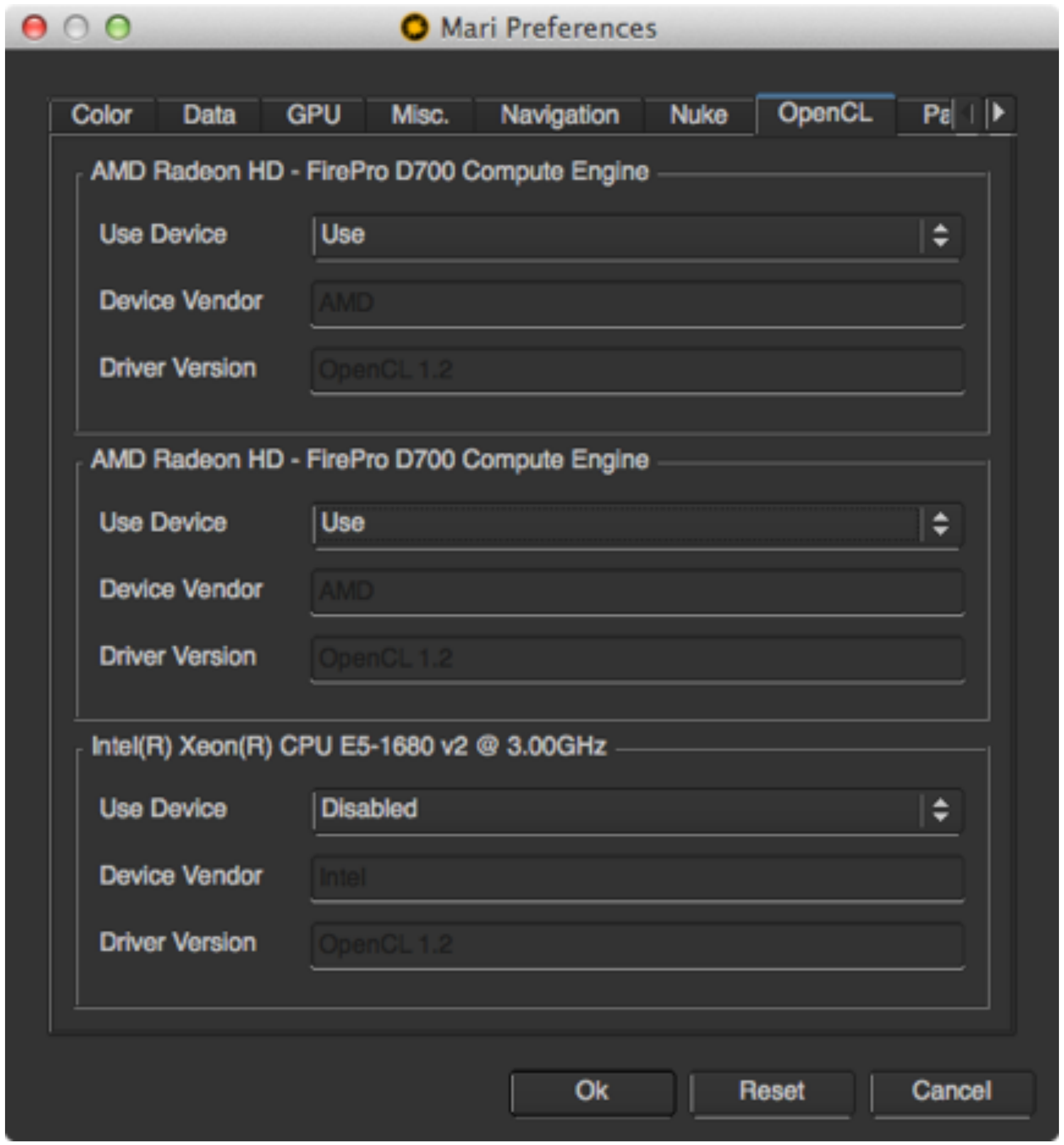
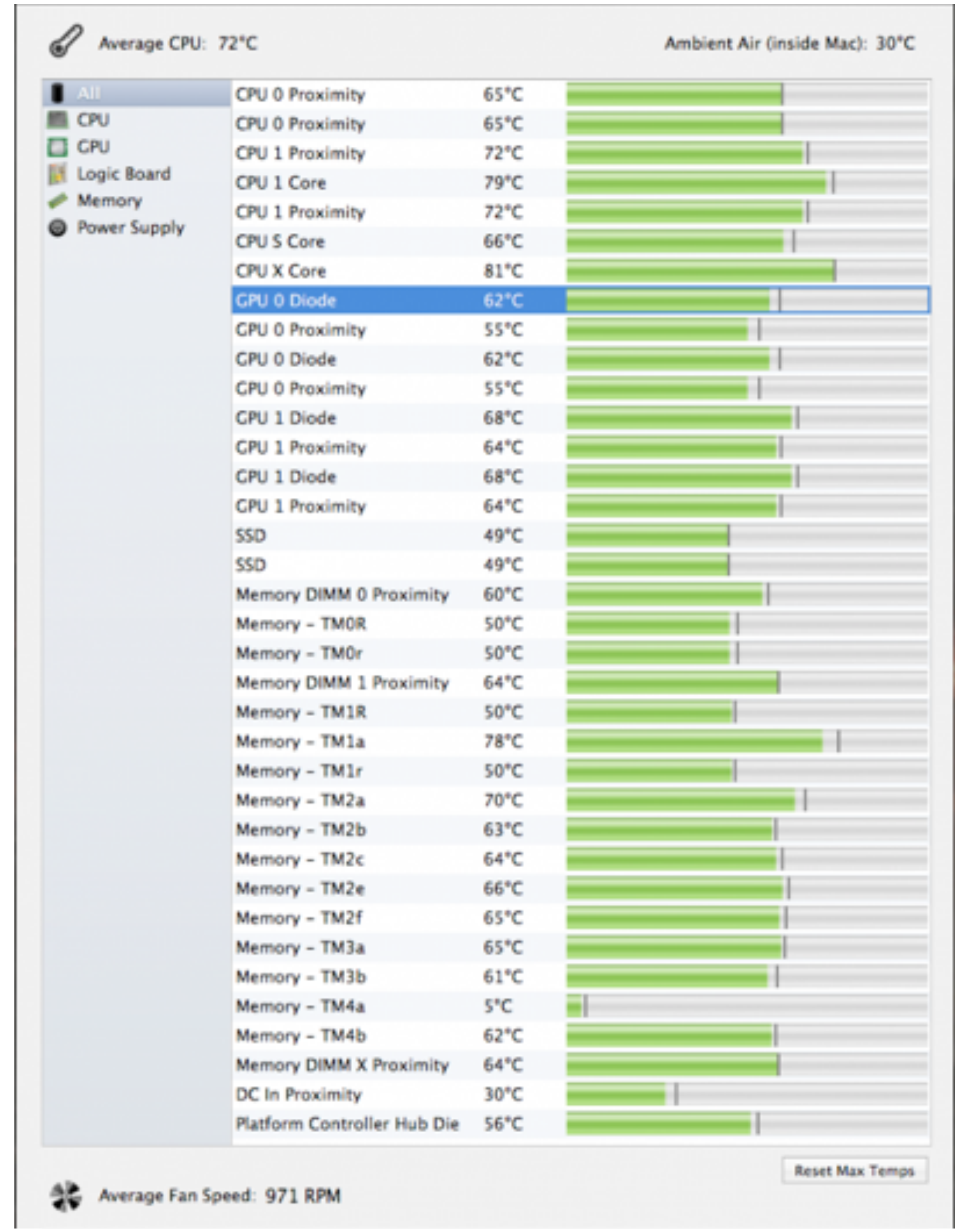
Which one?

Heat is a concern!





Short Discussion of Parallelism

- Types of Parallelism
  - task parallelism
  - data parallelism

Task Parallelism

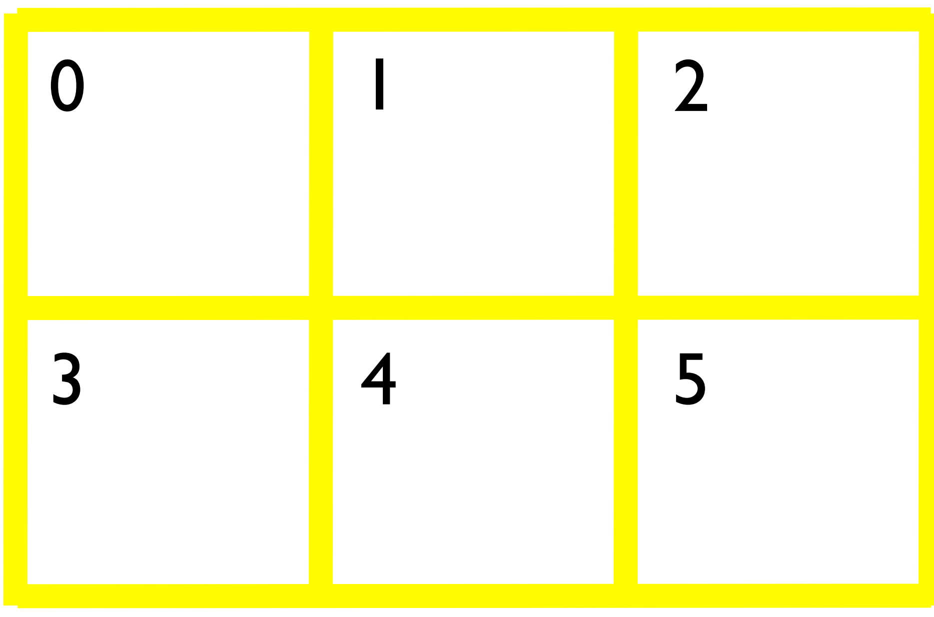
- Simple to understand
  - make a list of things to do
  - you have a set of T tasks
  - you have a set of P processors
  - give each task to a separate machine
  - time O(T/P)

Amdahl's Law

- Scaling O(T/P) is a lie
- Assume P is infinite, time can't be zero
  - always serial costs: startup, I/O, interprocess communication (MPI), ...
- WARNING, file system (NFS) is a serial resource, shared by everyone
  - write to local /tmp or /scratch when possible

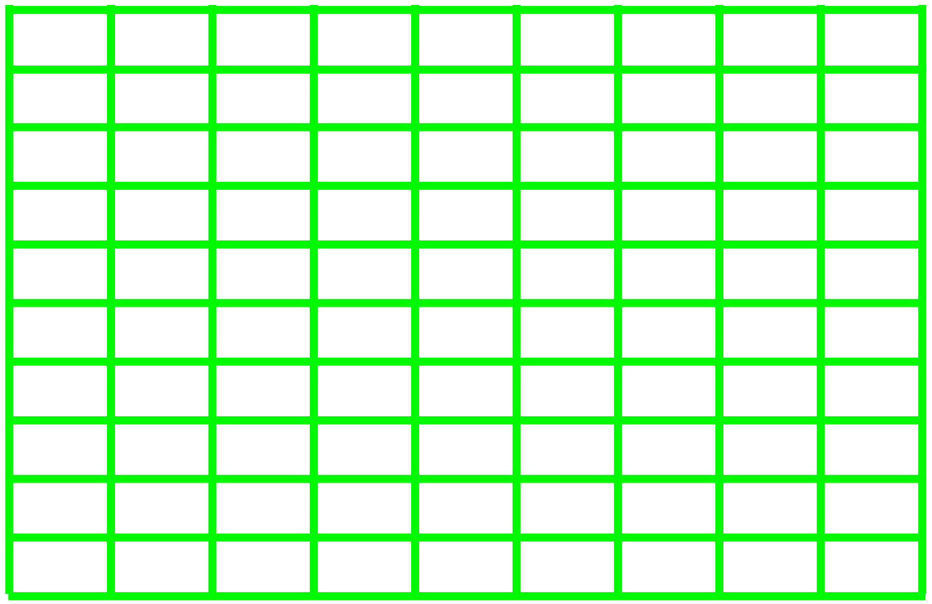
Processor Topology

- A set of P processes can be arranged in a virtual grid of Mp*Np = P processes
- 2 rows by 3 columns = 6 processes



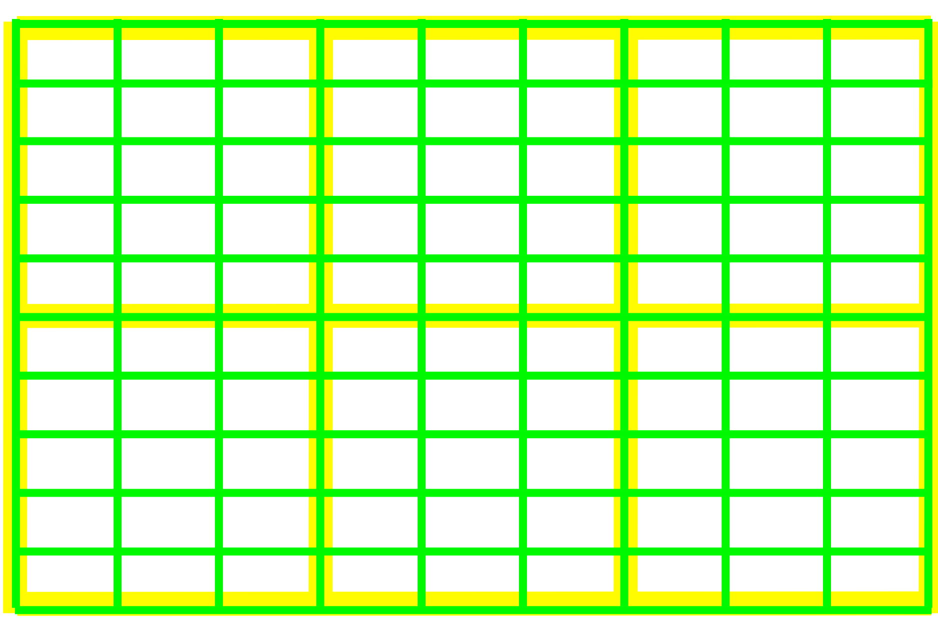
Data Grid Topology

- Cells of data can be arranged in a grid of M*N = L cells
- 10 rows by 9 columns = 90 cells



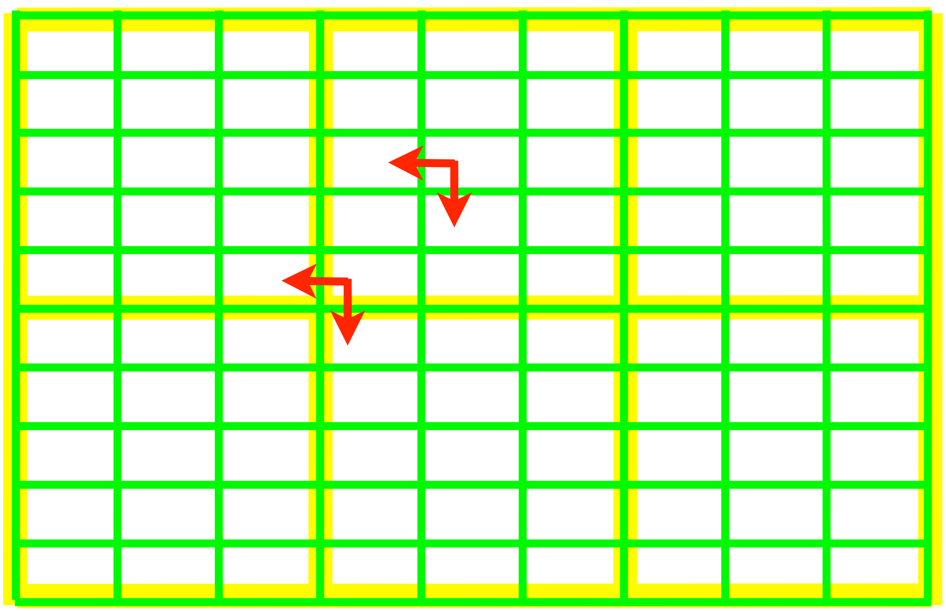
Data Parallelism

- Distribute a group of cells to a processor
- Scales well (up to 100 K + processors)
    - weak scaling: as cell count increases, use more processors
- 5 rows by 3 columns = 15 cells per processor



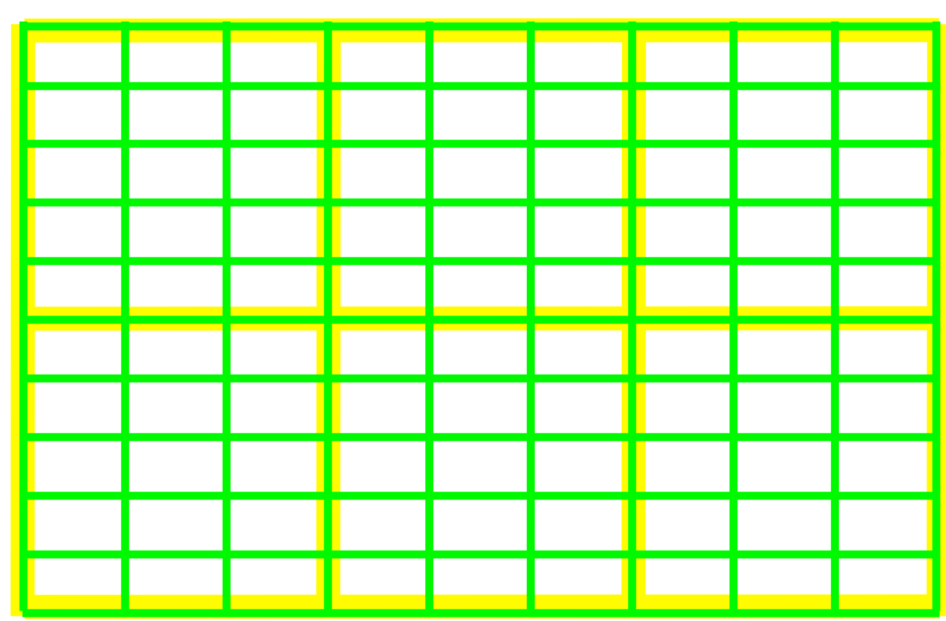
Data Parallelism: Communication

- Communication is usually between neighboring processors
  - communication costs scale as processor surface
  - computation done on volume (# of cells)
- Global communication often scales O(log(P))
  - calculate an average over all cells (e.g., average temperature)



Data Parallelism Scaling

- Weak scaling beats Amdahl's law because number of cells per processor is constant
- Unless global communication, communication costs are also fixed



Access to ACISS

- Sign up for ACISS:
  - http://prodigal.nic.uoregon.edu:4063/newuser
- Try simple commands on ACISS
  - https://blogs.uoregon.edu/casspr/2012/05/25/mpi-workshop-simple-task/