

CS 695 High Performance Computing

Fall 2007

Homework 1

Due: Thurs September 13, 2007

The parallel computers with the best performance at any time are listed in the *Top 500* list, maintained at www.top500.org. At this website, you will find that as of June 2007, the top three performers are the IBM Blue Gene/L at Lawrence Livermore National Laboratory, a Cray XT4 at Oak Ridge National Lab, and the Red Storm machine at Sandia National Lab. The Red Storm is the basis for the Cray XT4 architecture, so we will consider the first two machines.

Compare the Blue Gene and the XT4 parallel computers, with regard to some of the questions in Figure 1 of the *View from Berkeley* paper we discussed in class. You can obtain information from links at the Top 500 web site to answer these questions. I have also provided a technical report from Oak Ridge National Laboratories on the memory performance of the Cray XT4 in the course web site.

1. What are the processors used in these machines? How many cores do they have? How many processors are available in the configurations at the two Labs? What is the peak performance? What performance has been achieved on the LINPACK benchmark?
2. How are the processors connected together? If there is more than one interconnection network, state what the different networks are used for. What is the communication bandwidth on each link of the interconnection network? What is the latency?
3. Describe the size of the primary memory, and the time for accessing a word from memory. A balanced multiprocessor design provides 1 MB of memory for each Million instructions per second executed by the machine. Is one of these machines more balanced in its design than the other? Also discuss the rest of the memory hierarchy, the sizes and nature of the caches, and the time needed to access an element from the cache.
4. What programming models are supported by these machines?
5. What significant applications have been solved or are proposed to be solved on these machines?