Virtual Memory

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Vitual Memory:

1. 作用：

   Use main memory as a “cache” for secondary (disk) storage

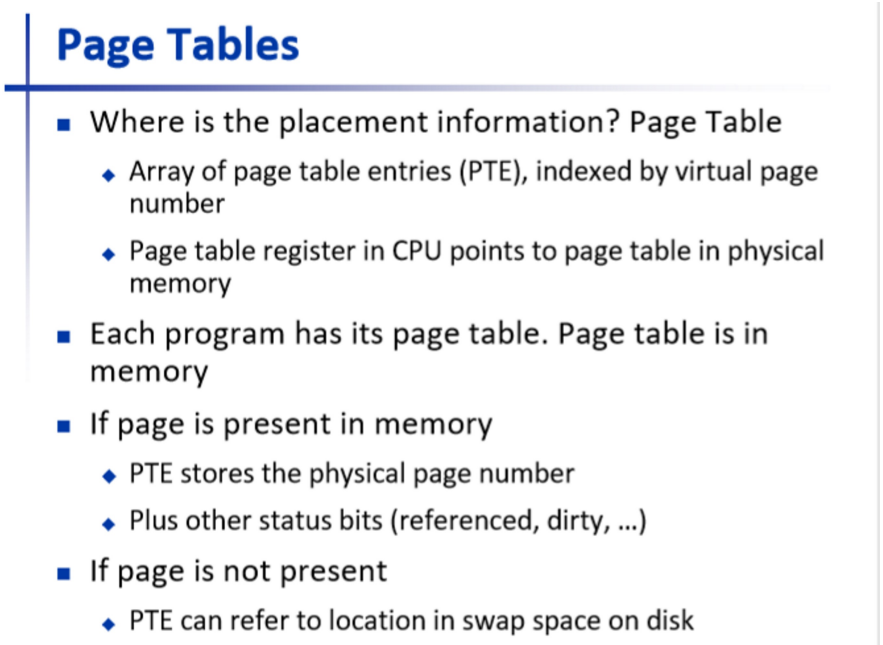
   Programs share main memory

2. 概念：page page fault

   由于page Fault Penalty太大，希望尽可能少miss，因此采取**Fully associated**

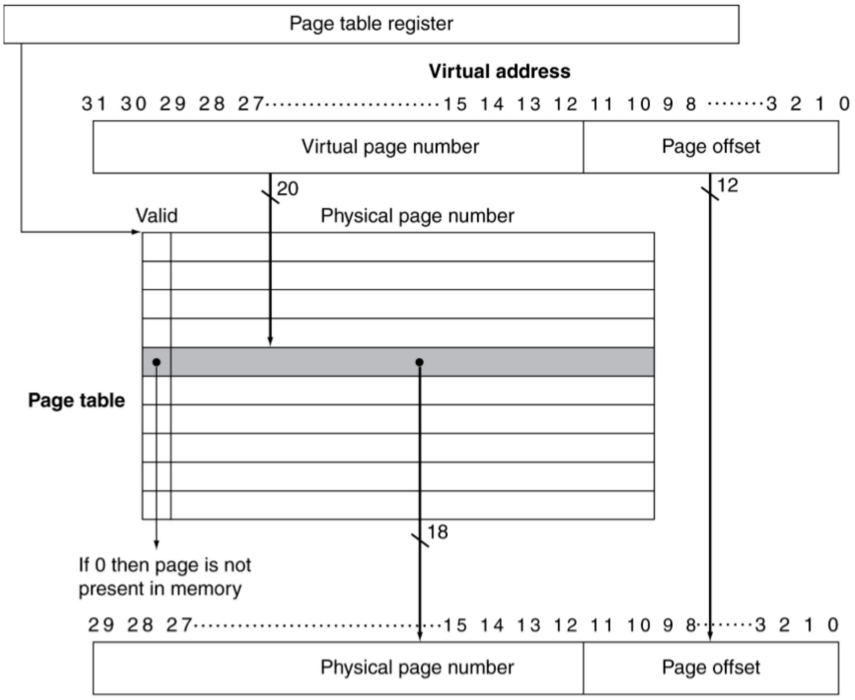
   - Try to minimize page fault rate
     - Fully associative placement
     - Smart replacement algorithms

1. Vitual address如何与实际地址对应：Page Table



   Page table储存Vpn到ppn的映射

   Page table储存在memory内，是一块**memory**



Valid 为0 代表此vitual address对应内容在disk中
还有dirty referrence等其他status bit
Page table register
不同程序有不同的page table

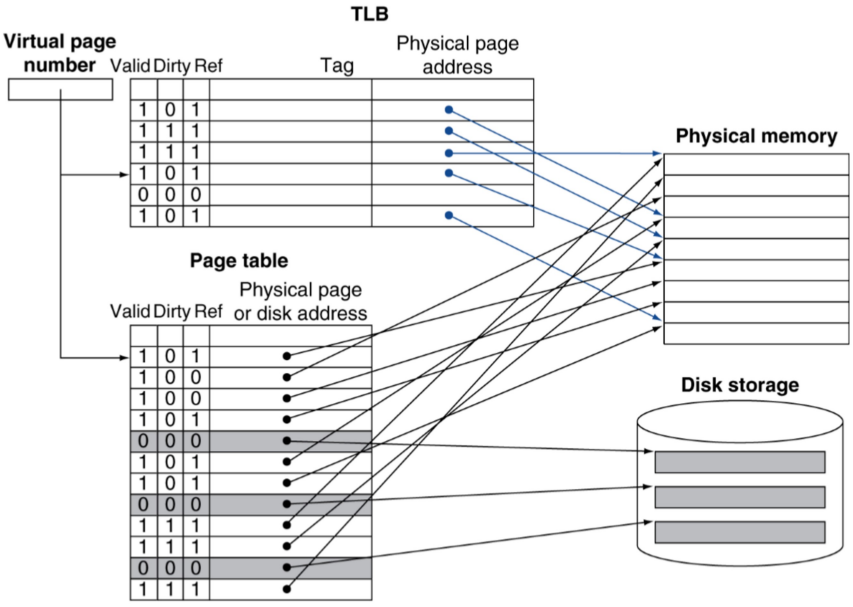
2. Replacement and write

Use bit/referrence bit——replacement——LRU appromiate

Dirty bit——write back

3. TLB

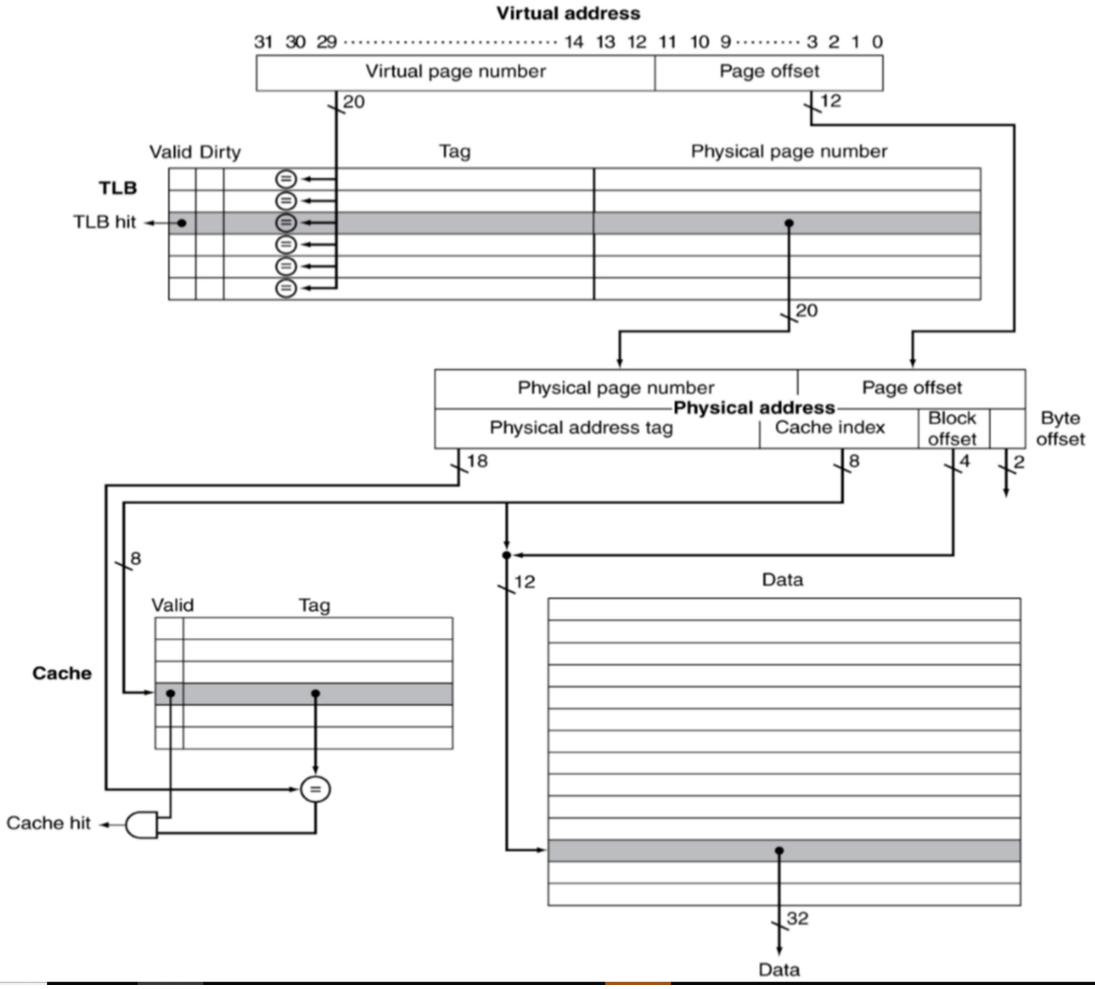
通过vitual address去Access memory需要两次memory access
因此有了TLB



TLB miss:

- If page is in memory
  - Load the PTE from memory and retry
  - Could be handled in hardware
    - Can get complex for more complicated page table structures
  - Or in software
    - Raise a special exception, with optimized handler
- If page is not in memory (page fault)
  - OS handles fetching the page and updating the page table
  - Then restart the faulting instruction

TLB interaction with cache：



4. Memory Protect

不同程序可以share相同的虚拟内存，但需要OS协助保证不发生错误访问

OS特权模式