Discussion 12 - Virtual Memory

CS 110 COMPUTER ARCHITECTURE

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Review

What is virtually memory ?

◦ An intermediate translation layer

◦ Provides an abstraction for dedicated memory space

◦ A mapping mechanism to isolate the applications from physical memory

Review

Why involve virtual memory ?

◦ Location Independent

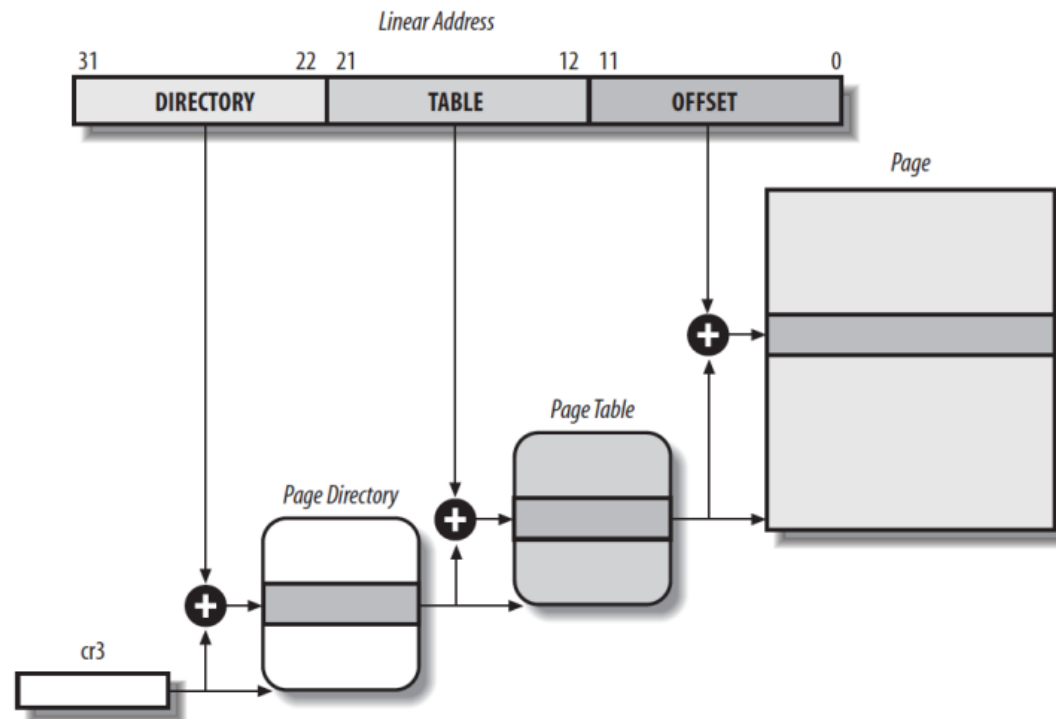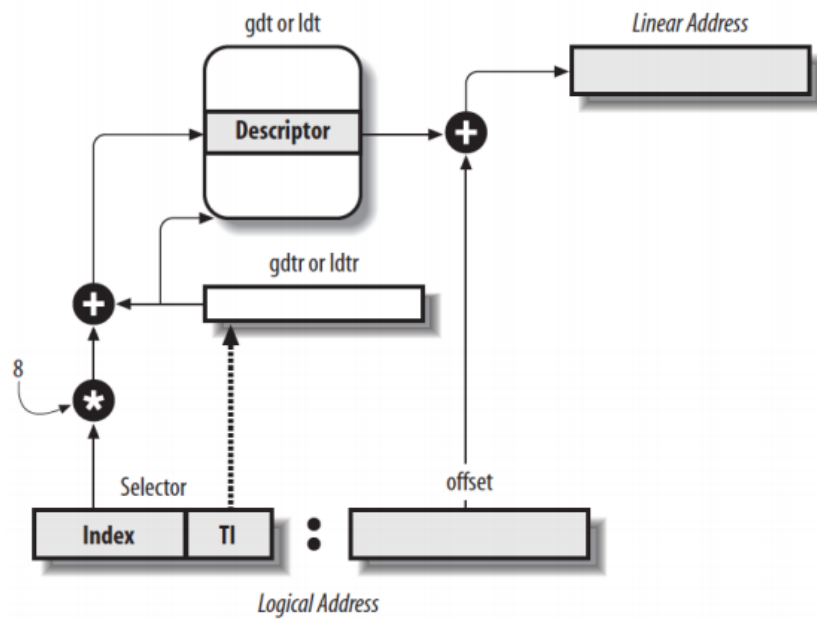◦ Multitasking

◦ Protection

◦ Sharing

◦ ……

Implementation

◦ Base and Bound

◦ Segmentation

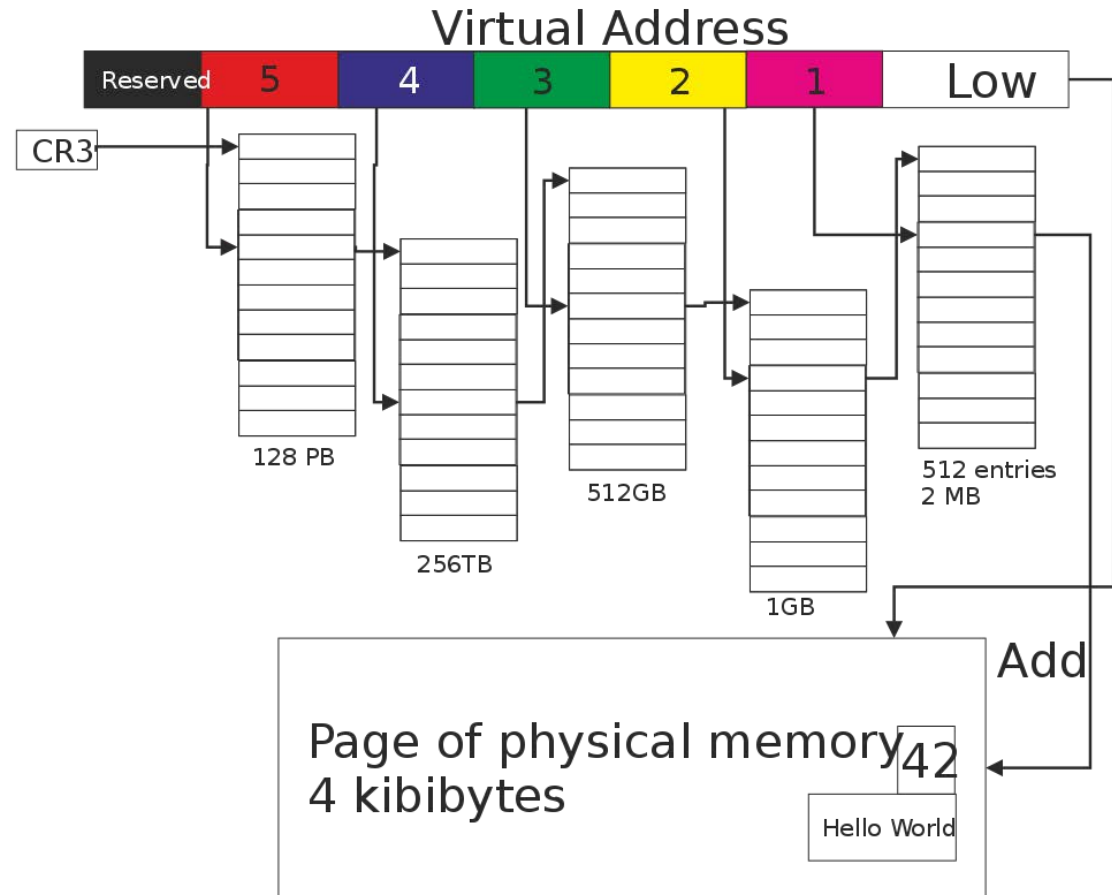◦ Paging

Virtual Memory on x86

Segmentation & paging mixed management

The segmentation is equivalently removed in x86-64

Mutli-level Paging

◦ Why multi-level paging ?

◦ Linux 4-level paging

◦ Intel 5-level paging

Translation Lookaside Buffer (TLB)

Virtual memory results in multiple access for a single request
- Poor performance

How to reduce the negative effects ?
- Cache

Implementation
- Direct mapping
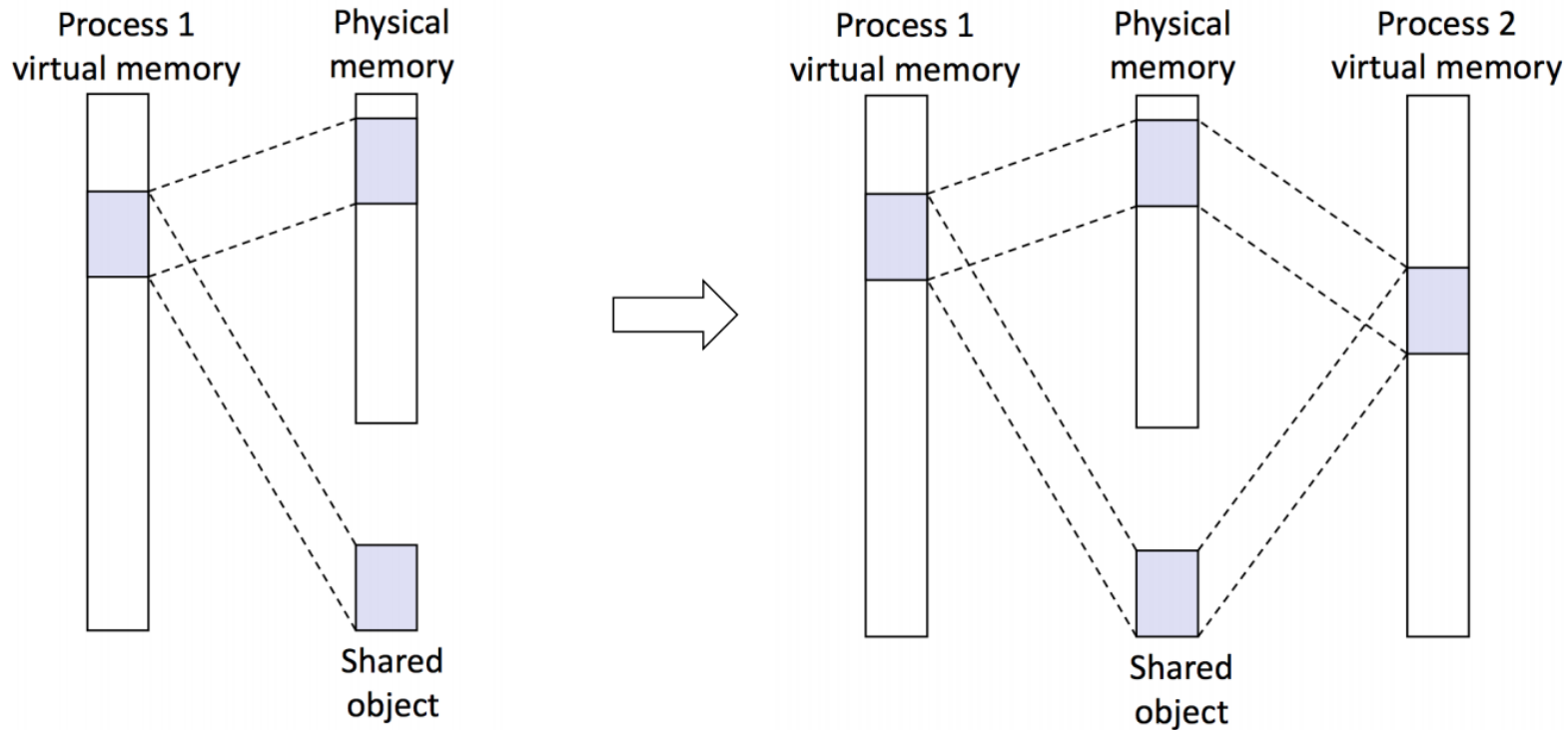- Set-associative
- Full associative

Demand Paging

- Lazy execution
- Copying virual pages into physical memory when it is actually referred
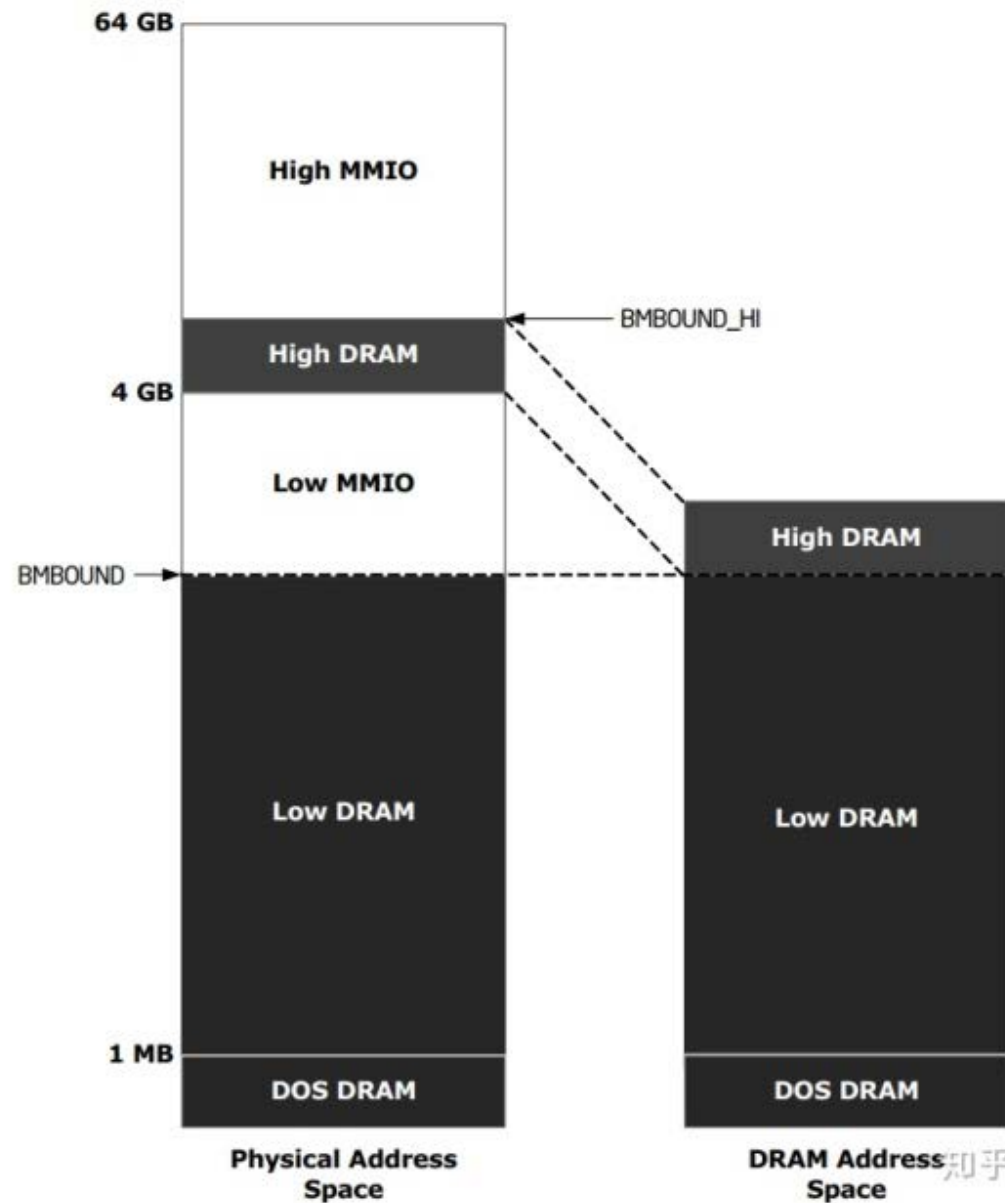- Page faults handle the allocation

Copy on Write (COW)

Sharing under demand-paging

More Virtual Memory

○ PCI devices (MMIO)

◦ GPU memory

○ On-Soc IP blocks

Q&A

THANKS FOR YOUR ATTENDANCE