

# Compound page

📅 2019-11-11 (<http://jake.dothome.co.kr/compound/>) 👤 Moon Young-il

(<http://jake.dothome.co.kr/author/admin/>) 📁 Linux Kernel (<http://jake.dothome.co.kr/category/linux/>)

<kernel v5.0>

## Compound page

- In the buddy system, free pages are managed on an order basis, and the pages that are assigned and used are used with the order removed. However, there are pages that are grouped and managed by order, and they are called compound pages.
  - See: An introduction to compound pages (<https://lwn.net/Articles/619514/>)
- use
  - Slap Cache
  - Huge Page
    - What makes it different from a typical high order page is that it is designed to maximize TLB performance.
    - To improve performance, Linux maps large pages (high order pages) to enable faster access using huge pages at the PMD level.
    - It is used by HugeTLBFS and Transparent Huge Page (THP).
- In December 2015, kernel v.12.4-rc6 removed the CONFIG\_PAGEFLAGS\_EXTENDED options, PG\_compound, and PG\_tail, leaving only PG\_head.
  - Note: mm: make compound\_head() robust  
(<https://github.com/torvalds/linux/commit/1d798ca3f16437c71ff63e36597ff07f9c12e4d6>)

### prep\_compound\_page()

/mm/page\_alloc.c

```

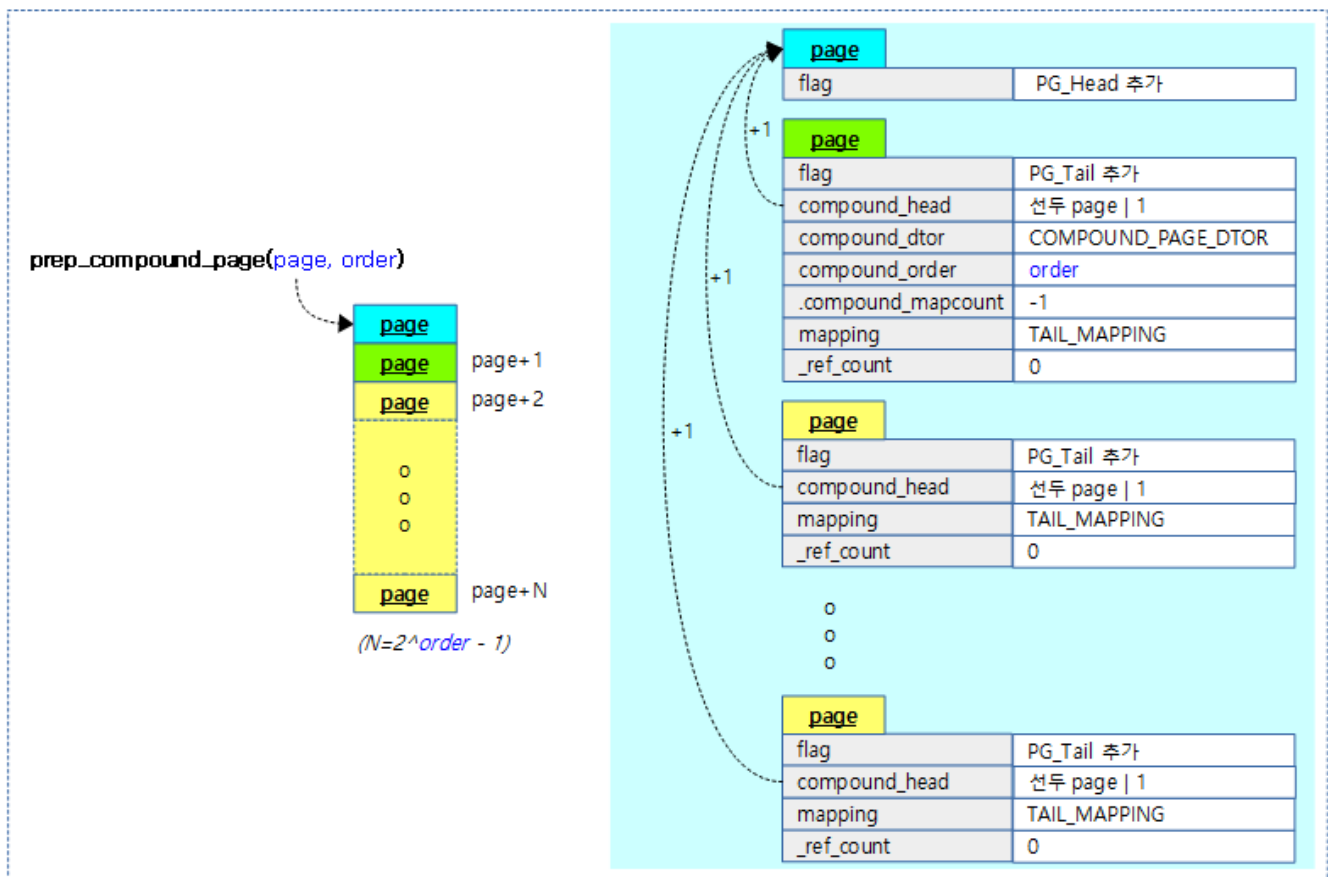
01 | void prep_compound_page(struct page *page, unsigned long order)
02 | {
03 |     int i;
04 |     int nr_pages = 1 << order;
05 |
06 |     set_compound_page_dtor(page, COMPOUND_PAGE_DTOR);
07 |     set_compound_order(page, order);
08 |     __SetPageHead(page);
09 |     for (i = 1; i < nr_pages; i++) {
10 |         struct page *p = page + i;
11 |         set_page_count(p, 0);
12 |         p->mapping = TAIL_MAPPING;
13 |         set_compound_head(p, page);
14 |     }
15 | }
```

Prepare a compound page.

- In line 6 of code, assign a COMPOUND\_PAGE\_DTOR to the compound destroyer ID.
  - The Destroyer ID is as follows:
    - NULL\_COMPOUND\_DTOR
    - COMPOUND\_PAGE\_DTOR
    - HUGETLB\_PAGE\_DTOR
    - TRANSHUGE\_PAGE\_DTOR
- On the second page of line 7 of the code, set the order.
- In line 8 of the code, set PG\_Head bits to the flag in the header page.
- In line 9~14 of the code, assign 0 to the reference counter of the remaining pages, point the rest of the pages to the head page, and set the PG\_Tail bits in the flag.

The following illustration shows how a compound page is prepared by the `prep_compound_page()` function.

- On the second page, there is compound information.



([http://jake.dothome.co.kr/wp-content/uploads/2016/06/prep\\_compound\\_page-1.png](http://jake.dothome.co.kr/wp-content/uploads/2016/06/prep_compound_page-1.png))

## page\_count()

include/linux/mm.h

```

1 | static inline int page_count(struct page *page)
2 | {
3 |     return atomic_read(&compound_head(page)->_count);
4 | }
```

Find out the `_count` value of the request page. If it's a compound page, the `_count` value is found on the leading page.

## compound\_order()

include/linux/mm.h

```

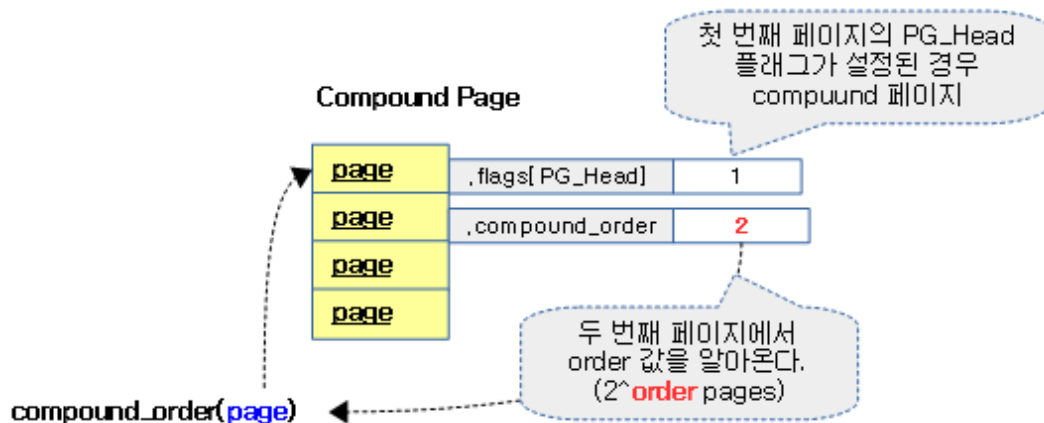
1 | static inline int compound_order(struct page *page)
2 | {
3 |     if (!PageHead(page))
4 |         return 0;
5 |     return page[1].compound_order;
6 | }

```

If it's a compound page, it knows the `compound_order`, and if it's not a compound page, it returns 0 order

- If the Head flag on the first page is set, it means a compound page.
- Notice the `compound_order` in the second page structure.

The following illustration shows the process of retrieving the order value from the compound page.



([http://jake.dothome.co.kr/wp-content/uploads/2016/06/compound\\_order-1a.png](http://jake.dothome.co.kr/wp-content/uploads/2016/06/compound_order-1a.png))

## 2 thoughts to "Compound Page"



HA SEUNG-JOON

2020-02-11 15:53 (<http://jake.dothome.co.kr/compound/#comment-232316>)

Is it HugeTLB and not Transparent Hugepage in the Huge page you're using? Oh boy

[RESPONSE \(/COMPOUND/?REPLYTOCOM=232316#RESPOND\)](/COMPOUND/?REPLYTOCOM=232316#RESPOND)**MOON YOUNG-IL ([HTTP://JAKE.DOTHOME.CO.KR](http://jake.dothome.co.kr))**2020-02-11 19:36 (<http://jake.dothome.co.kr/compound/#comment-232350>)

Hello?

Both HugeTLBFS and Transparent Huge Page (THP) are composed of compound pages.

The text has also been added.

I appreciate it.

[RESPONSE \(/COMPOUND/?REPLYTOCOM=232350#RESPOND\)](/COMPOUND/?REPLYTOCOM=232350#RESPOND)

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[◀ Swap -3- \(allocate/unallocate swap zones\) \(http://jake.dothome.co.kr/swap-3/\)](http://jake.dothome.co.kr/swap-3/)

[Kernel v5.4 release \(LTS version\) ▶ \(http://jake.dothome.co.kr/v5-4/\)](http://jake.dothome.co.kr/v5-4/)

## Munc Blog (2015 ~ 2023)