CSC 4103 - Operating Systems
Spring 2008

LECTURE - XIV

MAIN MEMORY - II

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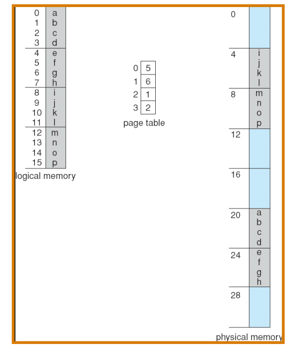
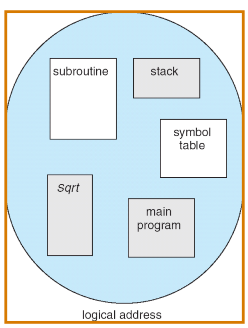
March 27th, 2008

Paging Example



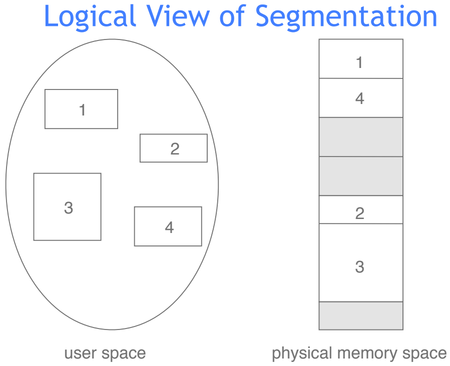
User's View of a Program



Segmentation

- Memory-management scheme that supports user view of memory
- A program is a collection of segments. A segment is a logical unit such as:
  main program,
  procedure,
  function,
  method,
  object,
  local variables, global variables,
  common block,

Logical View of Segmentation



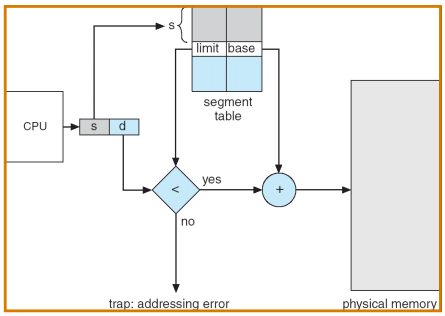
Segmentation Architecture

- Logical address consists of a two tuple:
  <segment-number, offset>,
- **Segment table** – maps two-dimensional physical addresses; each table entry has:
  - base – contains the starting physical address where the segments reside in memory
  - *limit* – specifies the length of the segment
- *Segment-table base register (STBR)* points to the segment table's location in memory
- *Segment-table length register (STLR)* indicates number of segments used by a program;

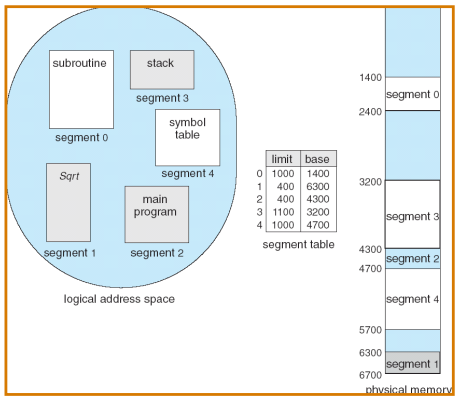
Segmentation Architecture (Cont.)

- Protection. With each entry in segment table associate:
  - validation bit = 0 ⇒ illegal segment
  - read/write/execute privileges
- Protection bits associated with segments; code sharing occurs at segment level
- Since segments vary in length, memory allocation is a dynamic storage-allocation problem
- A segmentation example is shown in the following diagram

Address Translation Architecture



Example of Segmentation



Exercise

- Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?

a. 1, 100

b. 2, 0

c. 3, 580

Solution

- Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

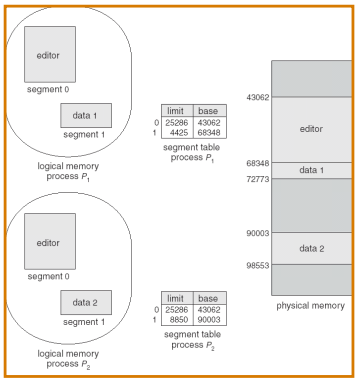
What are the physical addresses for the following logical addresses?

a. 1, 100
illegal reference (2300+100 is not within segment limits)

b. 2, 0
physical address = 90 + 0 = 90

c. 3, 580
illegal reference (1327 + 580 is not within segment limits)

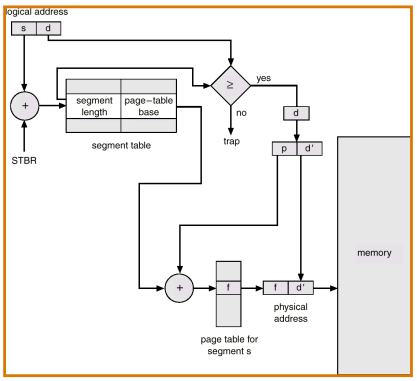
Sharing of Segments



Segmentation with Paging

- Modern architectures use segmentation with paging (or paged-segmentation) for memory

MULTICS Address Translation Scheme



Acknowledgements

- "Operating Systems Concepts" book and supplementary material by A. Silberschatz, P. Galvin and G. Gagne
- "Operating Systems: Internals and Design Principles" book and supplementary material by W. Stallings
- "Modern Operating Systems" book and supplementary material by A. Tanenbaum
- R. Doursat and M. Yuksel from UNR