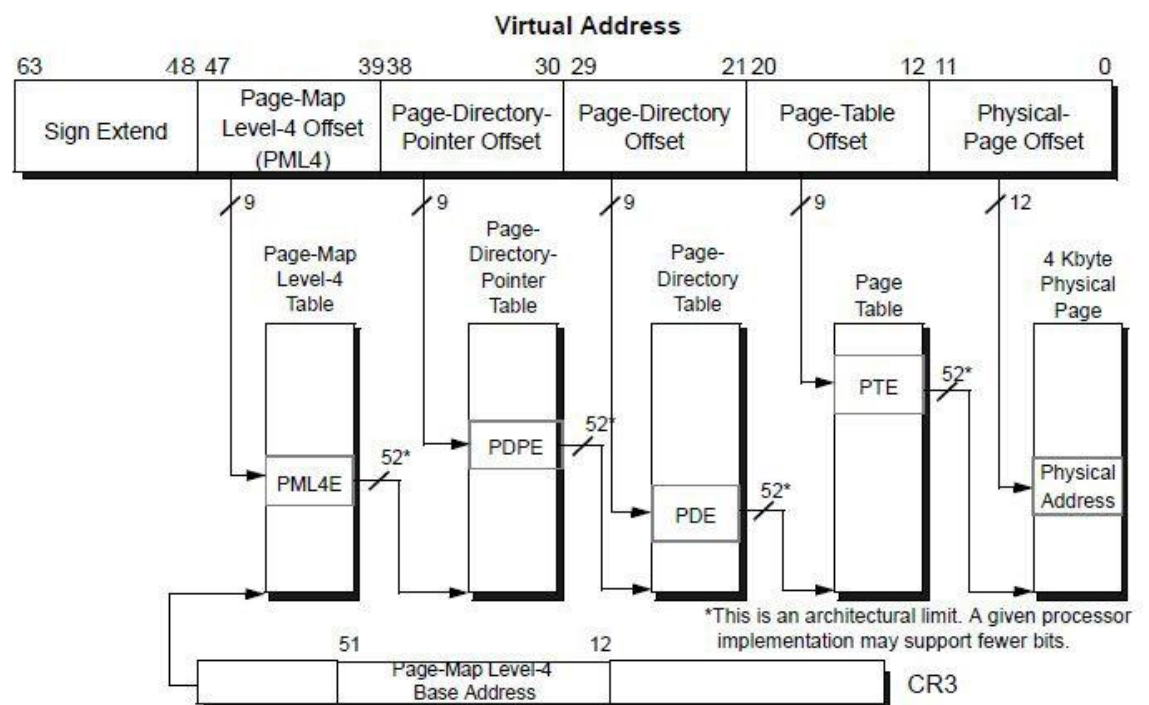


# Operating System HW4

Due 2020/1/12 23:55

- Background

- **Page table** is the primary technique to implement virtual memory. The CPU uses the value of the **CR3** register to locate the page table. In this project, you will modify the page table to map two different virtual addresses to the same physical address.



- For example,
  - cr3 : 0x70300e000
  - virtual address : 0x563229f05456

	PML4	PDPT	PD	PT	offset
index	0xac	0xc8	0x14f	0x105	0x456
index * 8	0x560	0x640	0xa78	0x828	

- Address of PML4 entry = 0x70300e560  
Content of PML4 entry = 0x80000007131b8067
- Address of PDPT entry = 0x7131b8640  
Content of PDPT entry = 0x6b84bf067
- Address of PD entry = 0x6b84bfa78  
Content of PD entry = ...
- Address of PT entry = ...  
Content of PT entry = ...

- Environment

- Load the virtual machine image provided by the previous homework.
- Download the homework files and execute the following commands

```
$ make
$ sudo make install
```

and type the command below to execute the homework program

```
$ ./main
```

- Map different virtual addresses to the same physical address

- In the homework program, there are two strings
  - char x[] = "This is OS homework 4"
  - char y[] = "You have to modify my page table"
- **[Task1 50pts]** Complete **TODO1** to modify the page table entries so that the printf("%s", y) at Line 72 shows the content of x on the screen and the printf statements at Line 78 and 79 show *"When you modify y, x is*

*modified actually*".

- **[Task2 50pts]** Complete **TODO2** to modify the page table entries so that the `printf("%s", y)` at Line 92 shows the original content of `y` on the screen
- We provide three functions **`get_cr3_value()`**, **`read_physical_address()`** and **`write_physical_address()`** as interface to kernel.
- You can add your own functions, but please make your modifications only in **`main.c`** since this is the only file you will hand in.
- Expected result

Before

x : This is OS homework 4.

y : You have to modify my page table.

After modifying page table

x : This is OS homework 4.

y : This is OS homework 4.

After modifying string `y`

x : When you modify `y`, `x` is modified actually.

y : When you modify `y`, `x` is modified actually.

After restoring page table of `y`

x : When you modify `y`, `x` is modified actually.

y : You have to modify my page table.

- Submission Rules

- After finishing the program, rename **`main.c`** to **`{Student_id}.c`**.
- Submit the file to **`e3`**.
- 10% of the score will be taken as punishment once you **submitted your HW in wrong formats**.
- Please make sure your program can be **compiled and executed on the virtual machine we provided** before your submission, since at least 20% of your score will be taken if any failures happened.

- Reference

- Key words: Page table, CR3