

Identification

Overview of Resource Expenditure Metering
T. H. VanVleck

Purpose

In order to be able to account for and control the usage of the system resources precisely, Multics must measure and record resource consumption at a very elementary level. Section B0.3.00 describes the technique for metering the expenditure of resources.

Overview

The initial design for the resource-usage meters distinguishes six quantities to be measured:

1. Processor usage - defined as the number of CPU memory accesses consumed by the execution of a process.
2. Main memory residence - the number of word-seconds attributed to a process because of its use of core storage. A word-second represents the use of one word of core for one second.
3. Secondary storage residence - the number of word-seconds attributed to an account because of its use of secondary storage. (Note that a process may, therefore, cause charges to many accounts in the course of execution by changing the length of files belonging to many accounts).
4. Secondary storage I-O traffic - a count of the number of GIOC cycles for words transmitted by the disk and drum DIM's for a process.
5. General I-O traffic - the number of GIOC cycles for words transmitted by the I-O system for other devices.
6. General I-O device use - the number of seconds a process has been connected to an I-O device.

In order to measure the consumption of these resources precisely, the system modules directly concerned with the use of each resource must perform metering operations,

and must make the meter readings available to supervisor modules concerned with accounting and monitoring.

In some cases, the system must be able to accumulate and record usage figures at times when a page fault is not permitted. Therefore, a wired-down "scratchpad" area, the Active Meter Table, is provided; it holds metering figures until they can be updated onto paged storage. Section B0.3.07 describes this table.

Every entry in the Active Process Table and every entry in the Active Segment Table contains a pointer to an Active Meter Table entry used to record the resource usage associated with the segment or process. Whenever a new segment or process is established, the Active Meter Table is searched to see whether a metering scratchpad for the appropriate account number exists, and a new Active Meter Table entry is created if not.

The usages metered in the scratchpad table must eventually be attributed to a particular account. The Active Meter Table contains the necessary information for finding the Account Data Segment which will receive the information. Updating from the meter table into the data segment must, of course, be done when the system can accept faults; in fact, whenever a process calls entrypoint "Block" or "Quit" of the Traffic Controller from outside ring 0, it is directed to a "Block-interceptor" which calls "update-accounting" to do the updating before going to the real Block or Quit. Performance-monitoring calls are also performed at this time. Updating is also performed whenever deactivation of segments or processes causes an entry in the Active Meter Table to be removed.

Sections B0.3.01 through B0.3.06 describe the strategies for metering the individual quantities.

"Update-accounting" is described in B0.4.01 and the Account Data Segment is described in B0.4.02.

Active Segment Table

Index to AMT
Index to AMT
Index to AMT

Active Meter Table

Meters Name of ADS
Meters Name of ADS

Active Process Table

Index to AMT

