Math Bits

690 Team

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Costs For Determining Preemption

Our algorithm involves two different costs which are used to evaluate whether or not a job j_i is killed on preemption—cost of killing (C_k) and cost of using a checkpoint with a potential migration to a new processor (C_p).

Even if we kill a process, it will eventualy need to be re-run. Therefore the cost of killing involves a factor of how much time a job has already been running as whatever work a processor has already done on that job will have to be done again. Because the assumption is that there is no overhead associated with killing, we can say that C_k is simply

$$C_k = t_i$$

where t_i is the amount of time job j_i has been worked on.

We now consider the cost of using a previous checkpoint. Assume we checkpoint at interval l. If we use a previous checkpoint, then we only have to re-run the job from a previous checkpoint as opposed to the whole job. However we also have to consider a migration cost. In the event a job switches to a new processor, an amount of overhead is associated with writing the memory of the checkpoint to the new processor. If we assume that a processor has an equal likelihood of being scheduled onto any processor, then the probability of incurring a migration cost is $(m-1)/m$ where m is the number of processors. Therefore our cost C_p is

$$C_p = (t_i - t_p) + \frac{o_m\,(m-1)}{m}$$

where t_p is the amount of time job j_i has been worked on at the most recent checkpoint and o_m is the overhead associated with migration. This value is constant. We know that $t_i - t_p$ must be bound by l and therefore we can say that

$$C_p < l + \frac{o_m\,(m-1)}{m}.$$

For later analysis it is important to note that the mean and standard deviations for amount of migrations with n_p preemptions using checkpoints are

$$\mu_p = n_p \frac{m-1}{m}$$
$$\sigma_p = \frac{\sqrt{n_p\,(m-1)}}{m}.$$