

Virtual Memory

Exercise 1: Segmented Virtual Memory

- Given:
 - A (very small) main memory with a size of 1000 bytes
 - A segment table:

segment number	physical start address	length	access rights
1	0	150	read/write
2	disk block 12	40	write only
3	150	180	read only
4	430	200	read/write
5	disk block 21	110	read/write
6	830	120	read/write

- The table below shows a sequence of segment accesses with their virtual addresses. Calculate the corresponding physical addresses (i.e. byte numbers in main memory) – even if the access is not permitted. Moreover, state whether the access is permitted – and, if not permitted, why not. If the segment is currently stored on hard disk, state this in the rightmost column of the table. Load the segment into main memory (using the "best-fit strategy"), modify the corresponding entry of the segment table and calculate the physical main memory address that results after this operation.

operation with virtual address	physical byte address	access permitted?
read segment 4, offset 0		
write segment 6, offset 90		
write segment 3, offset 78		
write segment 2, offset 35		
read segment 1, offset 155		
read segment 5, offset 80		

Exercise 2: Paged Virtual Memory

- Given:
 - A paged virtual memory with a page size of 2 KB (= 2048 bytes).
 - A part of the page table of a process:

virtual page number	start address of physical page frame
0	14336
1	24576
2	disk block 11
3	4096
4	0
5	disk block 2
6	8192
7	...
...	...

- Do the following:
 - For the virtual addresses in the table, calculate the corresponding physical main memory addresses (if the page is currently stored in main memory) or determine the number of the disk block and the offset within the block (if the page is currently stored on hard disk).

virtual address	physical address
0	
7500	
4500	
2000	
11000	
13000	

- Assume now that virtual page no. 3 is evicted to disk block 17, thus freeing a page frame in main memory. Virtual page no. 5 is then loaded into this page frame.
 - How must the page table be modified?
 - Where and how does, in the second table, the mapping from virtual addresses to physical addresses change?