ISPD19 Contest:
Evaluation Metrics and Ranking Method

William Chow, Gracieli Posser, Stefanus Mantik, Yixiao Ding, Wen-Hao Liu

Cadence Design Systems, Inc.

12/15/2018

cādence®

Evaluation Metric

Evaluation Metric

- The quality of result for a routing solution is measured by the following equation. A solution with a smaller scaled score is considered as a better solution in this contest

    Scaled_score = original_score * (1 + nondeterministic_penalty + runtime_factor)

- The scaled score is considered as an **infinity** number if one the following condition happens.
  - The proposed router has segmentation fault / crash
  - The proposed router changes placement, netlist, or any design information in the solution file
  - The runtime usage of the proposed router is over the given runtime limitation (real time). **The details about the runtime limit will be released later.**
  - The memory usage of the proposed router is over **64 GB**.

- The original score can be obtained by the evaluator released on the ISPD19 contest website

Evaluation Metric (cont.)

- Scaled_score = original_score * (1 + nondeterministic_penalty + runtime_factor)
- The original score is measured by the weighted sum of the following metrics, which is computed by the released evaluator. The numbers in the brackets are the weight associated to each metric. The wirelength unit here is the number of M2 pitches.
  - Short metal area / M2 pitch (500)
  - Number of short violations (500)
  - Number of spacing violations (500)
  - Number of min-area violations (500)
  - Total length of the wires outside of the routing guides (1)
  - Total number of the vias outside of routing guides (1)
  - Total length of off-track wires (0.5)
  - Total number of off-track vias (1)
  - Total length of wrong-way wires (1)
  - Total number of single-cut vias (4)
  - Total number of multi-cut vias (2)
  - Total length of wires (0.5)
- Every net in the solution must be connected. If there is any unconnected net (open net) detected by Innovus' connectivity checking, the solution will be considered as **INVALID**.
  - A solution with zero open net is always better than a solution with any open net.
  - For two invalid solutions, the one with less number of open nets is considered as better.
  - For two solutions with zero open net, the one with lower score is better.

Evaluation Metric (cont.)

- Scaled_score = original_score * (1 + nondeterministic_penalty + runtime_factor)

- We will run multiple times of the proposed router, and pick the median scaled score as the final score for a benchmark.

- If we observe nondeterministic results, nondeterministic_penalty will be 3%; otherwise, it will be 0.

- The nondeterministic penalty is to reflect the debugging and maintenance difficulty for a nondeterministic router

Evaluation Metric (cont.)

- Scaled_score = original_score * (1 + nondeterministic_penalty + runtime_factor)

- Runtime_factor = min(0.1, max(-0.1, **0.02** * log2(**Router_Wall_Time / Median_Wall_Time**)))

- The median wall time is the median runtime of all submitted detailed routers from contestants for the benchmark

- The runtime penalty/benefit is limited within 0.1/-0.1

- Based on the following curve, say, a router is 8X faster/slower than the median, it will get 6% score benefit/penalty

Runtime factor
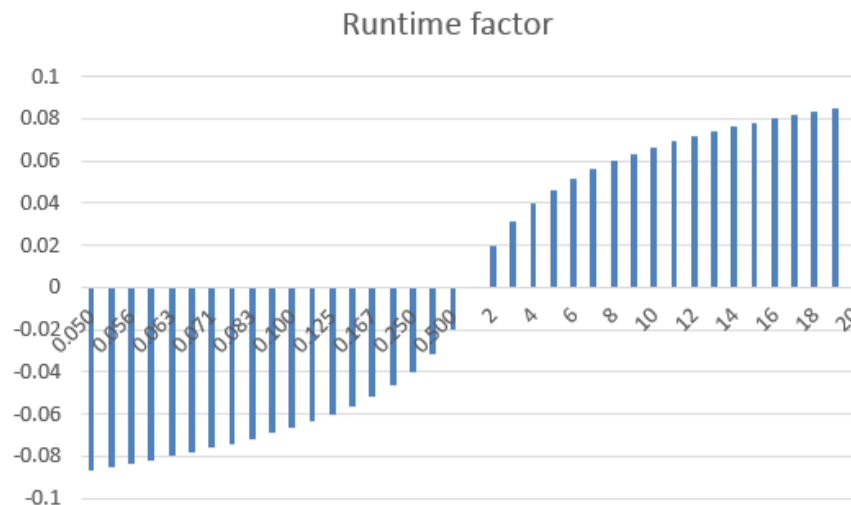
Ranking Method

Ranking Method

- Rank each team for each benchmark. The team with a smaller scaled score will get a smaller ranking number, which means a better ranking.
- Prune out the worst (i.e., biggest) ranking number, and then average the remaining rankings for each team. The team with the smallest averaged ranking number wins the contest.
- If tight, the averaged ranking including the worst one will be considered.
- Example:

Scaled Score Table

	team 1	team 2	team 3	team 4	team 5
benchmark1	80	200	200	250	100
benchmark2	90	180	70	130	60
benchmark3	70	X	40	X	180
benchmark4	300	800	180	250	400
benchmark5	150	X	150	170	160

'X' means a failure

Ranking Table

	team 1	team 2	team 3	team 4	team 5
benchmark1	1	3	3	5	2
benchmark2	3	5	2	4	1
benchmark3	2	5 (X)	1	5 (X)	3
benchmark4	3	5	1	2	4
benchmark5	1	5 (X)	1	4	3

Final Ranking Result

	team 1	team 2	team 3	team 4	team 5
benchmark1	1	3	3	5	2
benchmark2	3	5	2	4	1
benchmark3	2	5	1	5	3
benchmark4	3	5	1	2	4
benchmark5	1	5	1	4	3
Avg without the outlier	1.75	4.5	**1.25**	3.75	2.25