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Assignment 1

1. **(5 points) What are the factors that limit the availability of high-end computing?**

   "high cost, decreasing number of vendors, variability of architecture types across vendors and between successive generations of a given vendor, and often inadequate software environments."

   -Introduction

   Basically high-end computers cost too much and the vendors supplying them aren't consistent, so it's difficult to get different machines to work together.

2. **(1 points) Provide the definition of a Beowulf-class system.**

   "a combination of hardware, software, and usage which while not all encompassing, yields a domain of computing that is scalable, exhibits excellent price-performance, provides sophisticated and robust environment, and has broad applicability."

   - Beowulf-class Clustered PC Systems

   Essentially, Beowulf is a new (as of 1998) way to create a low-cost, high performance compute-system by networking multiple PC systems (clusters) and running them in parallel. Instead of having one super machine handling all of the computation, the computations are distributed to the machines in the cluster and handled in parallel.

3. **(4 points) What are the four determining factors to support scalability of a Beowulf-class system?**

   1. Hardware M2COTS are not tested for real-world scaling. Network switches are especially concerning. The concern is that they won't perform as expected in the full Beowulf system.

   2. Number of disks on EIDE or SCSI channels and the number of EIDE or SCSI channels.

3. The ability of memory bandwidth to support multiple processors per SMP motherboard

4. Filesystem scalability: needs to be scalable through parallel software. The filesystems need to be able to work for multiple machines.

    -Determining Factors

The biggest factors that affect scalability of Beowulf-class system are available bandwidth, latency of communication between machines and of compute, and efficient global synchronization.

4. (5 points) What are the three distinguishing characteristics of application algorithms that scale?

"Applications that are written in a "parallel out-of-core style tend to run well on Beowulf-class systems. This is because the granularity of the parallelization is large and explicit."

"Applications that can be written without explicit global synchronizations tend to run well on Beowulf class systems."

"Applications that combine all of their communications into one massive communication such as one global transpose."

    -Algorithm Scaling Characteristics

1. Run as much as possible in parallel

2. Reduce the amount of global synchronizations

3. Send fewer, but larger clumps of data over networks.