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Laboratory task 4

Operating Systems – 2020/2021 Summer Semester

I declare that this piece of work is which is the basis for recognition of achieving learning outcomes in the Operating Systems course was completed on my own.

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Introduction

In this lab we are to get familiar with paged memory management with the use of MOSS Memory Management Simulator. 8 First pages of virtual memory will be mapped to physical memory and we'll read from an address on each of the 64 virtual pages. This will show us the behavior of page faults and the page replacement algorithm.

What is virtual memory

If a computer runs out of physical memory it can map some portion of it into secondary memory (such as external storage devices). This part of the memory acts as if it was a part of the main memory and is called virtual memory. The implementation can be done via either paging or segmentation.

What is paging

Paging consists in dividing virtual memory into blocks of identical size called pages, dividing the main memory into page frames and transferring these between virtual and physical memory. This is done with the use of a page table which contains the mapping between virtual and physical addresses and contains a frame table which keeps the information on which frames are mapped.

What is page replacement and page fault

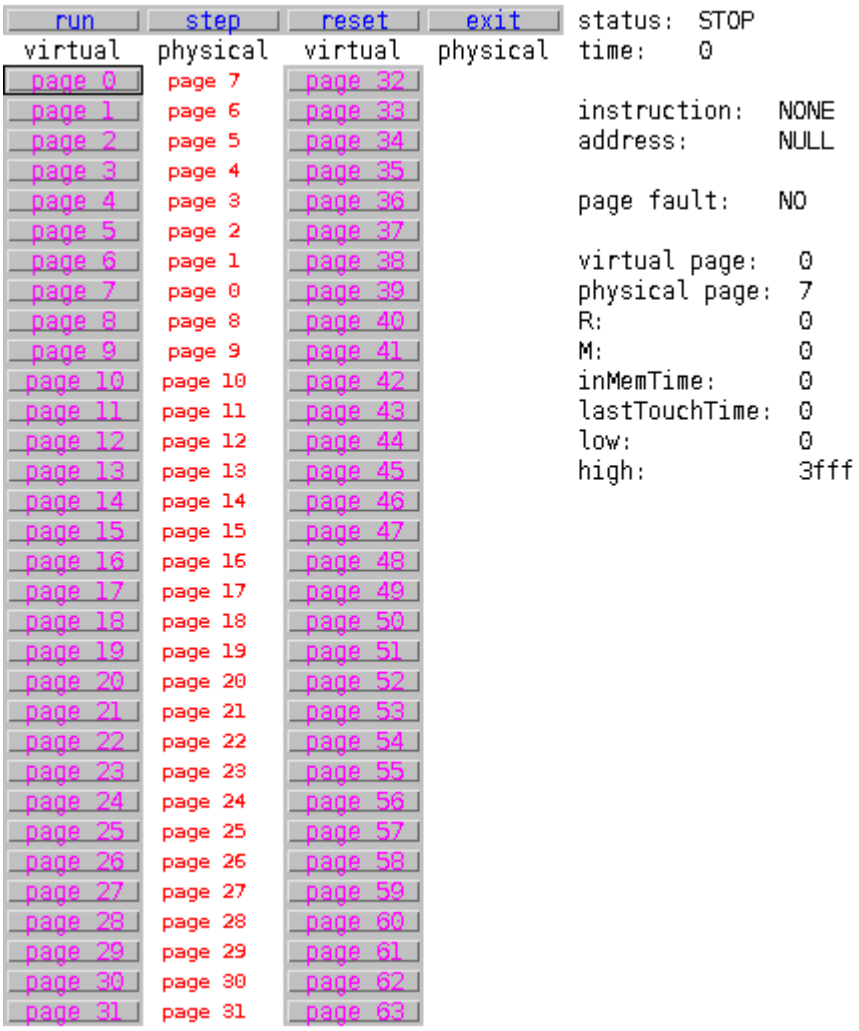
If, after checking the page table, we find out that the page we want to reference is not present in physical memory a “page fault” exception is raised and we need to decide which page to either page (or swap) in and which to page (or swap) out. This is done via one of many page replacement algorithms.

Page replacement algorithm used

By checking the source files we can find in "PageFault.java" that the default page replacement algorithm is first-in first-out (FIFO). That means all pages in the memory are kept in a queue (with the oldest page at the front), and if there in a need for a page to be replaced, the front of the queue is selected.

Comments

After assigning the first 8 virtual memory pages to physical memory pages we turn on MOSS (but not yet run it) and we can check by clicking on page 0-7 buttons that the physical memory pages were mapped correctly. The other virtual memory pages up to page 31 have been mapped automatically by the program.



Trying to read the pages up to page 31 all goes well, but then we reach page 32 which means we are trying to reference a virtual memory page which does not have a physical memory page mapped. This results in a page fault. The situation is the same for all pages >31. Since our page replacement algorithm is FIFO the page to get replaced is the oldest one, in our case the one that was mapped to virtual memory page 0, as it was the first one read and thus was in the front of the in the queue. After that we go in order and see what was mapped to virtual memory page number 1, 2, 3 and so on and repeat the process.

We finish in a situation in which the original mapping between virtual and physical pages has been shifted by 32, and we have read from all 64 virtual pages addresses.