

15-418/15-618 Parallel Computer Architecture and Programming

Homework 4, Parallel VLSI Wire Routing via MPI

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Use MPI to write a message passing version of the same application as the previous assignment. (Wire Routing under message-passing programming models (only have PRIVATE address spaces).)

- Learn how to compile and run MPI binaries on the same host and across the nodes of a cluster.
- Evaluate where optimizations are most valuable.

Notes:

Sending messages is relatively expensive, experienced MPI programmers generally try to structure their code to avoid frequent communication

At the very end, it turns out that machine 28 is a problem where `perf` is not installed. See 2024 Fall Piazza @368

1. **[40 points] Design and performance debugging for the message-passing approach.**
 - i. Similar to OpenMP implementation. After implementing the MPI paralleled program, we have correctness results attached at the end of the report.
2. **[15 points] Experimental results from the GHC machines**
 - i. First,
3. ~~**[20 points] Experimental results from the PSC machines**~~

Correctness Tests

```
siqiguo@ghc56:~/private/15-618-Parallel-Computing/asst4/code$ ./checker.pl
```

```
-----
```

```
Running tests on ghc56.ghc.andrew.cmu.edu
```

```
-----
```

```
Test : easy with 1 cores
Correctness passed!
Your time : 0.6370366600
Target Time: 0.49
Your cost : 121978
Target Cost: 122050
```

```
Test : easy with 2 cores
Correctness passed!
Your time : 0.3346642290
Target Time: 0.31
Your cost : 122405
Target Cost: 122050
```

```
Test : easy with 4 cores
Correctness passed!
Your time : 0.2201978630
Target Time: 0.19
Your cost : 123904
Target Cost: 122050
```

```
Test : easy with 8 cores
Correctness passed!
Your time : 0.1405227760
Target Time: 0.13
Your cost : 125892
Target Cost: 122050
```

```
Test : medium with 1 cores
Correctness passed!
Your time : 10.9571411100
Target Time: 9.52
Your cost : 601215
Target Cost: 601213
```

```
Test : medium with 2 cores
Correctness passed!
Your time : 9.9203150420
Target Time: 6.12
Your cost : 612134
Target Cost: 601213
```

```
Test : medium with 4 cores
Correctness passed!
Your time : 8.0959574360
Target Time: 4.04
Your cost : 621736
Target Cost: 601213
```

```
Test : medium with 8 cores
Correctness passed!
Your time : 6.8566017200
Target Time: 3.41
Your cost : 641197
Target Cost: 601213
```

```
Test : hard with 1 cores
Correctness passed!
Your time : 13.4858831170
Target Time: 11.15
Your cost : 1031998
Target Cost: 1032198
```

```
Test : hard with 2 cores
Correctness passed!
Your time : 11.2784738400
Target Time: 7.08
Your cost : 1052142
Target Cost: 1032198
```

```
Test : hard with 4 cores
Correctness passed!
Your time : 10.8472393710
Target Time: 4.1
Your cost : 1063102
Target Cost: 1032198
```

```
Test : hard with 8 cores
Correctness passed!
Your time : 7.5720181200
Target Time: 3.1
Your cost : 1076051
Target Cost: 1032198
```

Test : extreme with 1 cores
 Correctness passed!
 Your time : 59.0921018140
 Target Time: 46.81
 Your cost : 23592484
 Target Cost: 23613045

Test : extreme with 2 cores
 Correctness passed!
 Your time : 30.5852387770
 Target Time: 28.95
 Your cost : 26268192
 Target Cost: 23613045

Test : extreme with 4 cores
 Correctness passed!
 Your time : 16.0450465490
 Target Time: 15.2
 Your cost : 29031434
 Target Cost: 23613045

Test : extreme with 8 cores
 Correctness passed!
 Your time : 8.5529003170
 Target Time: 11
 Your cost : 30714138
 Target Cost: 23613045

 Score table:

Test Name	Core Num	Target Time	Your Time	Target Cost	Your Cost	Score
easy	1	0.49	0.6370366600	122050	121978	0.769186501762709
easy	2	0.31	0.3346642290	122050	122405	1
easy	4	0.19	0.2201978630	122050	123904	1
easy	8	0.13	0.1405227760	122050	125892	1
medium	1	9.52	10.9571411100	601213	601215	2
medium	2	6.12	9.9203150420	601213	612134	1.2338317833838
medium	4	4.04	8.0959574360	601213	621736	0.998028962463532
medium	8	3.41	6.8566017200	601213	641197	0.994661827900367
hard	1	11.15	13.4858831170	1032198	1031998	2.48037148993481
hard	2	7.08	11.2784738400	1032198	1052142	1.88323352089275
hard	4	4.1	10.8472393710	1032198	1063102	1.13392906520381
hard	8	3.1	7.5720181200	1032198	1076051	1.22820625262846
extreme	1	46.81	59.0921018140	23613045	23592484	3.16861296606714
extreme	2	28.95	30.5852387770	23613045	26268192	3.59568637232437
extreme	4	15.2	16.0450465490	23613045	29031434	3.25344521390159
extreme	8	11	8.5529003170	23613045	30714138	3.0752020453903
Total score:						28.8143960018536/40