5_1_fastroute	131
3_5_opendp	128
3_3_place_gp	182
2_2_floorplan_io	125
6_report	414
2_5_tapcell	117
2_1_floorplan	143
3_2_place_iop	139
4_1_cts	283
4_2_cts_fillcell	118
2_6_pdn	122



Timing report from 4_1_cts.log

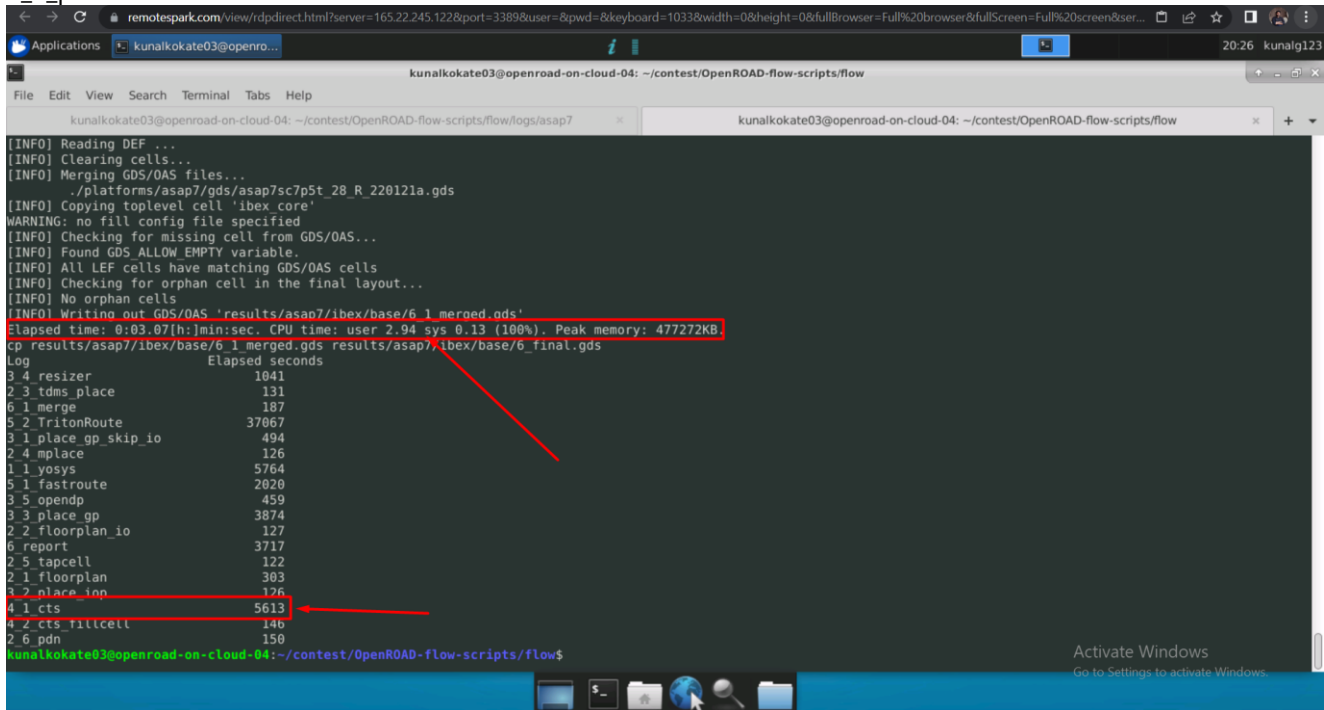
Elapsed time: 0:04.43[h:]min:sec. CPU time: user **4.36** sys 0.06 (99%). Peak memory: 197336KB.

IBEX Design

Elapsed time: 0:03.07[h:]min:sec. CPU time: user 2.94 sys 0.13 (100%). Peak memory: 477272KB.

cp results/asap7/ibex/base/6_1_merged.gds results/asap7/ibex/base/6_final.gds

Log	Elapsed seconds
3_4_resizer	1041
2_3_tdms_place	131
6_1_merge	187
5_2_TritonRoute	37067
3_1_place_gp_skip_io	494
2_4_mplace	126
1_1_yosys	5764
5_1_fastroute	2020
3_5_opendp	459
3_3_place_gp	3874
2_2_floorplan_io	127
6_report	3717
2_5_tapcell	122
2_1_floorplan	303
3_2_place_iop	126
4_1_cts	5613
4_2_cts_fillcell	146
2_6_pdn	150



```
remotespark.com/view/rdpdirect.html?server=165.22.245.122&port=3389&user=8pwd=&keyboard=1033&bwidth=0&height=0&fullBrowser=Full%20browser&fullScreen=Full%20screen&ser...
kunaikokate03@openro...
kunaikokate03@openroad-on-cloud-04: ~/contest/OpenROAD-flow-scripts/flow
File Edit View Search Terminal Tabs Help
kunaikokate03@openroad-on-cloud-04: ~/contest/OpenROAD-flow-scripts/flow/logs/asap7
kunaikokate03@openroad-on-cloud-04: ~/contest/OpenROAD-flow-scripts/flow
[INFO] Reading DEF ...
[INFO] Clearing cells...
[INFO] Merging GDS/OAS files...
./platforms/asap7/gds/asap7sc7p5t_28_R_220121a.gds
[INFO] Copying toplevel cell 'ibex core'
WARNING: no fill config file specified
[INFO] Checking for missing cell from GDS/OAS...
[INFO] Found GDS_ALLOW_EMPTY variable.
[INFO] All LEF cells have matching GDS/OAS cells
[INFO] Checking for orphan cell in the final layout...
[INFO] No orphan cells
[INFO] Writing out GDS/OAS 'results/asap7/ibex/base/6_1_merged.gds'
Elapsed time: 0:03.07[h:]min:sec. CPU time: user 2.94 sys 0.13 (100%). Peak memory: 477272KB.
cp results/asap7/ibex/base/6_1_merged.gds results/asap7/ibex/base/6_final.gds
Log
Elapsed seconds
3_4_resizer 1041
2_3_tdms_place 131
6_1_merge 187
5_2_TritonRoute 37067
3_1_place_gp_skip_io 494
2_4_mplace 126
1_1_yosys 5764
5_1_fastroute 2020
3_5_opendp 459
3_3_place_gp 3874
2_2_floorplan_io 127
6_report 3717
2_5_tapcell 122
2_1_floorplan 303
3_2_place_iop 126
4_1_cts 5613
4_2_cts_fillcell 146
2_6_pdn 150
kunaikokate03@openroad-on-cloud-04:~/contest/OpenROAD-flow-scripts/flow$
```

Timing report from 4_1_cts.log

Elapsed time: 1:33.33[h:]min:sec. CPU time: user 93.20 sys 0.13 (100%). Peak memory: 297076KB

RISCV32i Design

Elapsed time: 0:02.48[h:]min:sec. **CPU time: user 2.38** sys 0.09 (99%). Peak memory: 445452KB.

cp results/asap7/riscv32i/base/6_1_merged.gds results/asap7/riscv32i/base/6_final.gds

Log	Elapsed seconds
3_4_resizer	497
2_3_tdms_place	121
6_1_merge	168
5_2_TritonRoute	27441
3_1_place_gp_skip_io	116
2_4_mplace	8111
1_1_yosys	1758
5_1_fastroute	793
3_5_opendp	365
3_3_place_gp	2136
2_2_floorplan_io	119
6_report	1804
2_5_tapcell	114
1_1_yosys_hier_report	2435
2_1_floorplan	183
3_2_place_iop	117
4_1_cts	1824
4_2_cts_fillcell	150
2_6_pdn	136

```
[INFO] Reporting cells prior to loading DEF ...
[INFO] Reading DEF ...
[INFO] Clearing cells...
[INFO] Merging GDS/OAS files...
./platforms/asap7/gds/asap7sc7p5t_28_R_220121a.gds
[INFO] Copying toplevel cell 'riscv_top'
WARNING: no fill config file specified
[INFO] Checking for missing cell from GDS/OAS...
[INFO] Found GDS_ALLOW_EMPTY variable.
[WARNING] LEF Cell 'fakram7_256x32' ignored. Matches GDS_ALLOW_EMPTY.
[INFO] Checking for orphan cell in the final layout...
[INFO] No orphan cells
[INFO] Writing out GDS/OAS 'results/asap7/riscv32i/base/6_1_merged.ods'
Elapsed time: 0:02.48[h:]min:sec. CPU time: user 2.38 sys 0.09 (99%). Peak memory: 445452KB.
cp results/asap7/riscv32i/base/6_1_merged.gds results/asap7/riscv32i/base/6_final.gds
Log
Elapsed seconds
3_4_resizer 497
2_3_tdms_place 121
6_1_merge 168
5_2_TritonRoute 27441
3_1_place_gp_skip_io 116
2_4_mplace 8111
1_1_yosys 1758
5_1_fastroute 793
3_5_opendp 365
3_3_place_gp 2136
2_2_floorplan_io 119
6_report 1804
2_5_tapcell 114
1_1_yosys_hier_report 2435
2_1_floorplan 183
3_2_place_iop 117
4_1_cts 1824
4_2_cts_fillcell 150
2_6_pdn 136
kunalg123@openroad-on-cloud-04:~/contest/OpenROAD-flow-scripts/flow$
```

Timing report from 4_1_cts.log

Elapsed time: 0:30.24[h:]min:sec. **CPU time: user 30.12** sys 0.11 (99%). Peak memory: 296780KB.