

# ICCAD 2019 CAD Contest

## Problem C: LEF/DEF Based Open-Source Global Router

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## 0. Announcement

### October

- 2019-10--

### September

- 2019-09-06- The FAQ of ProblemC is updated.
- 2019-09-05- The FAQ of ProblemC is updated.

### August

- 2019-08-21- The FAQ of ProblemC is updated.
- 2019-08-14- ProblemC description and FAQ are updated.
- 2019-08-13- The Beta Report and the FAQ of Problem C are updated.

### July

- 2019-07-29- The FAQ of ProblemC is updated.
- 2019-07-24- ProblemC description and FAQ are updated.
- 2019-07-24- The ispd19eval of ProblemC is replaced with eval.
- 2019-07-19- The FAQ of ProblemC is updated.
- 2019-07-16- The FAQ of ProblemC is updated again.
- 2019-07-16- The FAQ of ProblemC is updated.
- 2019-07-16- The ispd19eval.tar of ProblemC is updated again.
- 2019-07-16- The drcu\_june19 of ProblemC is updated again.
- 2019-07-15- The ispd19eval.tar of ProblemC is updated.
- 2019-07-15- The drcu\_june19 of ProblemC is updated.
- 2019-07-10- The Alpha Report and FAQ of ProblemC is updated.
- 2019-07-10- The FAQ of ProblemC is updated.
- 2019-07-09- The Alpha Report of ProblemC is updated.

### June

- 2019-06-28- ProblemC description and FAQ are updated.
- 2019-06-28- The drcu\_june19 of ProblemC is updated.
- 2019-06-26- The FAQ of ProblemC is updated.
- 2019-06-25- ProblemC description is updated.
- 2019-06-18- The FAQ of ProblemC is updated.
- 2019-06-04- The iccad19\_benchmarks\_v2 of ProblemC is updated.
- 2019-06-04- The FAQ of ProblemC is updated.

### May

- 2019-05-24- The FAQ of ProblemC is updated.
- 2019-05-17- ProblemC description and FAQ are updated.
- 2019-05-17- The iccad19\_benchmarks of ProblemC is updated.
- 2019-05-07- ProblemC description is updated.

## **March**

- 2019-03-25- ProblemC is updated.

## **February**

- 2019-02-01- ProblemC is announced.

# ICCAD 2019 Contest

## LEF/DEF Based Open-Source Global Router

### Introduction

Due to the increasing complexity and enormous solution space of the VLSI routing problem, the routing is typically split into two stages -- global routing and detailed routing. In global routing, the routing region is divided into rectangular grid cells (GCells) and represented using a coarse-grained 3D routing graph. Capacities and various constraints are assigned to the edges and vertices in this 3D routing graph so that overall routing topology and layer assignment can be optimized considering routability, timing, crosstalk, power, etc.

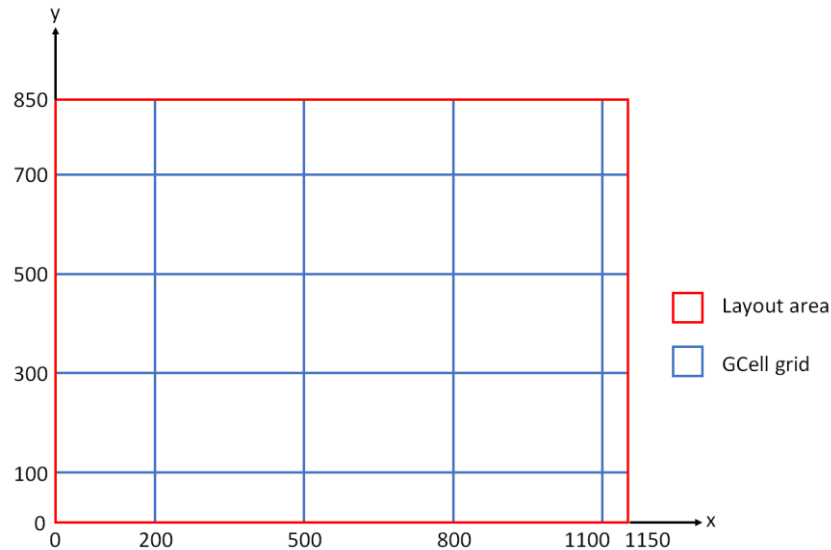
In this contest, to simplify our focus, we assume that a placement solution is already well-optimized for multiple metrics (e.g., timing, power, etc.), and the global router, without concerning metrics such as timing and / or crosstalk, only needs to provide a 3D global routing solution which the detailed router can then use as guidance to generate a DRC-clean routing solution. Toward this end, the global routing solution must maximize routability, pin accessibility, etc. to ensure that the disturbance of net topology during detailed routing is minimized.

### Input/Output Format

The design and technology are provided in LEF/DEF format. Teams will need to parse design and technology information from LEF and DEF files. A good starting point is the LEF/DEF parser [here](#).

Unlike in the ISPD-2018/2019 contests, in this global routing contest, we specify GCells by utilizing the definition from the DEF GCELLGRID section. The figure below illustrates the following definition:

```
GCELLGRID X 1100 DO 2 STEP 50 ;  
GCELLGRID X 200 DO 4 STEP 300 ;  
GCELLGRID X 0 DO 2 STEP 200 ;  
GCELLGRID Y 700 DO 2 STEP 150 ;  
GCELLGRID Y 100 DO 4 STEP 200 ;  
GCELLGRID Y 0 DO 2 STEP 100 ;
```



The output file format will be the ISPD-2018/2019 route guide format. This choice of input/output formats is intended to make it possible for as many academic teams and tools as possible to access this contest, and to enable integration with both commercial tool flows and the academic detailed routers created for the ISPD-2018/2019 contests.

In the route guide format, the global routing solution for a net consists of several guides. Each guide is a rectangle on a specific metal layer, covering one or multiple contiguous GCells. To be consistent with our GCELLGRID definition, we make the following restrictions to each guide:

- If a GCell is covered by a guide, the guide must cover that **entire** GCell area, and NOT just part of that GCell area.
- ONLY guides on routing layers (i.e., TYPE ROUTING in LEF) are needed. Guides on via layers (i.e., TYPE CUT in LEF) are skipped.

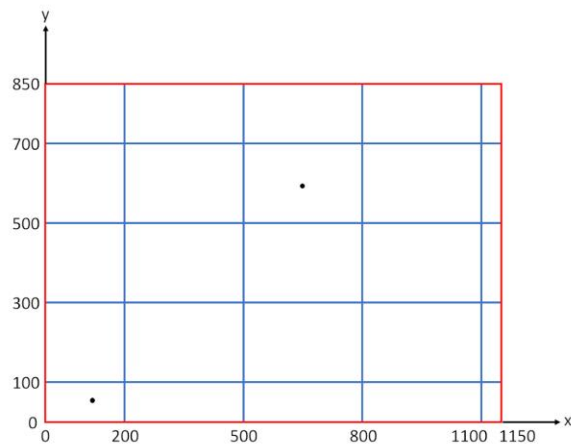
A global routing solution for a net is considered to be valid if

- **All pins (i.e., instance terms and IO terms) of the net are covered by its guides.** Here, “covered by” means that for each pin of the net, at least one shape of the pin and one guide of the net are on the same metal layer, and have intersection area strictly greater than ( $>$ ) zero.
- **The guides of the net induce a connected graph.** That is, let each guide correspond to a vertex in the graph. And, let an edge exist between two vertices of the graph if the corresponding two guides satisfy either of the following two conditions: (i) they touch each other on the same metal layer; (ii) they are on neighboring metal layers with an overlapped area (projected to xy plane) strictly greater than ( $>$ ) zero. The graph induced in this way must be connected.

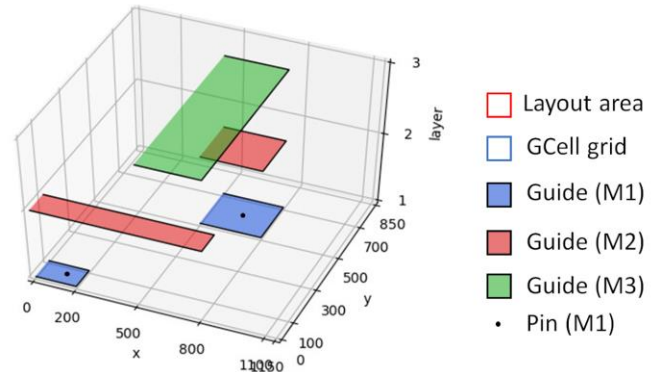
A global routing solution is considered to be valid if the solution is valid for all of the nets. The figure below shows a valid global routing solution for a two-pin net, corresponding to the following guides:

net0

```
(
0 0 200 100 Metal1
0 0 800 100 Metal2
500 0 800 700 Metal3
500 500 800 700 Metal2
500 500 800 700 Metal1
)
```



(a) 2D view of a net with two pins



(b) 3D view of a valid GR solution

## Benchmarks

We use the same benchmarks from [ISPD-2018](#) and [ISPD-2019](#) contests with GCELLGRID added in DEF file. **Please download the benchmark suite ([here](#))**. Hidden benchmarks will be used along with all the public benchmarks for final evaluation.

## Router Evaluation and Ranking

To best evaluate and bridge the gap between global routing and detailed routing, we do not directly evaluate global routing solution based on any extracted information from the output route guide file. Instead, the global routing solution will be detailed routed using executable of academic detailed routers from CUHK ([here](#)).

With tool sponsorship from Cadence Academic Network, we are able to use Cadence Innovus Implementation System<sup>1</sup> and the modified ISPD-2018 and ISPD-2019 evaluation binary and scripts ([here](#)) on TSRI machines to calculate detailed routing scores. (Each team is now able to launch detailed router, Innovus + evaluation binary on TSRI machines.) Innovus can be found by sourcing the following scripts.

<sup>1</sup> The TSRI/CIC environment, including computing resources and licensed tools, is for the CAD Contest only. Do NOT use it for any other purpose.

source /cad/cadence/CIC/innovus.cshrc  
source /cad/cadence/CIC/license.csh

The raw score will be purely based on the quality of the resulting detailed routing solution using the same ISPD-2019 contest metrics shown in the table below.

Length of wire	0.5	Length of out-of-guide wires	1
# vias	4	# out-of-guide vias	1
Length of wrong-way wire	1	Number of min-area violations	500
# off-track vias	1	Number of spacing violations	500
Length of off-track wires	0.5	Number of short violations	500
		Short metal area / M2 pitch	500

The raw score will be scaled by a runtime factor and by a non-determinism penalty factor of the global router. We use the same equation as in the ISPD-2018/2019 contests. A good global routing solution reduces the search and repair effort needed in the detailed router. Therefore, the runtime factor applies to both the global and detailed router.

$$\text{Runtime\_factor} = \min(0.1, \max(-0.1, 0.02 * \log_2( \text{GRouter\_Wall\_Time} + \text{DRouter\_Wall\_Time} ) / \text{Median\_Wall\_Time} ) )$$

The median wall time is the median runtime of all submitted global routers from contestants for the benchmark. The runtime penalty/benefit is limited within 0.1/-0.1 .

Teams are allowed to use multi-threading (up to 8) in their router, but they will receive a non-determinism penalty factor of 3% if the output guide file is non-deterministic using the same command line arguments.

## Final Submission

For final submission, each team will need to upload their GR binary to their assigned CIC machine. We will use the submitted GR binary to generate GR solution, measure runtime and then feed to a DR of our choice (binary will be distributed and updated until prior to the submission) to generate routed DEF for final score calculation.

The executable of the submitted global router needs to be named “iccad19gr” and be able to take the following command line arguments. We will always specify 8 threads as the command line argument but the multithreading feature is optional.

```
./iccad19gr -lef [lef_file] -def [def_file] -threads [num_threads] -output  
<output_file_name>
```

## Open-Sourcing Bonus

The organizers have augmented the available prizes as follows. The highest prize-winning team that releases their code under a BSD, MIT or Apache license during ICCAD-2019 will receive a bonus prize (given in \$USD) of 4X their awarded prize. Thus, this team would receive a total of 5X their original prize money. Similarly, the second (resp. third) highest prize-winning team that releases their code under a BSD, MIT or Apache license during ICCAD-2019 will receive a bonus prize (given in \$USD) of 2X (resp. 1X) their awarded prize.

## Contest Organizers

Alexander Volkov (Mentor Graphics)

Sergei Dolgov (Mentor Graphics)

Lutong Wang (UCSD)

Bangqi Xu (UCSD)

**Special thanks to Cadence Academic Network for the tool/script sponsorship**



VII. Alpha Report

ispd18_test1	ispd18_test2	ispd18_test3	ispd18_test4	ispd18_test5	ispd18_test6	ispd18_test7	ispd18_test8	ispd18_test9	ispd18_test10
failed	1087503327 done	1168057041 done	failed	failed	5933702844 done	failed	failed	10210673332 done	12270888567 done
25893252 done	failed	1138992334 done	4596229229 done	4037662018 done	5944595429 done	12086730627 done	11879174984 done	10049675082 done	12119730860 done
1416503 done	21735596 done	33841605 done	58970778 done	120765515 done	45755225 done	382934862 done	383970780 done	75247762 done	177749962 done
2362041 done	34181335 done	100957957 done	failed	failed	failed	failed	failed	failed	failed

VIII. Beta Report

rank	ispd18_test1	ispd18_test2	ispd18_test3	ispd18_test4	ispd18_test5	ispd18_test6	ispd18_test7	ispd18_test8	ispd18_test9	ispd18_test10	ispd19_test1	ispd19_test2	ispd19_test3	ispd19_test4	ispd19_test5	ispd19_test6	ispd19_test7	ispd19_test8	ispd19_test9	ispd19_test10
1	288410	4673056	5201356	15393910	16268123	21205829	37737163	38255578	32678367	44395660	597682	21600436	954739	9999999999	9999999999	46974396	92067724	139025766	222457596	222562605
2	291291	4700934	5298745	15756404	16366743	21630646	38412191	38602461	33129214	42704252	597403	21910640	1060034	22312599	3297338	47336856	98736640	136530155	214519790	214337744
3	297129	5003263	5635071	16268350	17967566	24017800	43016159	45273832	37659606	52936349	661069	26355530	1141897	9999999999	9999999999	62036496	227532048	9999999999	9999999999	9999999999
4	304085	5353365	53634935	86926374	166026018	37634891	301834954	9999999999	56488632	135638437	876266	98496148	4552255	9999999999	9999999999	316074639	9999999999	4835565686	7541508522	2929561276
5	84364970	1032841970	1093354907	4801303324	4021395941	6046191559	12155012048	11930217141	10277507279	12485152962	119200077	4676342440	213406572	2862951919	711422229	10949456858	21952297820	20628000195	21007046464	20502461943
6	2289170	87518858	89550922	267804752	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	3154377	427539080	13130472	9999999999	9999999999	9999999999	16616411408	9999999999	9999999999	16304845977
7	10248673	195349549	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999
8	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999	9999999999

final ranking	ispd18_test1	ispd18_test2	ispd18_test3	ispd18_test4	ispd18_test5	ispd18_test6	ispd18_test7	ispd18_test8	ispd18_test9	ispd18_test10	ispd19_test1	ispd19_test2	ispd19_test3	ispd19_test4	ispd19_test5	ispd19_test6	ispd19_test7	ispd19_test8	ispd19_test9	ispd19_test10	sum of raw ranking	minus worse one	final avg. ranking
1	1	1	1	1	1	1	1	1	1	2	2	1	1	3	3	1	1	2	2	2	29	3	1.368421053
2	2	2	2	2	2	2	2	2	2	1	1	2	2	1	1	2	2	1	1	1	33	2	1.631578947
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	6	67	6	3.210526316
4	4	4	4	4	4	4	4	5	4	4	4	4	4	3	3	4	6	3	3	3	78	6	3.789473684
5	7	7	7	6	6	5	5	5	4	5	5	6	6	2	2	5	5	4	4	5	100	7	4.894736842
6	5	5	5	5	5	6	6	6	5	6	6	5	5	3	3	6	4	5	5	4	100	6	4.947368421
7	6	6	7	7	7	6	6	6	5	6	6	7	7	3	3	6	6	5	5	6	116	7	5.736842105
8	8	8	8	7	7	6	6	6	5	6	6	7	7	3	3	6	6	5	5	6	120	8	5.894736842

## IX. FAQ

Q1. In the output, to determine if two gcells are connected, "(1)they touch each other on the same metal layer." Q: If two gcells on the same layer only touch each other by a point, for example one is at the lower left of another gcell. is it considered as connected?

A1. If two guides touch only by a point, then it's considered as disconnected. For two same-layer guides to be considered connected, they must share an edge with length strictly greater than ( $>$ ) zero.

Q2. In some routing guide input of ISPD18/19, some pins don't have routing guide on the same layer. I guess this is not allowed in this contest?

For example in figure (b), if there are two vias directly connecting to the two pins on M1, the two blue guides on M1 is not necessary.

A2. Since we do not have via guides, all guides must be on the routing layer. In your example, the two M1 (blue) guides are necessary if those pin shapes only exist in M1. A pin is considered covered only if at least one shape of the pin and one guide of the net are **on the same metal layer**, and have **intersection area strictly greater than ( $>$ ) zero.**"

Q3. Some of the input doesn't have GCELLGRID information, such as ispd18\_test1. Will the input be updated later?

A3. Please download the latest benchmark suite.

Q4. We hope to know when will details of the benchmarks be released.

Since, though, we have access to ispd-2019 contest's benchmarks, they don't contain any information of GCell specification.

A4. You can download the latest [benchmark suite](#) (v1, 5/16/2019) with GCELLGRID included. Please be sure to use the testcases from our download link since the GCELLGRID included is different than the content you can find from the ISPD-2018/2019 website.

Q5. If two gcells are on a horizontal layer and adjacent to each other in vertical direction, are they considered connected?

A5. Yes.

Q6. I would like to know where to get the source codes from academic routers (CUHK, UCSD, NCTU, POSTECH and UFRGS). I'm asking this because they will be used to evaluate our solution and I found only two of them

(CUHK: [github.com/cuhk-eda/dr-cu](https://github.com/cuhk-eda/dr-cu) and UFRGS: [github.com/RsynTeam/rsyn-x](https://github.com/RsynTeam/rsyn-x)).

A6. We will only provide academic router binaries to the contestants.

Q7. We have noticed some anomalies in the benchmarks for problem C released on May 17th.

Two of them are listed below.

1. Several benchmarks have pins outside of the gcell grids.  
For example in ispd18\_test1, ispd18\_test2, we found there are pins whose locations are beyond the last (highest) X grid line.
2. The gcell specification of ispd19\_test2 is also kind of strange.

```
GCELLGRID Y 1740000 DO 2 STEP 5600 ;  
GCELLGRID Y 0 DO 581 STEP 3000 ;  
GCELLGRID X 1173000 DO 2 STEP 5400 ;  
GCELLGRID X 0 DO 2 STEP 3001 ;
```

The Y direction is fine, but for the X direction, only 4 grid lines are defined.

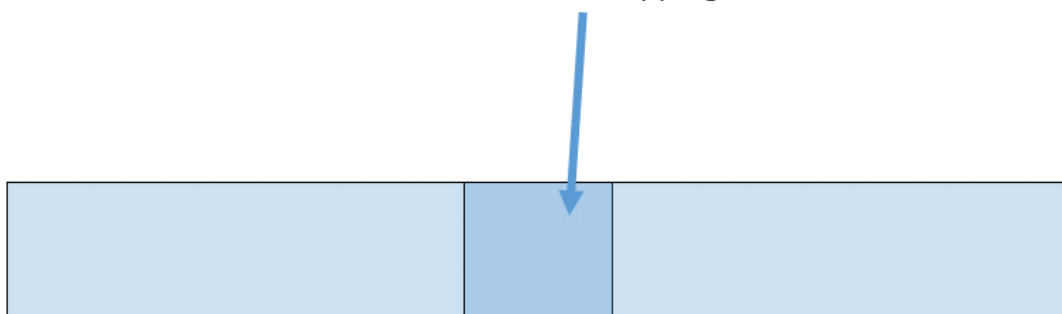
Hope you can update accordingly in a future version,  
or clarify a little bit if it is our misunderstanding. Thank you.

A7. Thanks for pointing out. We have updated the GCELLGRID in benchmark v2.  
Please let us know if you find any more issues.

Q8. i am hoping to know, if it is feasible that two gcells can overlapped each other while the gcells are belongs to same net?

(you can comprehend by looking up the attached file)

Metal 1 overlapping



A8. It's allowed.

Q9. Can we use c++11 in our code?

A9. There is no restriction in the programming language and standard. However, we do require that your binary is okay to run on the TSRI/CIC machines. To achieve this, please make sure to statically link (-static) your binary on your platform so most of Linux distributions will be able to run it without any pre-installed packages.

Q10. We wanted to install two packages called flex and bison, so that we can compile the SI2 Parser on the host machine and extract the libraries so that they are compatible with the host architecture. However, we do not have sudo access, and when we tried to download the packages and compile them, it also needed sudo access. Can those two packages be provided?

Thank you!

A10. We expect you to statically link your binary (-static) on your platform and upload to the TSRI/CIC machines so that your binary would have no dependency issues. An alternative way is to build all necessary packages by yourself on TSRI/CIC machines then include and link against the correct directory. Your building and installation of 3rd party packages into your directory on TSRI/CIC machines requires no root access. However, you still have to use -static linking so that the binary is okay to run even on a system without such packages.

Q11. I would like to ask that in the document, FAQ problem7, the committee said they will provide academic router binaries.

Also, at the bottom of page 6 also said that (Each team is now able to launch detailed router, Innovus + evaluation binary on TSRI machines.)

But I did not find any execution file in my account from TSRI machines.

Could you please kindly point out where DR's binary files are?

A11. We have just uploaded the latest version of Dr. CU from CUHK (many thanks to their contributions...) and you should be able to download it from the contest website.

Q12. hi, i am a contestant of problem C

we have received the alpha test evaluation report lately,

but get confused about the number on the report,

is that DR wire length?

and what is failed mean specifically?

A12. the number is the detailed routing raw score. The detailed routing is produced by Dr. CU, then the raw score is produced by the ISPD-2019 contest official evaluator. If

we could not get the detailed routing result produced by Dr. CU binary, the result shows as “fail”.

Q13. We find that in some benchmarks the track distance is less than a pitch. I'm wondering if it is valid or not. For example in ispd18\_test1.

In lef, Metal 3 is horizontal. Pitch = 0.2.

In def, the track of metal 3 is,

TRACKS X 200 DO 977 STEP 400 LAYER Metal3

TRACKS Y 190 DO 1000 STEP 380 LAYER Metal3

Because Metal 3 is horizontal so we should use the "TRACKS Y....STEP 380...". The step is 380 which is 0.19um.

This track distance 0.19 is less than pitch in lef, which is 0.20.

Does it mean that, I can use only one track in every two tracks?

A13. Ideally, the global routing available resource can be different per gcell because of non-uniform tracks, blockages, PDN and routed nets. All the above could make two gcells with different available resources. You are not supposed to assume that every neighboring gcell has the same resource. The actual resource modeling should take all the above into account. The pitch definition in LEF is just a foundry recommended setting, with no enforcement to the user. Block owner designs their own track patterns and the detailed router has to follow the TRACKS definition in DEF instead of LEF. The block owner is fully responsible to make the TRACKS definition compatible with all required design rules, including but not limited to various SPACING rules. TRACK STEP could be smaller, equal or larger than the recommended pitch value as long as design rules are met. Please find Q17 in ispd18 contest (<http://www.ispd.cc/contests/18/#faq>)

Q14. We are a team of problem C.

And we have some questions regarding the newly released alpha test result.

(1) The first thing is that we find the scores in the alpha report are quite different to our own tested ones. So we hope to know what our scores are exactly in the alpha test.

(2) We want to know how the scores in the report are ranked.

Since the 2nd place actually do better than the 1st place for almost every case.

A14.

(i) We use a script to launch the GR and DR in 8-thread mode, then evaluate the routed def using Innovus v18.14 followed by ispd19 evaluation scripts (note that we always use ispd19 evaluation script regardless of testcases). I have attached

the gr/dr log and evaluated result for ispd18\_test9 as attached; Please let us know if you find anything wrong.

(ii) In alpha test, we do not give a rank. Please find the updated document.

Q15. We are trying to download and run the Dr. CU detailed router from the problem description at

<http://iccad->

[contest.org/2019/Problem\\_C/2019ICCAD\\_ProblemC\\_V6\\_total.pdf](http://iccad-contest.org/2019/Problem_C/2019ICCAD_ProblemC_V6_total.pdf) ,

but we couldn't unzip the file.

We used the commands

```
$ gunzip drcu_june19.gz and
```

```
$ gzip -d drcu_june19.gz
```

but got error: "gzip: drcu\_june19.gz: not in gzip format".

Could you give us a pointer as to how we may use this file?

As a follow-up, we are aware that there are two links in the problem description, one at

[http://iccad-contest.org/2019/Problem\\_C/drcu\\_june19.gz](http://iccad-contest.org/2019/Problem_C/drcu_june19.gz) , and another at

<http://ispd.cc/contests/19/ispd19eval.tgz> .

The second link is working, but the first doesn't. We are curious about the first link. Thanks.

A15. We are sorry for the misleading download links. Now both the detailed router and the evaluation scripts are repacked to be .zip format. For the detailed router, please unzip and "chmod+x drcu\_june19" to run. For the evaluation script, please unzip and you should be able to run according to the ISPD-2019 contest instructions.

Q16. We would like to know, while we are running Dr.CU there are some error appears (see below)

```
Warning: Net net35341 expands 9 iterations, which takes 0.000126242 s in total.  
Error: Exceed the guideExpandIterLimit, but still FAIL_DETACHED_GUIDE
```

what is the meaning of these error?

A16. guide must be **\*\*connected\*\*** and must cover **\*\*all pins\*\***. The definition of legal solution has been described in the document. We also suggest that you compare your solution of a specific net with ISPD-provided guide file (you can

download the benchmarks from ISPD website) and find the difference to better understand the legality of guide file. We recommend you check your global routing solution by visualizing your guide with pin shapes. Disjoint guide or pin will be a problem for detailed router and will result in sub-optimal solution quality or routing failure.

Q17. We are the participants of problem C.

We have some questions about test cases.

For all the cases, is that the pins in all the connections are all at the Metal 1 only?

A17. No. There is no assumption in the pin layers. In industrial LEF/DEF format, a pin can be in any layer, or any combination of multiple layers, and it can cross one gcell, or more gcells.

Q18. For prob. C, we notice that much more min-area violations are detected by the ispd19 evaluator, compared to the report of drcu or even the report given by the ispd18 evaluator.

We are not sure if this is normal.

Take benchmark ispd18\_test1 for example, no min-area violation is detected by drcu or ispd18eval at all, but the ispd19eval detects 1896 min-area violations, which makes up 73.1% of our final score.

Several other ispd18 benchmarks have shown similar results when tested using ispd19eval.

Besides, we have also tested the guide provided by the ispd2018 contest, and the min-area violation dominates the total score as well.

Therefore we hope you can look into the discrepancy.

Attached is our generated guide file for ispd18\_test1 and the corresponding evaluation report. Thank you.

A18. Thank you very much for letting us know this issue. To avoid such problem, we have updated the evaluation script to use modified versions of both ISPD18 and 19 scripts. For ISPD18 testcases, please use ISPD18 scripts. For ISPD19 testcases, please use ISPD19 scripts. You can download the modified version of scripts from ICCAD contest website.

Q19. We ran ispd19\_eval script and in the drcu score report we found that there is an error type called "#min-area violation". However, this seems to be a broad statement, minimum area of what? For instance, parallel spacing too short? Or

insufficient pin coverage? Would you give us some examples to specify what problems could it be that raised this type of violation? Thank you.

A19. We have found that all ispd18 testcases evaluated by ispd19eval will result in too many min-area violations. These violations are caused by non-sufficient pin coverage in detailed router. Since we don not think global router should take this responsibility, we have broadcasted to teams that we will use ispd18eval for ispd18 testcases, and we have found no such issue. Please download the evaluator again from the contest website and use the latest version. Please let us know if you still find such an issue.

Q20. We want to know how to evaluate our final result.

We have learned that "The global routing solution will be evaluated using the executables of one or more academic detailed routers. Final score of each team will be a weighted sum of detailed router scores scaled by a runtime factor." We want to know such as: what the detailed router scores related to? how to scale? and so on. Can you give us some expressions to evaluate our final result?

Thanks a lot.

A20. Please see Q25.

Q21. while we try the new ispd18 evaluator,  
we ended up with FATAL :kernel too old

```
Net net1634: dangling Wire.
Net net1492: dangling Wire.
Net net361: dangling Wire.
Net net487: dangling Wire.
Net net1979: dangling Wire.
Net net2194: dangling Wire.
Net net701: dangling Wire.
Net net641: dangling Wire.
Net net681: dangling Wire.
Net net2498: dangling Wire.
Net net821: dangling Wire.
Net net831: dangling Wire.
Net net2531: dangling Wire.
Net net2746: dangling Wire.
Net net857: dangling Wire.
Net net2811: dangling Wire.
Net net1023: dangling Wire.
Net net1063: dangling Wire.
Net net3090: dangling Wire.
Net net3152: dangling Wire.
Net net3114: dangling Wire.
Net net3150: dangling Wire.
Net net1105: dangling Wire.
Net net1301: dangling Wire.
Net net2335: dangling Wire.
Net net2543: dangling Wire.
Net net2821: dangling Wire.
Net net1801: dangling Wire.
Net net1877: dangling Wire.
Net net2903: dangling Wire.
Net net1745: dangling Wire.
Net net2045: dangling Wire.
Net net1905: dangling Wire.
Net net2317: dangling Wire.
Net net2097: dangling Wire.
Net net2809: dangling Wire.

Begin Summary
  231 Problem(s) (IMPVFC-04): The net has dangling wire(s).
  231 total info(s) created.
End Summary

End Time: Tue Jul 30 14:25:32 2019
Time Elapsed: 0:00:00.0

***** End: VERIFY CONNECTIVITY *****
Verification Complete : 231 Viols. 0 Wrngs.
(CPU Time: 0:00:00.4 MEM: -98.914M)

*** Memory Usage v#1 (Current mem = 722.099M, initial mem = 191.336M) ***
*** Message Summary: 3 warning(s), 5 error(s) ***

--- Ending "Innovus" (totcpu=0:00:21.6, real=0:00:21.0, mem=722.1M) ---

./ispd18eval -lef l8testcase/ispd18_test1.input.lef -def l8output/ispd18_test1.output.def -guide l8testcase/output181.guide -georpt eval.geo.rpt -conrpt eval.con.rpt
FATAL: kernel too old
```

is it because of the old version of our innovus or other problem, please let me know^^

A21. We think the issue might be with your old OS kernel version. We have tested the ispd18 evaluation script on TSRI machines (CentOS 6.8 default tcsh



shell with Innovus 17.11) without any problem using ISPD-provided ispd18\_test1. We have also tested on CentOS 7 machines and Innovus 17/18/19 versions without any problem. We suggest you to test on a recent version of CentOS/RHEL 6/7 and check whether the evaluation has any issues.

Q22. As far as I know, the evaluator of ispd 2018 only consider the area of violations, but ignore the number of violations.

However, the evaluator of ispd 2019 considers both the area and the number of violations,

which seems to be more reasonable.

So, will you update this feature in the evaluator of ispd 2018 to make the two evaluators more consistent?

A22. Due to the capability of the academic detailed router, currently we have no plan to include it in the ISPD-2018 testcases.

Q23. Attached file is a simple example where I found ispd18eval.sh works properly while ispd19eval.sh aborts due to parsing issue. It contains input def and lef in a folder. On top level, a guide file and a toy.out is the detailed routing result generated by [DR.CU](#).

A23. We have tried ispd19 eval on your given top example and we do not find any issue. Could you explain more details? The following is the report generated by ispd19eval

```
./ispd19eval -lef toy/ispd18_sample.input.lef -def toy.out -guide toy.guide -georpt eval.geo.rpt -conrpt eval.con.rpt
```

+-----+						
Routing						
+-----+						
Values   Metrics   Weights   Scores						
+-----+						
Total wire length   162255   405.64   0.50   202.82   41.3%						
Total SCut via count   44   44.00   4.00   176.00   35.8%						
Total MCut via count   0   0.00   2.00   0.00   0.0%						
+-----+						
Guides and tracks Obedience						
+-----+						
Out-of-guide wire   33750   84.38   1.00   84.38   17.2%						
Out-of-guide vias   20   20.00   1.00   20.00   4.1%						
Off-track wire   135   0.34   0.50   0.17   0.0%						

Off-track via	0	0.00	1.00	0.00	0.0%
Wrong-way wire	3195	7.99	1.00	7.99	1.6%

-----+

Design Rule Violations					
------------------------	--	--	--	--	--

-----+

Number of metal/cut shorts	0	0.00	500.00	0.00	0.0%
Area of metal/cut shorts	0	0.00	500.00	0.00	0.0%
#min-area violations	0	0.00	500.00	0.00	0.0%
#PRL violation	0	0.00	500.00	0.00	0.0%
#EOL Spacing violation	0	0.00	500.00	0.00	0.0%
#Cut Spacing violation	0	0.00	500.00	0.00	0.0%
#Adj. Cut Spacing violation	0	0.00	500.00	0.00	0.0%
#Corner Spacing violation	0	0.00	500.00	0.00	0.0%

-----+

Connectivity (must be zero for valid solution)					
--	--	--	--	--	--

-----+

#open nets	0	0.00	0.00	0.00	0.0%
------------	---	------	------	------	------

-----+

Total Score					491.35
-------------	--	--	--	--	--------

-----+

+++++

+ PASS : Solution is valid +

+++++

Q24. We will use the ‘FLUTE’ to generate our results. However, FLUTE requires two files — ‘powv.dat’ and ‘post.dat’.

Q: Can we also submit these two files and other file, when submitting the final version? Do we need to explain in the README file?

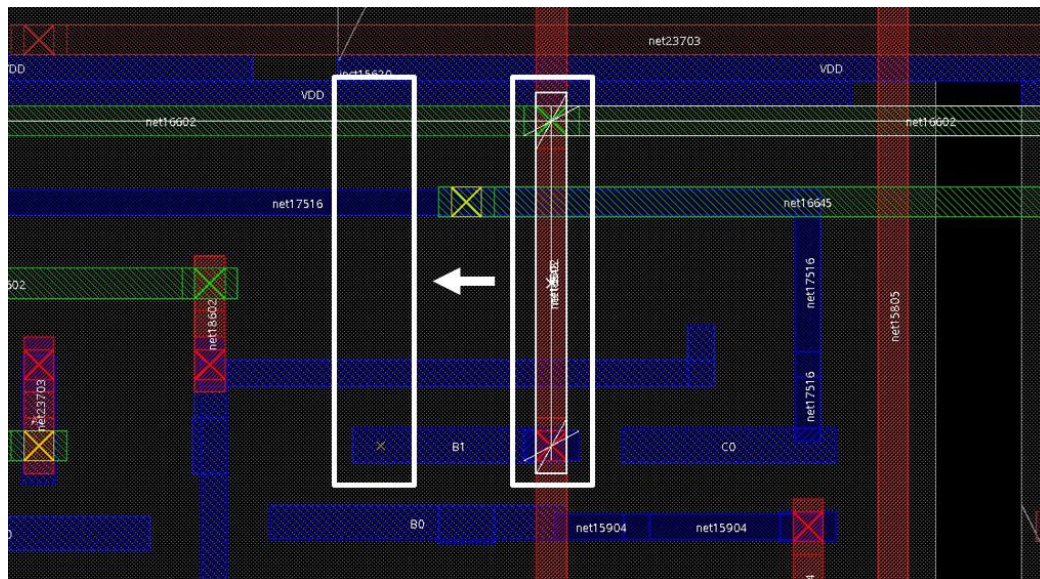
A24. Yes. However, the evaluation process is automatic and does not process any READMEs. You can assume that your submitted directory structure is preserved.

Q25. I'm sending this email just to ask for the binaries because we found only the CUHK: [github.com/cuhk-eda/dr-cu](https://github.com/cuhk-eda/dr-cu) and we would like to evaluate our solution with the others.

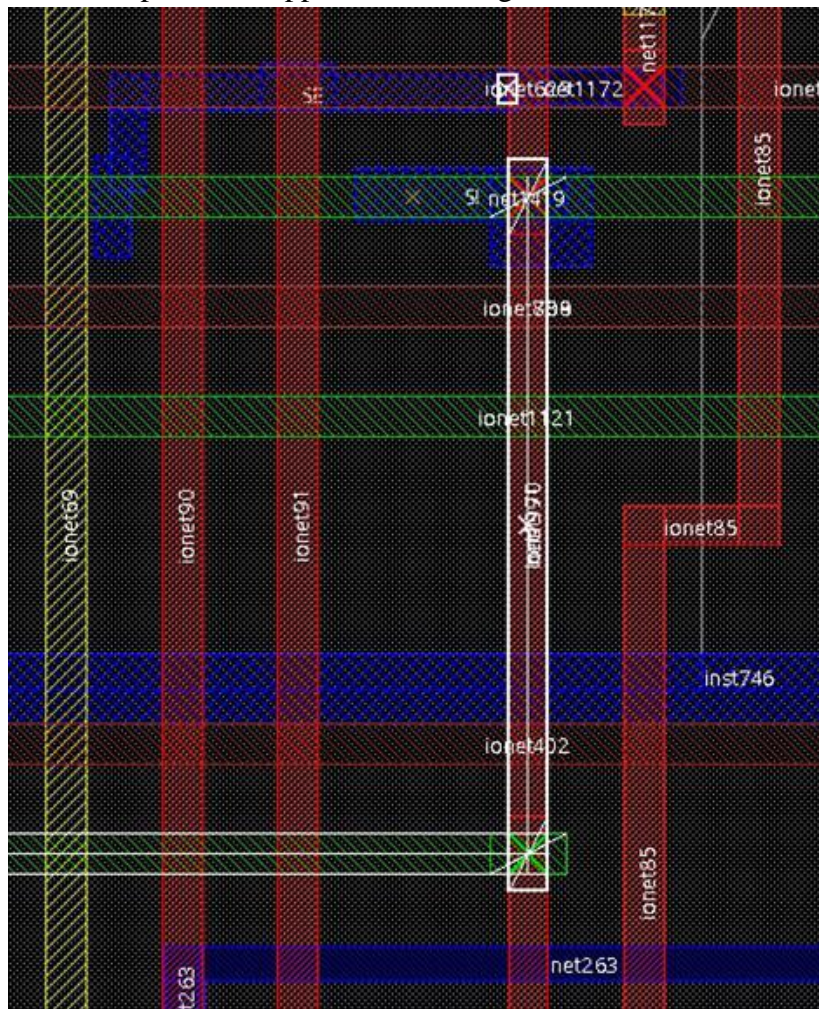
A25. Given the beta submission results. We will only use the CUHK detailed router for the final evaluation.

it is totally fine for this segment move to another access point on the left to avoiding short DRV





but DR.CU choose the violation point first  
so did the problem happen on this image







A27. We will run Dr. CU multiple times during final evaluation to mitigate the impact from nondeterministic crash from Dr. CU along with pruning out worst rank(s) for each team for final ranking as we mentioned in the other question.

Q28. hi, we find out a serious problem.....

The parser of Dr.CU only allow to parse lower case letters metalX in ispd19\_test4.input.guide and ispd19\_test5.input.guide , while other cases only allow to parse upper case letters MetalX, i am hopping to know which kind of metal(Metal) should we give for the hidden case. or there is a unified format please that me know.

A28. We will make sure that for the hidden cases, the naming convention for metal layers will not make Dr. CU crash.

Q.29 We would like to ask some questions.

First, we have a problem with the latest version of ISPD19 evaluator.

The evaluator says "Incomplete def file. Error in file eval.def at line 119129, on token NETS." "The errors found when reading the DEF file 'eval.def' are too serious to continue."

I have attached the error message in this mail.

We have checked that the evaluator is the most recent one in the ICCAD contest website.

The previous ISPD19 evaluator works well, but there are errors for the recent evaluator.

It would be really appreciated if you can check this issue.

The second question is that we have a Detailed Routing problem with Dr.CU in testbench ispd19\_test4.

It has a segment fault problem, while Detailed Routing processing.

We're wondering if there is any question from other teams about this issue, or just our global routing result is the problem.

A29. The final ranking method will mitigate the impact from the ISPD evaluator and Dr. CU as much as possible (At least one worst ranking for each team will be pruned out before final ranking calculation). (We haven't heard about ispd19\_test4 issue from other teams)

Q30. I'm having the same problem with first half of Question 29. The evaluator ends with a similar error message.

Could you please help me with it?

The problem is solved by changing the .tcl file "-check\_only default" to "-check\_only all".

Finally which one will the contest use to evaluate?

A30. We have seen team(s) passing with current evaluation method. We will use "-check\_only default" unless otherwise updated on website.