Hardware Aware Scientifc Computing (HASC) - Exercise 03

Manuel Trageser
Justin Sostmann

Exercise 1 *Parallel Implementation of the Astrophysical N-body Problem*

1)

Done

2)

-

3)

Check the plot.ipynb notebook for the plots.

4)

Check the performance plots in the plot.ipynb notebook.

5)

Check the plot.ipynb notebook for the plots. And nbody.cc for the code of the AoS vectorized version and nbody2.cc for the SoA vectorized version.

We played around with various ideas and implementations for the AoS version, but did not achieve any significant speedup compared the the provided `nbody_avx.cc`.
Our final version of the AoS version can be found in nbody.cc. The idea was to use a *global* block of 4 `Vec4d`s that interact in the inner loop with 2 particles at a time. As the outer loop loads 4 particles at a time, which are `2(pos and acc)*4(x,y,z, pad)*4*8bytes = 256bytes` we can load all 4 outer particles in 2 cache lines which should be one load operation.
-> This version is obviously slower than the provided `nbody_avx.cc`, as we did not actually use effective blocking.

As a fallback implementation we tried to improve the provided `nbody_intel_SoA.cc` by using the hint on the exercise sheet.
-> This sadly still did not improve the performance. It actually performed worse than the original code.