Virtual Memory in Linux

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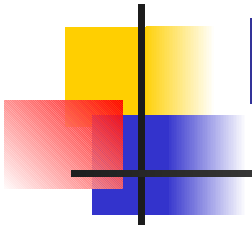


Introduction

Memory management under Linux has 2 parts:

- Allocating and freeing physical memory
- Handling virtual memory

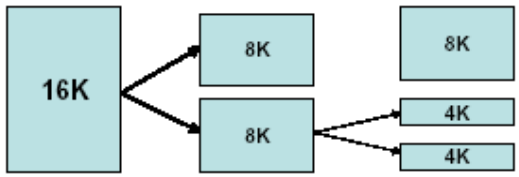
The code of the memory management system reside inside

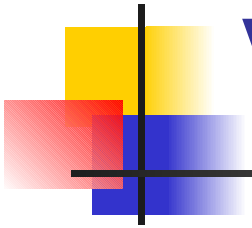
- mm/
- arch/i386/mm

Management of Physical Memory (Page Allocator)

- The primary physical memory manager is the **page-allocator**

  (file: mm/page_alloc.c).
- Responsible for allocating and freeing all physical pages.
- Uses the **buddy-heap algorithm** to keep track of available physical memory.





Virtual Memory View

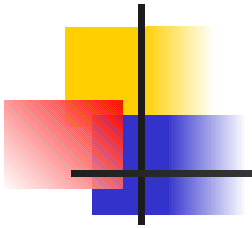
The virtual memory manager maintains 2 views of a process's address space .

Logical view **::** The address space consist of non-overlapping regions, each represent a continuous, paged aligned subset of the address space.

- Described by the *vm_area_struct*
- The regions of each address space are linked into a balanced binary tree to allow fast lookup

Physical view **::** stored in the hardware page tables.

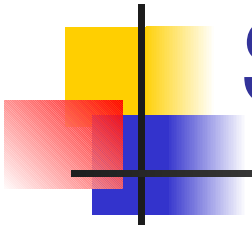
- The hardware tables determine the exact location of every page.



Swapping and Paging

- An important task of a virtual-memory system is to relocate pages from physical memory out to disk.
- Early UNIX systems swapped out the entire process at once.
- Modern UNIX systems rely more on paging.
- In order to do that Linux too uses the paging mechanism
- The paging system can be divided to the policy algorithm and the paging mechanism
- Linux's pageout policy is LFU (least frequently used)
- LFU takes into account :
  - Timestamp of the last access.
  - Number of accesses.

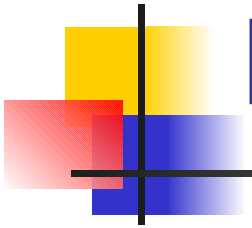
Swapping and Paging



- The paging mechanism supports both paging to dedicated swap devices and to files.
- Blocks are allocated from the swap device according to bitmap of used blocks.
- The allocator uses the next fit algorithm.
- When a page is swapped out the page-not-present bit is set (or the present is unset).
- *cat /proc/swaps* shows information about the used swap devices.

For e.g :

Filename	Type	Size	Used	Priority
/dev/cciss/c0d0p2	partition	2097136	292752	-1



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