CSC470 Fall, 2000

Computer System Modelling And Analysis

Laboratory #3
October 17th/19th and 24th/26th, 2000

Assignment

In the second week of Lab #3, you are asked to use the various models produced in the preparation phase to predict the effects of various changes to the systems and their workloads.

1. System A Alone

System A, which consists of a cpu and two disks, is currently used to support an interactive stock market system, through which users can inquire about prices, and initiate buy or sell orders.

To answer the questions below, use the single class model based on a *terminal* type workload that you constructed and validated in the preparation.

(a). For system A, the current "Service Level Objective" (SLO) that has been agreed upon with the users of the system is that the average response time of the system should be less than or equal to 20 seconds ($R \leq 20$). But in the base line performance data the average response time is over 30 seconds. Use your model to predict the effect of upgrading the current cpu to a dual processor. With that upgrade, what do you expect the average response time will be? Will the SLO be satisfied?
[To reflect the change to a dual processor, use the command "processors 2" in the context of the center representing the cpu.]

(b). It is anticipated that, by next year, the workload intensity on System A will increase by 50% (i.e., 50% more interactive users).

i. Will the dual processor version of System A created in part (a) still be sufficient to satisfy the Service Level Objective?

ii. What would the performance of the system be if the cpu were further upgraded to a quad processor (consisting of four processors identical to the original System A cpu)?

iii. To what extent can performance be further improved by adding a third disk (identical in characteristics to the first two), and redistributing the files so that all three disks are used? (Describe specifically what changes you make.)

[Continued on Other Side.]

2. System B Alone

For System B, the current SLO's are:

warehouse:	X_{ware}	>	.005
development:	R_{devl}	<	40.0
inventory:	R_{invn}	<	25.0

(a). Try the changes below in order to attempt to make System B satisfy the current SLO's.

i. Use priority scheduling at the cpu, set the priority level of class warehouse lower than the other two. Are the SLO's satisfied?

ii. Spread the I/O activity for class development evenly over all four disks (while keeping the priority structure as in part (i)). Are the SLO's satisfied?

iii. Make a further change (in addition to the first two) by upgrading the cpu to a dual processor. Are the SLO's satisfied?

(b). By next year, it is expected that the number of development users will increase from 12 to 14, and the rate of inventory transactions will increase from .045 to .060 per second. Also, the SLO for the warehouse class will require a throughput of at least .008 (rather than .005). Working from the system as specified at the end of part (a), try out the following changes to try to make sure that the SLO's are all satisfied.

(i). Try increasing the multiprogramming level of class warehouse in order to improve its throughput. Are the SLO's satisfied?

(ii). Restore the original multiprogramming level for class warehouse, and add a fifth disk to the system. Balance the warehouse I/O load across three disks, the two initially used and the new one. For class inventory, move half the I/O load on the second disk to the new (fifth) one.

(iii). Once again, try increasing the multiprogramming level of class warehouse to satisfy all SLO's simultaneously.

3. System A and System B Together

When System A and System B were treated individually, in order to satisfy current SLO's, it was necessary to to upgrade the processors of *both* systems to dual processors. Consider now satisfying the current SLO's in a more economical way by:

- upgrading one (but not both) of the two processors;
- moving one (or more) workloads from one system to the other; and
- smoothing the I/O load of one of the workloads on one of the systems.

Describe a minimal set of such changes that permits the current SLO's for all four workloads to be satisfied. (Assume that the two original processors are of the same model, and that all six disks have identical performance characteristics.)