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FROM: F. J. Corbató and R. C. Daley

DATE: December 11, 1969

SUBJECT: Emergency Measures to Improve Multics Response

Running of the Multics Fortran Script with the PDP-8 indicates that Multics can currently support forty to sixty users of this class. However, the heavy use of Multics by system programmers currently overloading the system and wrecking response for other, income-producing users. Response under these heavy loading conditions is driving away prospective paying users who are forming lasting impressions of Multics. The initial impression frequently is that Multics is possibly powerful but apparently clumsy. The users, of course, neither realize nor appreciate that the poor response is due to the excessive load developed by the especially heavy demands of system programmers. It is extremely important to develop the confidence of a substantial user community in order to justify and support continued Multics development.

In order to improve the above situation the following emergency plan, which has been approved by the joint IPC - Multics planning group, will be implemented immediately:

1. The maximum number of non-paying users (e.g. Multics developers, system daemons, etc.) will be limited to 15.

2. The scheduling algorithm initial time burst for each interaction will be reduced from 4 seconds to 2 seconds. The effect of this will be to introduce an additional scheduling queue in front of the three existing queues.

3. As rapidly as system performance and response can reach acceptable levels, the restriction on the maximum number of system programmers will be relaxed accordingly. In order that these restrictions may be relaxed as soon as possible, the best use of the limited number of lines is to concentrate our attention more heavily on performance issues. For this reason a two level priority system will be established to expedite critical tasks affecting system performance and reliability. (Task priorities will be set by R. C. Daley.)

4. Because the number of priority tasks will be small, it is expected that there will be some slack for non-priority access. Clearly, it is in the best interests of all for Multics programmers to login, do their work, and logout in the shortest real-time possible. Line-hogging will be considered extremely anti-social during this critical period.

5. A bumping policy (in software eventually) will be implemented to support the above limit of non-paying users. A person logging in on a priority task may bump the longest logged-in non-priority user when there is a full complement of system programmers. A non-priority user may bump another non-priority user when the latter has been logged in for over one-half hour. A user who is bumped, should not attempt to login again in less than 10 minutes in order that others have an opportunity to access the system.

It should be pointed out that there are a number of tasks which are scheduled to be completed during the next several weeks and are expected to have a substantial effect on system performance and response. As these tasks are completed and performance is improved, the restrictions on system programmer access to Multics will be relaxed accordingly. Some of the critical performance tasks scheduled for the coming weeks are summarized below in the order they are expected to be completed.

1. Installation of DSU270 disks - this task is expected to reduce drastically the time spent in multiprogramming idle.

2. Revision of the scheduling algorithm. This task introduces a refinement to the scheduler to allow smaller initial time bursts without causing the longer-running users excessive paging.

3. Recode of the basic command processing loop -- the mini-shell, listener, tio_, and IPC are being recoded and reorganized to

minimize the amount of code and per process data required for command processing. This task should greatly reduce the cost of issuing a trivial command.

4. Recode of page fault handling. The page fault handler is being recoded in machine language to drastically reduce the CPU and real time required to process a missing page fault. In addition, a mechanism for pre-paging selected user pages is to be provided with the new page fault handler.

5. TTY DIM recode - The typewriter DIM is to be recoded to improve its performance and overall buffering strategy. (During the recode the capability to support ARDS terminals will be included.)

The above temporary limitations on machine access are being applied with regret, but with the conviction that these steps are necessary to the success of the Multics system and future Multics development. The heavy concentration of effort and priority on performance-oriented tasks is not meant to imply that other tasks are not equally important. Rather, the current assignment of priorities is intended to avoid prolonging this difficult period any longer than necessary.