

CSCI 596: HW 8

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1 OpenMP Target Offload Computation of π

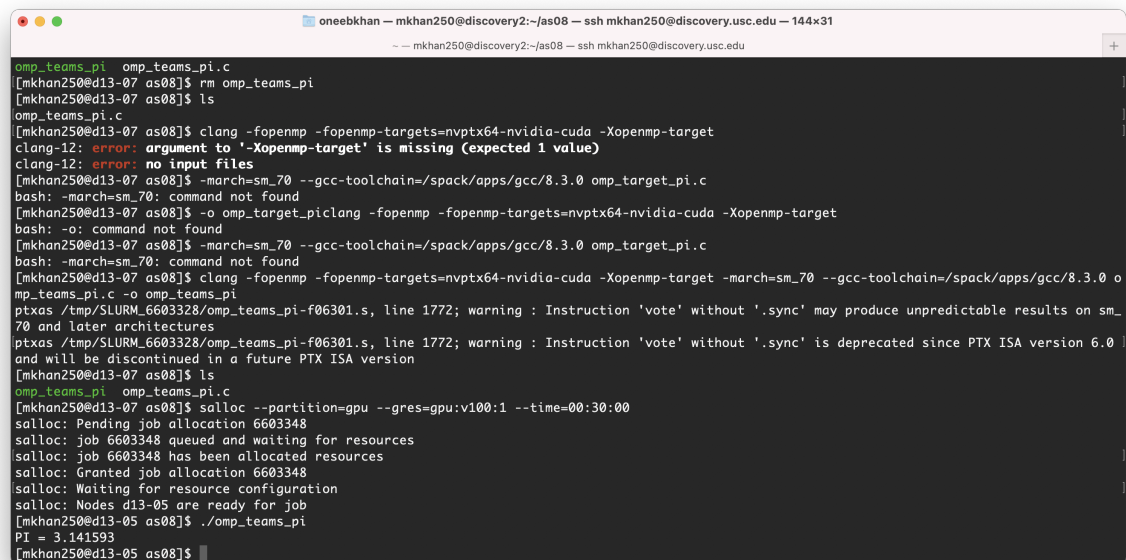
1.1 Modified source Code of *omp_teams_pi.c*

The text below is the code for the modifications made to the *omp_teams_pi.c* file from the previously named *omp_target_pi.c*.

```
1 #include <omp.h>
2 #include <stdio.h>
3 #define NBIN 1000000
4 #define NTMS 12
5 #define NTRD 96
6
7 int main() {
8     float step, sum=0.0, pi;
9     step = 1.0/(float)NBIN;
10    float sum_teams[NTMS];
11    for (int j=0; j<NTMS; j++) sum_teams[j] = 0.0;
12
13    // #pragma omp target map(step,sum)
14    #pragma omp target teams map(step,sum_teams) num_teams(NTMS)
15    {
16        #pragma omp distribute
17        for (int j=0; j<NTMS; j++) {
18            long long ibgn = NBIN/NTMS*j;
19            long long iend = NBIN/NTMS*(j+1);
20            if (j == NTMS-1) iend = NBIN;
21            // #pragma omp parallel for reduction(+:sum) num_threads(NTRD)
22            #pragma omp parallel for reduction(+:sum_teams[j]) num_threads(NTRD)
23            // for (long long i=0; i<NBIN; i++) {
24            for (long long i=ibgn; i<iend; i++) {
25                float x = (i+0.5)*step;
26                // sum += 4.0/(1.0+x*x);
27                sum_teams[j] += 4.0/(1.0+x*x);
28            }
29        } // End OMP Distribute
30    } // End OMP Target
31
32    for (int j=0; j<NTMS; j++) sum += sum_teams[j];
33
34    pi = sum*step;
35    printf("PI = %f\n", pi);
36    return 0;
37 }
```

1.2 Output of *omp_teams_pi.c*

Output of *omp_teams_pi.c* after being run on a GPU accelerated compute node.



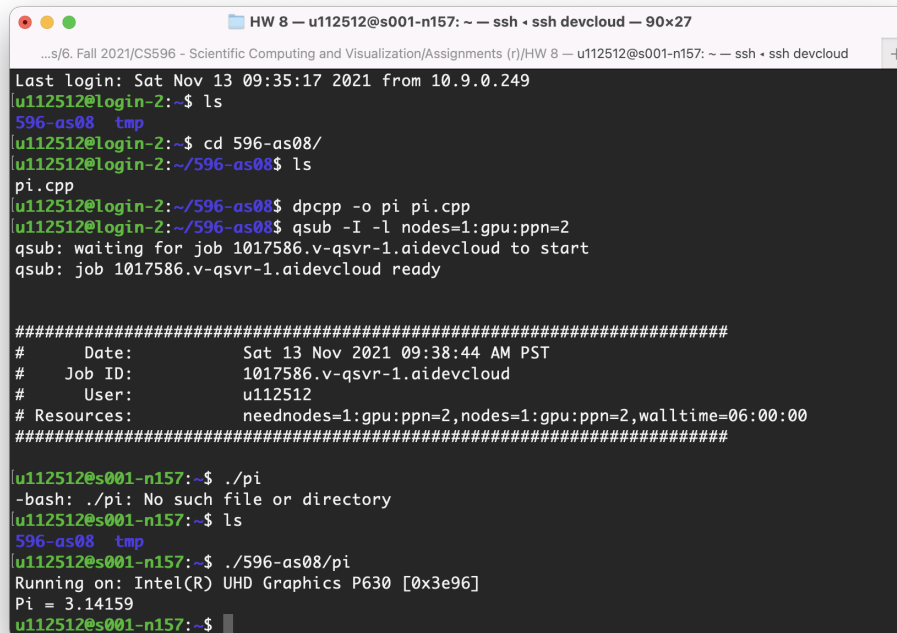
```
oneebkhan — mkhan250@discovery2:~/jas08 — ssh mkhan250@discovery.usc.edu — 144x31
-- mkhan250@discovery2:~/jas08 — ssh mkhan250@discovery.usc.edu

omp_teams_pi  omp_teams_pi.c
[mkhan250@d13-07 as08]$ rm omp_teams_pi
[mkhan250@d13-07 as08]$ ls
omp_teams_pi.c
[mkhan250@d13-07 as08]$ clang -fopenmp -fopenmp-targets=nvptx64-nvidia-cuda -Xopenmp-target
clang-12: error: argument to '-Xopenmp-target' is missing (expected 1 value)
clang-12: error: no input files
[mkhan250@d13-07 as08]$ -march=sm_70 --gcc-toolchain=/spack/apps/gcc/8.3.0 omp_target_pi.c
bash: -march=sm_70: command not found
[mkhan250@d13-07 as08]$ -o omp_target_pyclang -fopenmp -fopenmp-targets=nvptx64-nvidia-cuda -Xopenmp-target
bash: -o: command not found
[mkhan250@d13-07 as08]$ -march=sm_70 --gcc-toolchain=/spack/apps/gcc/8.3.0 omp_target_pi.c
bash: -march=sm_70: command not found
[mkhan250@d13-07 as08]$ clang -fopenmp -fopenmp-targets=nvptx64-nvidia-cuda -Xopenmp-target -march=sm_70 --gcc-toolchain=/spack/apps/gcc/8.3.0 o
mp_teams_pi.c -o omp_teams_pi
ptxas /tmp/SLURM_6603328/omp_teams_pi-f06301.s, line 1772; warning : Instruction 'vote' without '.sync' may produce unpredictable results on sm_
70 and later architectures
ptxas /tmp/SLURM_6603328/omp_teams_pi-f06301.s, line 1772; warning : Instruction 'vote' without '.sync' is deprecated since PTX ISA version 6.0
and will be discontinued in a future PTX ISA version
[mkhan250@d13-07 as08]$ ls
omp_teams_pi  omp_teams_pi.c
[mkhan250@d13-07 as08]$ salloc --partition=gpu --gres=gpu:v100:1 --time=00:30:00
salloc: Pending job allocation 6603348
salloc: job 6603348 queued and waiting for resources
salloc: job 6603348 has been allocated resources
salloc: Granted job allocation 6603348
salloc: Waiting for resource configuration
salloc: Nodes d13-05 are ready for job
[mkhan250@d13-05 as08]$ ./omp_teams_pi
PI = 3.141593
[mkhan250@d13-05 as08]$
```

2 DPC++ Computation of π

2.1 Output of *pi.c*

Output of *pi.c* after being run on a GPU accelerated compute node on the Intel Devcloud using DPC++.



```
HW 8 — u112512@s001-n157: ~ — ssh • ssh devcloud — 90x27
...s/6. Fall 2021/CS596 - Scientific Computing and Visualization/Assignments (r)/HW 8 — u112512@s001-n157: ~ — ssh • ssh devcloud
Last login: Sat Nov 13 09:35:17 2021 from 10.9.0.249
[u112512@login-2:~$ ls
596-as08 tmp
[u112512@login-2:~$ cd 596-as08/
[u112512@login-2:~/596-as08$ ls
pi.cpp
[u112512@login-2:~/596-as08$ dpcpp -o pi pi.cpp
[u112512@login-2:~/596-as08$ qsub -I -l nodes=1:gpu:ppn=2
qsub: waiting for job 1017586.v-qsvr-1.aidevcloud to start
qsub: job 1017586.v-qsvr-1.aidevcloud ready

#####
#      Date:          Sat 13 Nov 2021 09:38:44 AM PST
#      Job ID:        1017586.v-qsvr-1.aidevcloud
#      User:          u112512
# Resources:          neednodes=1:gpu:ppn=2,nodes=1:gpu:ppn=2,walltime=06:00:00
#####

[u112512@s001-n157:~$ ./pi
-bash: ./pi: No such file or directory
[u112512@s001-n157:~$ ls
596-as08 tmp
[u112512@s001-n157:~$ ./596-as08/pi
Running on: Intel(R) UHD Graphics P630 [0x3e96]
Pi = 3.14159
[u112512@s001-n157:~$ ]
```