

```
1. #include <asm/page.h>
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1. #define __pa(x)          __virt_to_phys((unsigned long)(x))
2. #define __va(x)          ((void *)__phys_to_virt((phys_addr_t)(x)))
3.
4.
5. virtual address ==> struct page *
6. #define virt_to_page(addr) pfn_to_page(virt_to_pfn(addr))
7.
8. struct page * ==> virtual address
9. #define page_to_virt(page) pfn_to_virt(page_to_pfn(page))
10.
11. struct page * ==> physical address
12. page_to_phys(page)
13.
14.
15. virtual address ==> page frame
16. #define virt_to_pfn(kaddr) (__pa(kaddr) >> PAGE_SHIFT)
17.
18. page frame ==> virtual address
19. #define pfn_to_virt(pfn) __va((pfn) << PAGE_SHIFT)
20.
21.
22. check virtual address是否合法
23. #define virt_addr_valid(kaddr) (((unsigned long)(kaddr) >= PAGE_OFFSET && (
    unsigned long)(kaddr) < (unsigned long)high_memory) \
24. && pfn_valid(virt_to_pfn(kaddr)))
```