Pin Access-Oriented Concurrent Detailed Routing

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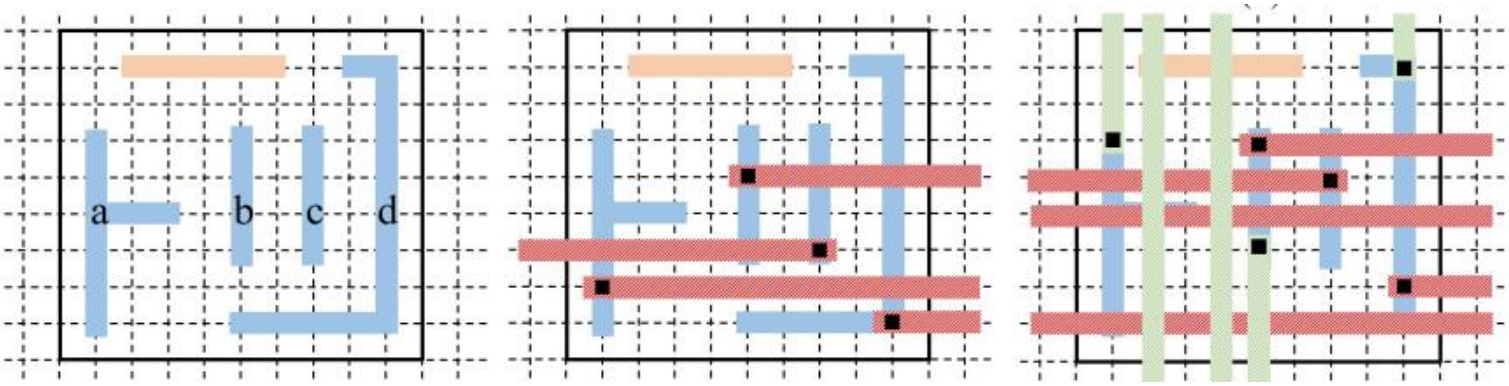
Motivation

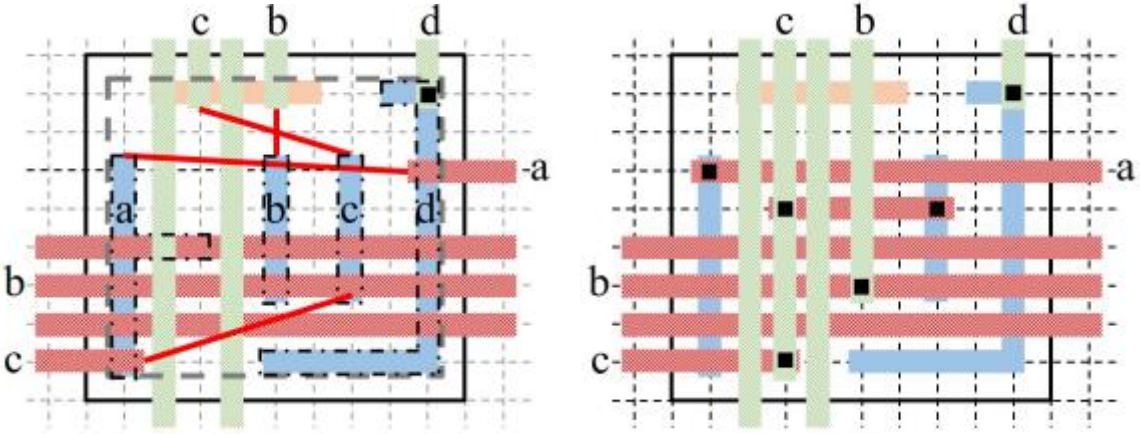
- Pin access problem
  - Previous solution
    - Create DR-clean pin extensions with Metal-2 wire segments
  - Short comings
    - Metal-2 segments limit the solution space
    - The length of Metal-2 segments are irrationally determined
    - Only one access point for each pin is assumed
- Pin Access-Oriented Concurrent Detailed Routing (PACDR)



(a) (b) (c)

Main Contribution

- Consider the bridge between track assignment and ILP-based detailed routing
  - Shorten or erase redundant metal
  - Insert auxiliary metal
  - Cluster relative nets by R tree algorithm
- Improve the exiting ILP-based detailed router [4]
  - Determine Steiner points automatically
  - Differentiate different obstacles
  - Undirected graph-based multi-commodity flow model



Experimental Results

- Undirected graph-based model vs. directed graph-based model
  - x_y_z: dimension of routing plane
  - Reduce 42% of variables
  - Reduce 41% of constraints

Case name	Un-directed		Directed [4]	
	Variables	Constraints	Variables	Constraints
9_8_3	3711	5001	6342	8241
9_8_5	6159	8025	10518	13425
9_8_6	7383	9537	12606	106017
11_17_3	16358	22529	27667	37676
11_17_5	27204	35993	45993	61238
11_17_6	32627	42725	55156	73019
Comp	0.58	0.59	1	1

Experimental Results

- PACDR vs. TritonRoute
  - Reduce total DRVs by 67%
  - 10X faster

Case name	Pin access-oriented concurrent detailed routing									
	CShort	CSpacing	EOL	MS	PRL	Total	CPU	Trivial	Single Cluster	Multiple Cluster
ispd18_test1	2	0	67	38	73	180	13.8	4764	11785	800
ispd18_test2	18	0	1409	640	1130	3197	210	31137	89597	14635
ispd18_test3	20	0	1360	670	1100	3150	461	30923	90878	14293
ispd18_test4	24	0	4879	815	634	6352	858	202217	73944	19571
ispd18_test5	19	4853	1061	1042	1360	8335	728	229821	70290	16359
ispd18_test6	13	6961	1570	1315	3367	13226	794	342967	107109	24206
ispd18_test7	31	10385	3804	2832	8443	25495	1408	569743	175503	38340
ispd18_test8	50	10370	3852	3008	8811	26091	1395	568803	175732	38269
ispd18_test9	28	10525	3756	2731	8246	25286	1257	574388	176152	37332
ispd18_test10	35	10570	5346	7315	10527	33793	1322	589725	181695	38050
Comp	1	1	1	1	1	1	1	-	-	-

TritonRoute-WXL initial detailed routing						
CShort	CSpacing	EOL	MS	PRL	Total	CPU
0	0	54	349	1100	1503	243
0	5	793	4485	12107	17390	2224
0	2	828	4416	11997	17243	2529
6	178	1447	9009	1312	11952	7509
0	334	3607	10474	3060	17475	8335
3	571	4258	11197	3458	19487	10468
0	1530	11882	17390	10537	41339	18194
2	1569	11649	17136	10260	40616	17926
1	1635	9976	16923	8326	36861	15823
7	1726	11157	22743	9276	44909	17781
0.075	0.076	1.927	7.354	4.633	3.067	11.887

THANK YOU