Timing results for Dardel

Axel Brandenburg

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1 Code and test case

For all tests, the PENCIL CODE was used. It is publicly available on `http://github.com/pencil-code`, where also detailed documentation is available. The code uses explicit sixth order finite differences. The time step is third-order. In this sample, we run isothermal magnetohydrodynamics in a periodic domain[1]. Power spectra are computed during the run, but our current parallelization of the Fourier transform requires that the meshpoint number is an integer multiple of the product of processor numbers in the y and z directions and the product of processor numbers in the x and y directions. In addition, the number of processors in one direction should not be so large that the number of mesh points per processor becomes comparable to or less than the number of ghost zones (which is 6).

2 Running the code

To run the code, get one of the sample run directories, e.g., `https://github.com/pencil-code/pencil-code/tree/master/doc/timings/N4096_32x32x32`. The relevant file to be changed is `src/cparam.local`

```
ncpus=2048,nprocx=4,nprocy=16,nprocz=ncpus/(nprocx*nprocy)
nxgrid=512,nygrid=nxgrid,nzgrid=nxgrid
```

in particular the values of ncpus, nprocx, nprocy, and nxgrid. Once they are chosen, say make, and submit start_run.csh.

[1] A sample run directory is available on `https://github.com/pencil-code/pencil-code/tree/master/doc/timings/N4096_32x32x32`

Table 1: Dardel timings

proc	$\frac{\mu s}{\text{pt step}}$	resol.	layout	comp.
128	6.346E-03	256^3	4x4x8	Cray
256	3.215E-03	256^3	4x8x8	Cray
512	1.857E-03	256^3	8x8x8	Cray
1024	1.505E-03	256^3	8x8x16	Cray
2048	1.884E-03	256^3	8x16x16	Cray
512	1.571E-03	512^3	8x8x8	
1024	1.102E-03	512^3	8x8x16b	
2048	5.508E-04	512^3	8x16x16	
4096	7.461E-04	512^3	16x16x16	
512	1.568E-03	512^3	8x8x8	gnu
1024	9.260E-04	512^3	8x8x16	gnu
2048	5.550E-04	512^3	8x16x16	gnu
4096	7.702E-04	512^3	16x16x16	gnu
4096	2.093E-04	1024^3	16x16x16	Cray
8192	1.215E-04	1024^3	16x16x32	Cray
16384	8.536E-05	1024^3	16x32x32	Cray
4096	2.754E-04	1024^3	16x16x16	gnu
8192	1.194E-04	1024^3	16x16x32	gnu
16384	6.046E-05	1024^3	16x32x32	gnu
32768	3.953E-05	1024^3	32x32x32	gnu
2048	3.416E-04	2048^3	8x16x16	
4096	1.859E-04	2048^3	8x16x32	
4096	1.674E-04	2048^3	16x16x16	
8192	9.271E-05	2048^3	16x16x32	
16384	6.853E-05	2048^3	16x32x32	
32768	2.909E-05	2048^3	32x32x32	
8192	8.588E-05	4096^3	16x16x32	
16384	4.368E-05	4096^3	16x32x32	
32768	3.153E-05	4096^3	32x32x32	

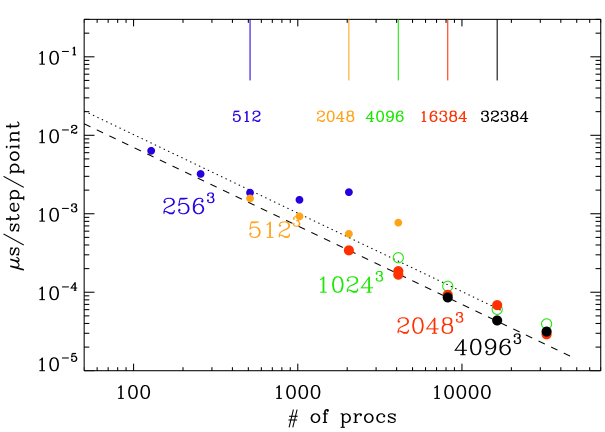

Figure 1: Strong scaling on Dardel.

3 Dardel

On Dardel, strong scaling tests have been performed for three mesh sizes. The time per time step and mesh point is given for different processor numbers and layouts. Generally, it is advantageous to minimize the processor surface area, and to keep the number of processors in the x direction small.

Comments. Performancewise, cray-O2 is equivalent to gnu-03. While gnu-03 is able to handle memory or whatever compiler problems much better, it is otherwise not better than Cray-02, and often some 10–20% slows, but this is within the measurement accuracy.

`$Header: /var/cvs/brandenb/tex/pencil-code/performance/notes_2021.tex,v 1.2 2021/10/31 03:19:57 brandenb Exp $`