Supercomputing Practical Exercise Sheet 08

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Exercise 1

This benchmark is executed on the Meggie Supercluster, running one node and one chip only, using the HPCG benchmark. Each node is equipped with two Intel Xeon E5-2630v4 Broadwell processors. We configure the parameters in the `hpcg.dat` with $N = nx = ny = nz = 192$. We start an interactive job using

```
srun -p work --time=24:00:00 --ntasks-per-node=1 --cpus-per-task=20 --nodes=1 --exclusive
                                    --pty bash -l
```

Once connected to a computenode, we load all necessary modules and type the command

```
mpirun -np 1 -ppn 1 -genv OMP_NUM_THREADS 10 -genv KMP_AFFINITY
        verbose,granularity=core,compact ./xhpcg_avx2
```

The result of the benchmark is: 9.910660 GFlop/s

Exercise 2

This benchmark is executed on the Meggie Supercluster, running on one full node, using the HPCG benchmark. Each node is equipped with two Intel Xeon E5-2630v4 Broadwell processors. We configure the parameters in the `hpcg.dat` with $N = nx = ny = nz = 192$. We start an interactive job using

```
srun -p work --time=24:00:00 --ntasks-per-node=1 --cpus-per-task=20 --nodes=1 --pty bash
                                        -l
```

Once connected to a computenode, we load all necessary modules and type the command

```
mpirun -np 2 -ppn 2 -genv OMP_NUM_THREADS 10 -genv KMP_AFFINITY
        verbose,granularity=core,compact ./xhpcg_avx2
```

The result of the benchmark is: 19.125464 GFlop/s

Exercise 3

These benchmarks are executed on the Meggie Supercluster, running on two, four, eight and sixteen full nodes, using the HPCG benchmark. Each node is equipped with two Intel Xeon E5-2630v4 Broadwell processors. We configure the parameters in the `hpcg.dat` with $N = nx = ny = nz = 192$. For each job, we start an interactive job by typing the command

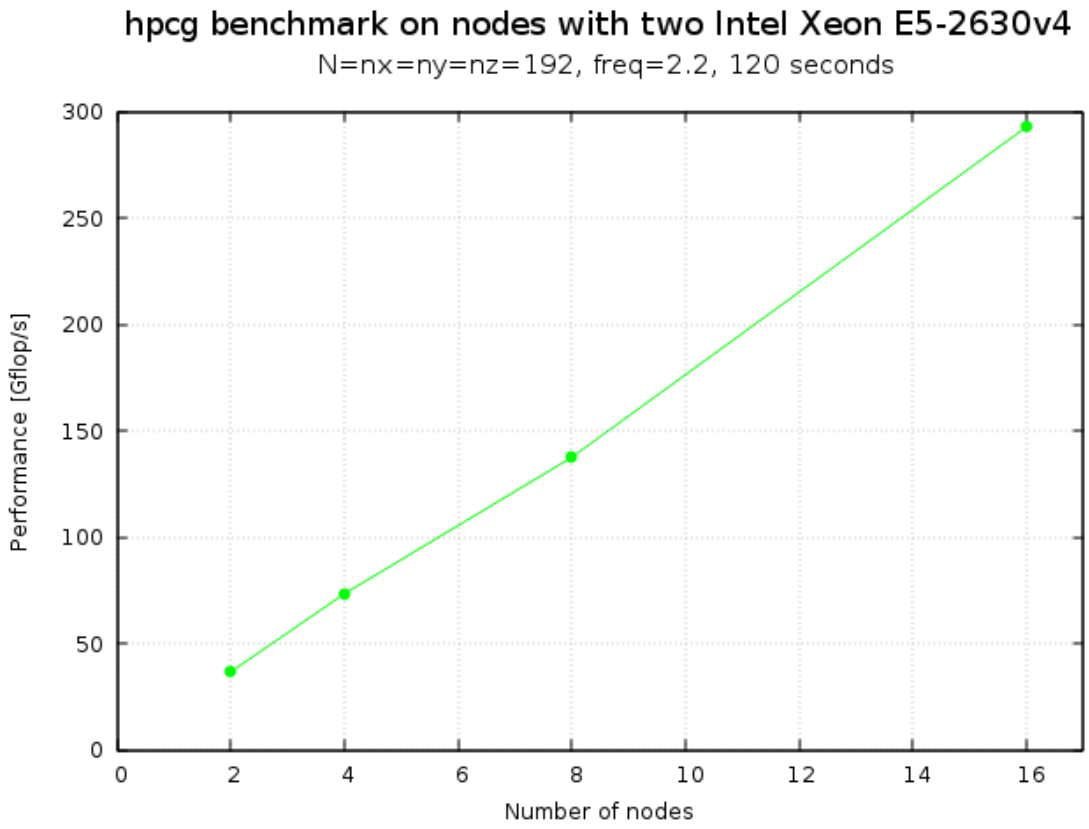
```
srun -p work --time=24:00:00 --ntasks-per-node=1 --cpus-per-task=20 --nodes=N --pty bash
                                        -l
```

using every jobs respective number of computenodes. Once connected to the computenodes, we load all necessary modules and type the command

```
mpirun -np NP -ppn 2 -genv OMP_NUM_THREADS 10 -genv KMP_AFFINITY
verbose,granularity=core,compact ./xhpcg_avx2
```

using every jobs respective number of processes. You can infer all the parameters and benchmarking results from this table:

Number of computenodes	2	4	8	16
Number of processes	4	8	16	32
$GFlop/s$	36.723935	73.436525	137.588941	292.871962



Exercise 4

These benchmarks are executed on the Emmy Supercluster, running one node and one GPU only, using the NVidia HPCG benchmark. Each node is equipped with two NVidia Tesla K20m GPUs. We test for total memory usage. We configure the parameters in the `hpcg.dat` with $N = nx = ny = nz \in \{32, 64, ..., 224\}$. For each benchmark, we start an interactive job using

```
qsub -lnodes=1:ppn=40:f2.2:k20m2x,walltime=2:00:00 -I
```

Once connected to a computenode, we load all necessary modules and type the command

```
./run_1_node_1gpu
```

You can infer all the parameters and benchmarking results from this table [1]:

$N = nx = ny = nz$	32	64	92	128	160	192	224
$GBytes$	0.023432	0.187358	0.642416	1.49882	2.92737	5.0585	8.0327

The performance of the K20m GPU with $N = nx = ny = nz = 192$ is $25.8617 GFlop/s$

[1] The last run kept getting terminated by the workload manager, which means that the GBytes value for $N = 224$ wasn't obtained via benchmarking, but was extrapolated from the previous results. We obtained it using $5.0585 \cdot (224/192)^3 = 8.0327$. We suggest that the results advance in a cubic progression.

Exercise 5

This benchmark is executed on the Emmy Supercluster, running one full node, using the NVidia HPCG benchmark. The node is equipped with two NVidia Tesla K20m GPUs. We configure the parameters in the `hpcg.dat` with $N = nx = ny = nz = 192$. We start an interactive job using

```
qsub -lnodes=1:ppn=40:f2.2:k20m2x,walltime=2:00:00 -I
```

Once connected to a computenode, we load all necessary modules and type the command

```
./run_1_node_2gpu
```

The result is $49.8 GFlop/s$

Exercise 6

These benchmarks are executed on the Emmy Supercluster, running two, four, eight and sixteen full nodes, using the NVidia HPCG benchmark. Each node is equipped with two NVidia Tesla K20m GPUs. We configure the parameters in the `hpcg.dat` with $N = nx = ny = nz = 192$. For each benchmark, we start an interactive job using

```
qsub -lnodes=NODES:ppn=40:f2.2:k20m2x,walltime=2:00:00 -I
```

using it's respective number of computenodes. Once connected to the computenodes, we load all necessary modules and execute the respective scripts. You can infer all the parameters and benchmarking results from this table

Number of nodes	2	4
GBytes	88.7	132.8