Introduction to Parallel Processing

Dr. Guy Tel-Zur

Spring 2023

Home assignment #2

N-body in MPI

Write a parallel C code with MPI to simulate a naive 2D N-body problem, $O(n^2)$.

Assume:

1. m=m_sun ≈ $2x10^{30}$kg.
2. Gravitational constant, $G=6.674\times10^{-11}N\cdot m^2/kg^{2.}$
3. v= Average speed ~ 200Km/sec.
4. N=992 stars.

- Generate initial random positions and velocities, in a square domain of size 100ly times100ly (1ly = 1 light year ≈ 9×10^{12}km) and velocities in the range 0.5v<v<1.5v with uniform direction distributions.
- Choose the time step.
- Choose the total number of time steps such that the execution will last longer than 2 minute.
- Use double precision for the physical variables.
- It is recommended to develop and visualize the results on the VM platform.
- Performance measurements must be performed on one of the "hobbit" nodes (no machine file).
- It is up to you to decide what action to take if a start exits the domain. For example, it can be reflected back inward or enter the domain from the other end.

What to submit?

1) Submit your working and documented code.
2) A plot of the speedup (t_2/t_p) vs. number of tasks (p=2,4,6,8 and 16).
3) For 992 stars and 8 MPI tasks, generate 3 snapshots of your galaxy (in the beginning, in the middle and in the end of the run) and submit them as images (*.png or *.jpg).
4) Screenshots of Jumpshot and Scalasca for 992 stars (currently these tools work only on the VM).
5) Conclusions.
6) Other instructions that were given in Lecture #1 – "Admin" apply here! i.e.
טופס מקוריות, חיבור 2 שאלות אמריקאיות

Due in two weeks.

Good luck!