LAB #3 – OpenMP – Persistent And Disposable

Timing comparison for OpenMP and PThreads – for AFFECT RATE = .03 and EPSILON = .03 on testgrid_400_12206

The actual number of threads created were always equal to the number of threads requested.

DISPOSABLE

Number of threads requested	PThreads(seconds)	OpenMP(seconds)
2	296	390
4	313	250
8	299	251
16	430	356
32	732	441

As can be seen above, OpenMP threading perform better than PThreads.

PERSISTENT

Number of threads requested	PThreads(seconds)	OpenMP(seconds)
2	277	260
4	198	160
8	254	188
16	489	247
32	705	302

Similarly here as well, OpenMP threading performs better than PThreads.

Summary-

1. Which threading mechanism, pthreads or OpenMP, provided the best results in your case?

   Ans . The OpenMP program parallelized using block distribution and seemed to outperform the corresponding PThreads implementation both the disposable and the persistent.

2. Which threading mechanism, pthreads or OpenMP, was the easiest to implement?

   Ans. Definitely, OpenMP was easier to implement. The workload distribution was taken care of implicitly. There was no hassle of creating and destroying threads. Whereas there was a tricky part in OpenMP Persistent model. Even though the OpenMP Single pragma has an implicit barrier, there was a barrier required at the end of the pragma OpenMP for in the pragma OpenMP parallel region. The absence of the barrier was causing threads to get stuck and not being able to exit from the program.

3. Which threading mechanism, pthreads or OpenMP, would you be most likely to select for a similar application?

   Ans. Definite choice would be OpenMP. Not only because it is simpler to implement but also because it is faster than PThreads. OpenMP helps us to focus on the actual problem rather than thread management.

4. Under what circumstances would you speculate that the other mechanism, pthreads or OpenMP, would be preferable?

Ans. With OpenMP, we donot have much control over threads. PThreads give us that flexibility. Thus in situations where we require more fine grained control over execution , we will go for PThreads.

5. Were there any surprises you encountered in this exercise?

Ans. With Persistent OpenMP, an explicit barrier was required.
Also , even though we increase the number of threads, the time taken for convergence doesnot increase dramatically (as was observed in PThreads) even though the program has been parallelized. OpenMP persistent model consistently performed better than the OpenMP disposable but the timing result difference was not dramatic even with 32 threads. Observing from the pervious PThreaded application, this was surprising.

SCREEN SHOTS FOR PERSISTENT OpenMP THREADS FOR AFFECT RATE=.1 AND EPSILON=.1 FOR 2/4/8/16/32 THREADS

```
time ./persistent .1 .1 2 < /class/cse5441/testgrid_400_12206
********************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 2 and actual number of threads = 2
elapsed convergence loop time (clock): 86380000
elapsed convergence loop time  (time): 43
elapsed convergence loop time  (chrono): 43626545.000000
********************************************************************************
real    0m43.704s
user    1m26.319s
sys     0m0.123
```

```
time ./persistent .1 .1 4 < /class/cse5441/testgrid_400_12206
********************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 4 and actual number of threads = 4
elapsed convergence loop time (clock): 109570000
elapsed convergence loop time  (time): 28
elapsed convergence loop time  (chrono): 28512938.000000
********************************************************************************
real    0m28.579s
user    1m49.437s
sys     0m0.195s
```

```
time ./persistent .1 .1 8 < /class/cse5441/testgrid_400_12206
********************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 8 and actual number of threads = 8
elapsed convergence loop time (clock): 187460000
elapsed convergence loop time  (time): 78
elapsed convergence loop time  (chrono): 78032529.000000
********************************************************************************
real    1m18.100s
user    2m59.906s
sys     0m7.615s
```

```
time ./persistent .1 .1 16 < /class/cse5441/testgrid_400_12206
********************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 16 and actual number of threads = 16
elapsed convergence loop time (clock): 92560000
elapsed convergence loop time  (time): 46
elapsed convergence loop time  (chrono): 46012154.000000
********************************************************************************
real    0m46.036s
user    1m25.117s
sys     0m7.462s
```

```
time ./persistent .1 .1 32 < /class/cse5441/testgrid_400_12206
********************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 32 and actual number of threads = 32
elapsed convergence loop time (clock): 104650000
elapsed convergence loop time  (time): 51
elapsed convergence loop time  (chrono): 51753367.000000
********************************************************************************
real    0m51.776s
user    1m30.060s
sys     0m14.618s
```

SCREEN SHOTS FOR DISPOSABLE OpenMP THREADS FOR AFFECT RATE=.1 AND EPSILON=.1 FOR 2/4/8/16/32 THREADS

```
time ./disposable .1 .1 2 </class/cse5441/testgrid_400_12206
**************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 2 and actual number of threads = 2
elapsed convergence loop time (clock): 119360000
elapsed convergence loop time  (time): 60
elapsed convergence loop time  (chrono): 59907396.000000
**************************************************************************
real    0m59.969s
user    1m59.320s
sys     0m0.112s
```

```
time ./disposable .1 .1 4 </class/cse5441/testgrid_400_12206
**************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 4 and actual number of threads = 4
elapsed convergence loop time (clock): 149900000
elapsed convergence loop time  (time): 39
elapsed convergence loop time  (chrono): 38338422.000000
**************************************************************************
real    0m38.400s
user    2m29.841s
sys     0m0.130s
```

```
time ./disposable .1 .1 8 </class/cse5441/testgrid_400_12206
**************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 8 and actual number of threads = 8
elapsed convergence loop time (clock): 212520000
elapsed convergence loop time  (time): 86
elapsed convergence loop time  (chrono): 85334827.000000
**************************************************************************
real    1m25.399s
user    3m24.796s
sys     0m7.794s
```

```
time ./disposable .1 .1 16 </class/cse5441/testgrid_400_12206
**************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 16 and  actual number of threads = 16
 elapsed convergence loop time (clock): 239840000
elapsed convergence loop time  (time): 115
elapsed convergence loop time  (chrono): 115026904.000000
**************************************************************************
real    1m55.093s
user    3m44.830s
sys     0m15.075s
```

```
time ./disposable .1 .1 32 </class/cse5441/testgrid_400_12206
**************************************************************************
dissipation converged in 75270 iterations,
      with max DSV = 0.0866713 and min DSV = 0.0780044
      affect rate  = 0.1 , epsilon = 0.1 , number of threads
desired = 32 and actual number of threads = 32
 elapsed convergence loop time (clock): 260780000
elapsed convergence loop time  (time): 126
elapsed convergence loop time  (chrono): 125886076.000000
**************************************************************************
real    2m5.954s
user    3m56.031s
sys     0m24.823s
```