

OHJ-4106 Operating Systems

Exam 5.5.2008

Calculators, computers or literature are NOT allowed in this exam.

1. Describe shortly (as to someone not familiar with this particular software systems subject) what these concepts are (2 p/item):
 - a) What are the main functions of an operating system?
 - b) Pre-emptive scheduling.
 - c) Swapping
 - d) Process states READY, RUN, WAIT

2. A newly started Linux process owns the memory pages seen in figure 1. Virtual memory addresses increase from bottom upwards and the protection bits are:

| | |
|---|--|
| r | page is readable by the process |
| w | page is writable by the process |
| x | the process can execute code from the page |

Explain what parts of the running process are located in each of the memory pages. Also explain where the data resides when it is not available in the main (physical) memory. (5 p)

3. What is a page replacement algorithm in paging memory systems? In what situations it is active and why? Explain either LRU (*Least Recently Used*) or DWS (*Denning Working Set*) algorithm by using an example. (6 p)
4. A process refers to four different memory addresses in its address space according to Figure 2 (order is top-down in the address space box). Using the figure, explain what happens with each memory reference. Distinguish between memory management hardware (MMU) operations and OS software operations. (8 p)

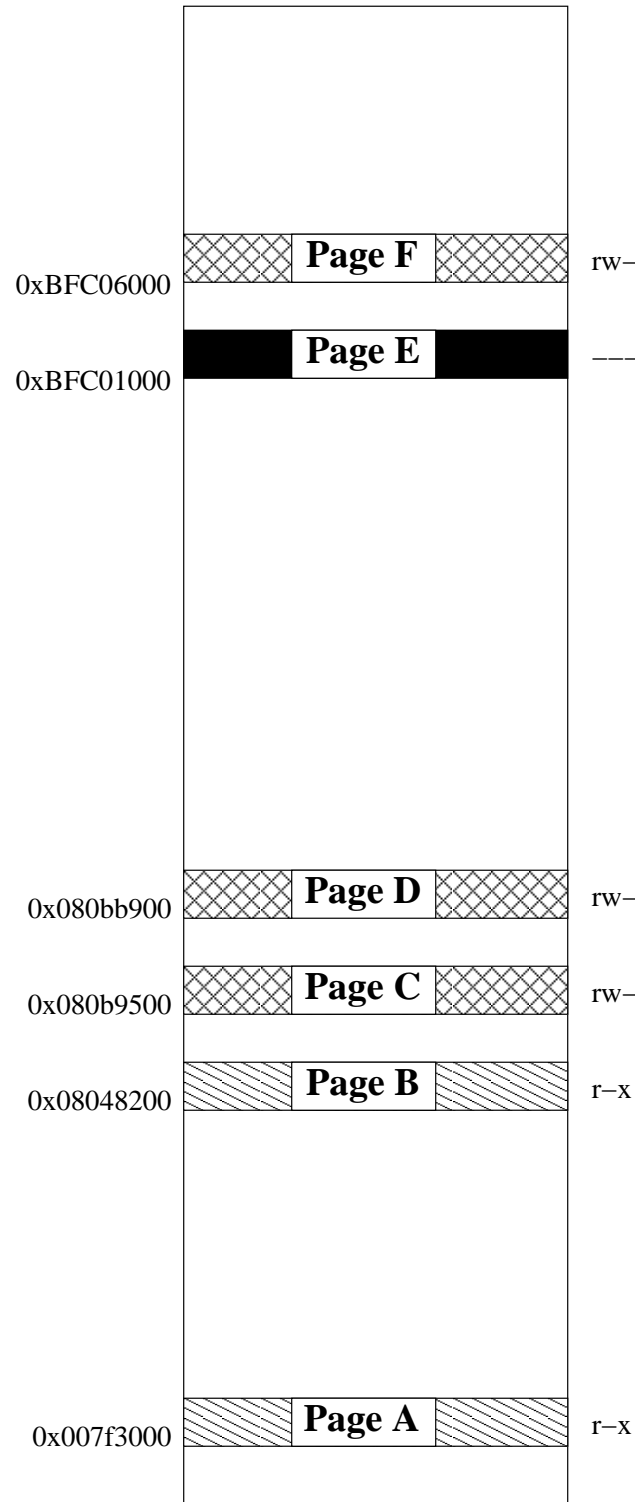


Figure 1: Memory pages used by a process

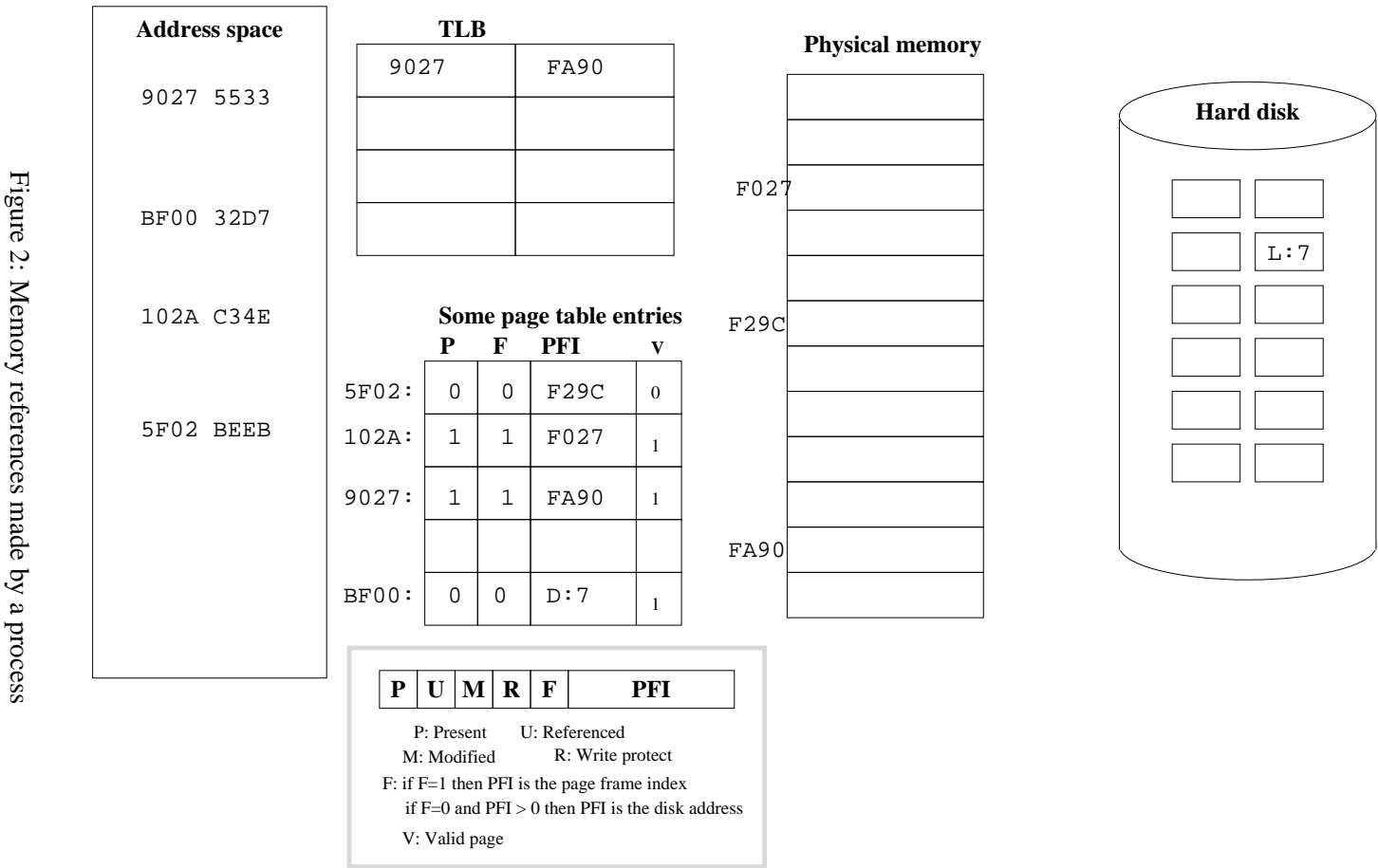


Figure 2: Memory references made by a process