

Project 1: Fake Demand Paging Device

SWE3015

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Our Goal





Our Goal



Fake Memory Assignment!!!



Specification

- Create /dev/osp device file
 - Providing only mmap operation
- When mmap system call is called
 - **DO NOT Allocate the Page NOW!!**
- If the access is attempted
 - Page fault must be raised.
 - Then allocate the memory page
 - BUT...



Specification

- We use only **ONE** memory page for whole mmap!
 - The “Scrooge” paging device
 - So, we can see same contents for all pages
 - From /dev/osp
- Option 1: implement it as a kernel module.
- Option 2: assign the page **ONLY ONE** mapping
 - If somewhere would make a page fault to access the page, the **previous mapping for the page should be unmapped.**





Example

```
const char memDevice[] = "/dev/osp";

if(argc > 1)
    seed = atoi(argv[1]);

srand(seed);
lines: open /dev/mem and error checking -----
/* mmap() the opened /dev/mem */
map= (int *) (mmap(0, MAPPED_SIZE, PROT_READ|PROT_WRITE, MAP_SHARED, _fdmem, DDR_RAM_PHYS));
map2= (int *) (mmap(0, MAPPED_SIZE, PROT_READ|PROT_WRITE, MAP_SHARED, _fdmem, DDR_RAM_PHYS));
lines: if(map == MAP_FAILED || map2 == MAP_FAILED){-----
printf("map: %016lx\n", map);

/* use 'map' pointer to access the mapped area! */
for (i=0; i<10; i++)
    printf("map content: 0x%x\n", *(map+i));
for (i=0; i<10; i++)
    printf("map2 content: 0x%x\n", *(map2+i));

printf("\n modifying map2\n");

for (i=0; i<10; i++)
    *(map2+i) = rand();

printf("\n reading again\n");

for (i=0; i<10; i++)
    printf("map content: 0x%x\n", *(map+i));
for (i=0; i<10; i++)
    printf("map2 content: 0x%x\n", *(map2+i));
```



Example

```
hahaman5@ubuntu: ~/test_mmem
hahaman5@ubuntu:~/test_mmem$ sudo ./read 1234
open /dev/osp successfully !
map: 00007f44b5125000
map content: 0x7afc3a1
map content: 0x64e79e95
map content: 0x19fe2471
map content: 0x2c9db77e
map content: 0x2e493787
map content: 0x113bd6fb
map content: 0x301fb86b
map content: 0x213173be
map content: 0x5ac27aa
map content: 0x709578e1
map2 content: 0x7afc3a1
map2 content: 0x64e79e95
map2 content: 0x19fe2471
map2 content: 0x2c9db77e
map2 content: 0x2e493787
map2 content: 0x113bd6fb
map2 content: 0x301fb86b
map2 content: 0x213173be
map2 content: 0x5ac27aa
map2 content: 0x709578e1
```

```
modifying map2
reading again
map content: 0x1c8f220e
map content: 0x1bbffa83
map content: 0x39499f0b
map content: 0x3f0e0f73
map content: 0x48e0f3ec
map content: 0x3ca510f5
map content: 0x3cca214b
map content: 0x44ef24a
map content: 0x7a1e0474
map content: 0x7ab03435
map2 content: 0x1c8f220e
map2 content: 0x1bbffa83
map2 content: 0x39499f0b
map2 content: 0x3f0e0f73
map2 content: 0x48e0f3ec
map2 content: 0x3ca510f5
map2 content: 0x3cca214b
map2 content: 0x44ef24a
map2 content: 0x7a1e0474
map2 content: 0x7ab03435
hahaman5@ubuntu:~/test_mmem$ █
```



Example

- Insert some logs when entering your code

```
6341.883536] Page fault by OSP!!!  
6341.883907] page's mapping: 00007f2170924000  
6341.885560] Page fault by OSP!!!  
6341.886028] page's mapping: 00007f2170922000  
6400.344724] start: 00007f44b5125000 end: 00007f44b5127000  
6400.344724] size: 8192 pgoff: 0000000000000000  
6400.347597] start: 00007f44b5123000 end: 00007f44b5125000  
6400.347597] size: 8192 pgoff: 0000000000000000  
6400.348503] Page fault by OSP!!!  
6400.348870] page's mapping: 00007f44b5125000  
6400.349452] Page fault by OSP!!!  
6400.349811] page's mapping: 00007f44b5123000
```




Assignment

- Assignment submission
 - Due date: APR 16th (Sun) 24:00
 - Mail to hahaman5@gmail.com
 - The title should be “[SWE3015] project1 *name*”
 - The mail must contains following
 - Screenshots of the Kernel log which shows your page fault handling
 - Screenshots of the test program
 - A brief report
 - Source code you written
 - Explain how you did it briefly.
 - Contribution for each



Adding A New Dev File

- HINT
 - See "drivers/char/mem.c"
 - You can track the string of well known dev file
 - E.g. /dev/zero, /dev/mem
- Assignment 1
 - TEAM X prepare a presentation how to make a dev file
 - What for devfs is?
 - How to create a dev file?
 - Common examples of devfs
 - Don't have to show to make exact file for this project.



Demand Paging

- You should implement in the demand paging implementation
 - In the end of page fault handler, you can find the code for it
- Assignment 2:
 - TEAM Y prepare a presentation
 - Explaining which code makes demand paging
 - How demand paging is done



Copy on Write

- Actually, it is not directly related to this project
 - But if you would do good, it might be added?
- Assignment 3:
 - TEAM Z prepare a presentation
 - Explaining which code makes copy on write
 - How CoW is done
- All presentation should not exceed 20 min.



Announcement

- No class on next Monday!
 - You have nothing to learn for memory 😊
- On Wednesday
 - Project 0.5 review
 - Students' presentations (assignment 1,2,3)
- No lecture session until midterm!



Discussion

- We will have discussion time in every class
- You also make questions in the forum