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Identification

Overview of Reschedule

Robert L. Rappaport, Michael J. Spier

Purpose

The Traffic Controller multiplexes (time-shares) the system's processor resources by allotting to each process a certain time quantum during which it may make uninterrupted use of a processor. The time allotment is kept in a hardware register, named the timer-register, which decrements its value by one with the passage of every time-unit (the unit may be either real-time or machine cycle). When a process' time allotment runs out, an interrupt is generated which causes the process to divert its execution into the Traffic Controller's entry point reschedule. There the process gives itself a new time-allotment and re-enters the race for a processor. This section describes the overall function of entry point reschedule.

Discussion

A running process always has a current time-allotment. Its time-allotment is never affected by calls to the Traffic Controller's multiprogramming entries block and wait. Associated with a process' time allotment is a level number which denotes the process' priority in the race for a processor. Whenever a process is put in the ready state (be it after rescheduling or after a wakeup), its level number determines its priority in the multi-process race for a processor. A process retains its level number for the duration of its time allotment; when the timer-runout interrupt occurs, the process reschedules itself by giving itself a lower-priority level and a corresponding new time allotment (see BJ.5.01); a process' priority can only vary within the limits of fixed (per process) boundaries, so that

highest-priority > = current-priority > = lowest-priority

A process' timer-runout may be precipitated (or in other words, a process' license to use the processor may be prematurely revoked) in the two following cases only:

1. By the process itself: If the process is engaged in dialogue with a human being (interaction), it has the right to demand its "highest-priority" level, so as to provide fast system response to human requests. As explained above, a process' time-allotment and a process' level number are associated; therefore the current time allotment has to be abandoned and a new one has to be computed in conjunction with the new level number. In case of an interaction, the process calls (indirectly through block) the scheduler and is rescheduled into its highest-priority level. Note that "interaction" here is taken to mean that the I/O system is anticipating console input; thus, if the I/O system finds it necessary to go blocked while awaiting such input, it does so with the interaction switch set.

2. By some other process: When a process is put into the ready-state a check is made to determine whether or not its current level entitles it to have a processor immediately. For example, if a process is interacting as explained above, and it is in need of a processor, and if the only available processor is currently assigned to some process which is engaged in some background task then it seems logical to allow the high-priority process to interrupt the low-priority one and take the processor for itself. When a process precipitates another process' timer-runout, we say that it pre-empts the other process.

When a process calls reschedule because it interacts or because it had a timer-runout interrupt, it performs the following functions:

1. It does its own processor-usage accounting, adding the last amount of used-up time to its cpu-usage meter and making sure that it still has processor-time resources left. If its resources are exhausted, it invokes its automatic-logout mechanism.

Assuming that it does dispose of more processor time

2. It reschedules itself (by calling the scheduler). This operation consists of the assignment of a new level and the computation of an associated time-allotment.
3. It puts itself on the ready-list and, if entitled to by virtue of its new level number, it possibly pre-empts a currently running process.
4. It gives the processor away to the topmost eligible process on the ready list (which might conceivably be this very same process).

Implementation

Entrypoint reschedule is called by the timer-runout interrupt interceptor only

call reschedule

When a process calls block (interaction_switch, event) with interaction-switch set to "on", the Traffic Controller knows that the process is engaged in interaction and calls the scheduler to give the process its highest-priority level number.

A process that has suffered pre-emption diverts its execution into the pre-emption interrupt interceptor which retrieves the remaining time in the timer-register and stores it in the process' APT entry, then puts the process on the ready-list and gives the processor away.

The scheduler is described in section BJ.5.01, the pre-emption mechanism in section BJ.5.02 and the cpu-metering module in BJ.5.03.