

## Simulation of Virtual Memory

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### Data Structures used:

- **PageTable:** array of page used by a process. It has been kept of fixed size i.e. 10 pages per process. There are overall 5 pagetables corresponding to 5 processes.
- **FrameTable:** Vmhandler manages a table which maps memory page frames with the process id and pageid of corresponding process.
- **Pages:** They consist of an array of 100 elements. Each element is of int type and represents a 'word'.

### Threads Created:

- **Process:** Five threads were created representing a process each.
- **FreeFrameManager :** It is a daemon thread which is activated when the number of free page frames drops below a threshold (3 in our case). It scans the pages in memory to identify a few that can be freed, and adds the page frames of these pages to the list of free page frames. It sleeps when the number of free page frames exceeds another threshold(5 in our case). It uses an approximate clock algorithm to free pages from the memory.
- **PageIOManager :** The page I/O manager performs page-out operations for dirty page frames in the free frames list; it sets the modify bit of a page frame to off when its page-out operation is completed. It is signalled by FreeFrameManager to perform its actions.

### Assumptions

No. of processes = 5

Pages required by each process = 10 (logical address space)

No. of page frames in memory = 23

No. of pages restricted in memory for each process = 4

## **Algorithm used**

FreeFrameManager & PageIOManager are daemon threads and they sleep for most of the time. FreeFrameManager is activated by any of 5 threads when a page fault occurs. Once it wakes up it finds the page to be freed in memory (if necessary) through an approximate clock algorithm. Simulation of clock algorithm is that it sets status of all pages of a thread to 0, once after every 10<sup>th</sup> page is referenced by it. This assures that we have recent information about access to a page, though it sometimes may not work as all the status are simultaneously made to 0. Once FreeFrameManager has completed its work it wakes up PageIOmanager to copy the page from memory to swap if its modified bit is 1.

## **Demonstration**

Simulation and demonstration has been done through JAVA applet.