Department of Computer Science and Engineering

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CS-501

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FRAGMENTATION AND SEGMENTATION CONCEPT

FRAGMENTATION

Question

- Given six memory partitions of 300 KB, 600 KB, 350 KB, 200 KB, 750 KB, and 125 KB (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of size 115 KB, 500 KB, 358 KB, 200 KB, and 375 KB (in order)? Rank the algorithms in terms of how efficiently they use memory.

Fragmentation 1/2

- *External Fragmentation:*
  - Total memory space exists to satisfy a request, but it is not contiguous.

- *Internal Fragmentation:*
  - Unused memory that is internal to a partition.

Fragmentation 2/2

- Reduce external fragmentation by *compaction*.
- Shuffle memory contents to place all free memory together in one *large block*.
- Compaction is *possible* only if relocation is dynamic, and is done at execution time.

SEGMENTATION

Segmentation 1/2

- *Segmentation* is a memory-management scheme that supports the programmer view of memory.

- A *logical address space* is a collection of segments.

- Each segment has
  - *a name* and
  - *a length*

Segmentation 2/2

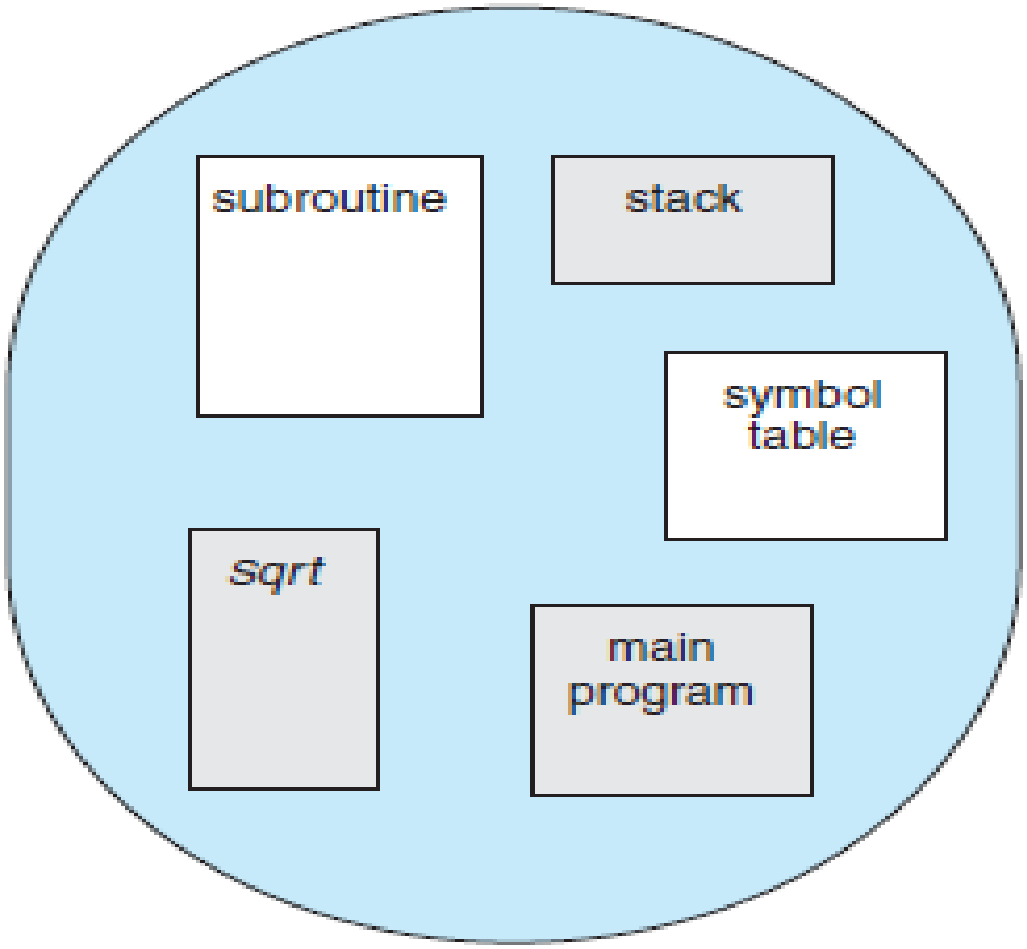
- The *addresses* specify both
  - The *segment name* and
  - The *offset* within the segment.

- The programmer, therefore, specifies each address by two quantities:
  - *a segment name/segment number*
  - an offset

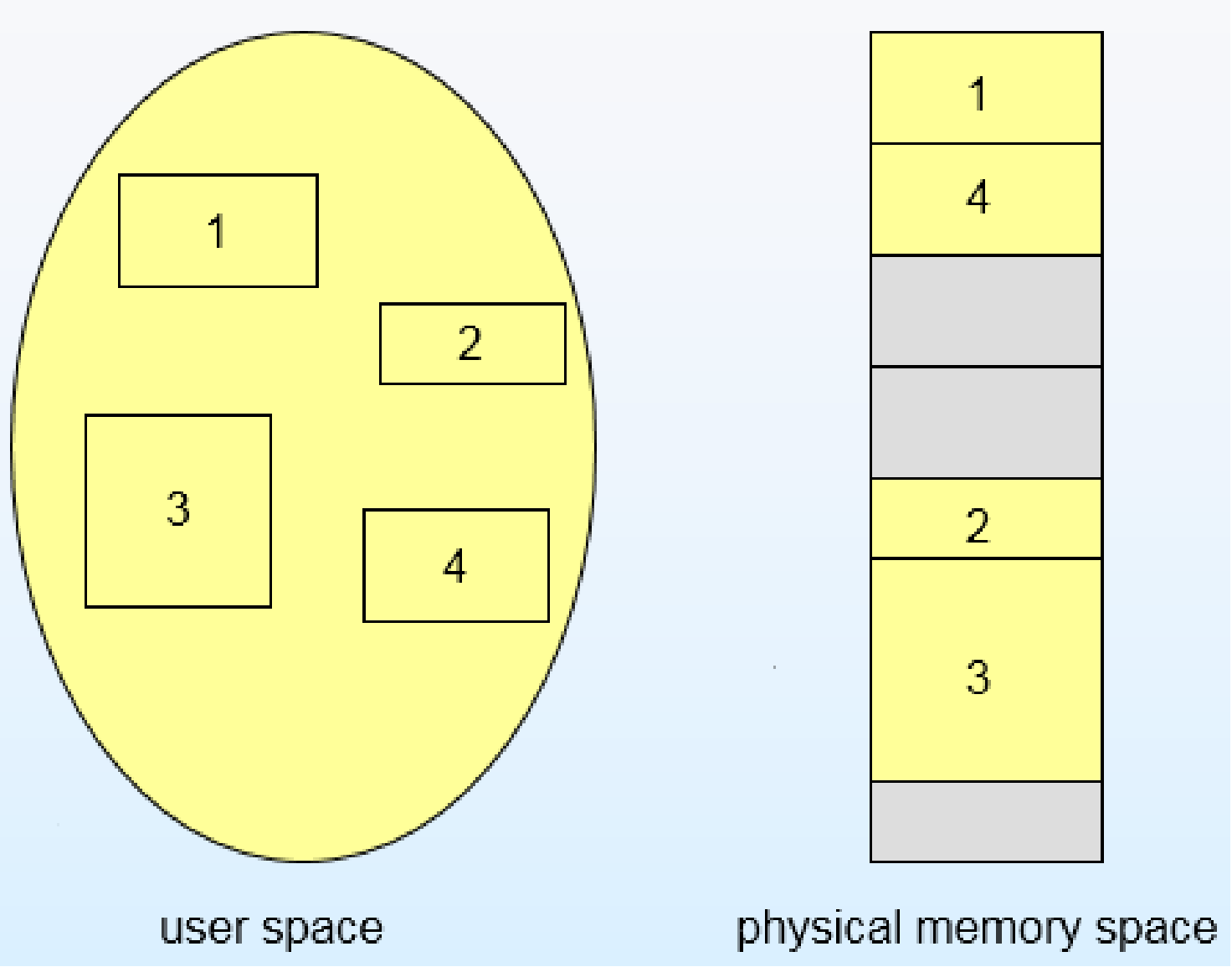
- Thus, a logical address consists of a two tuple:

<*segment-number*, *offset*>

User's View of a Program



Logical View of Segmentation



Segmentation Hardware 1/3

- An implementation to map *two-dimensional user-defined addresses* into one-dimensional physical addresses.

- This mapping is effected by a *segment table*.

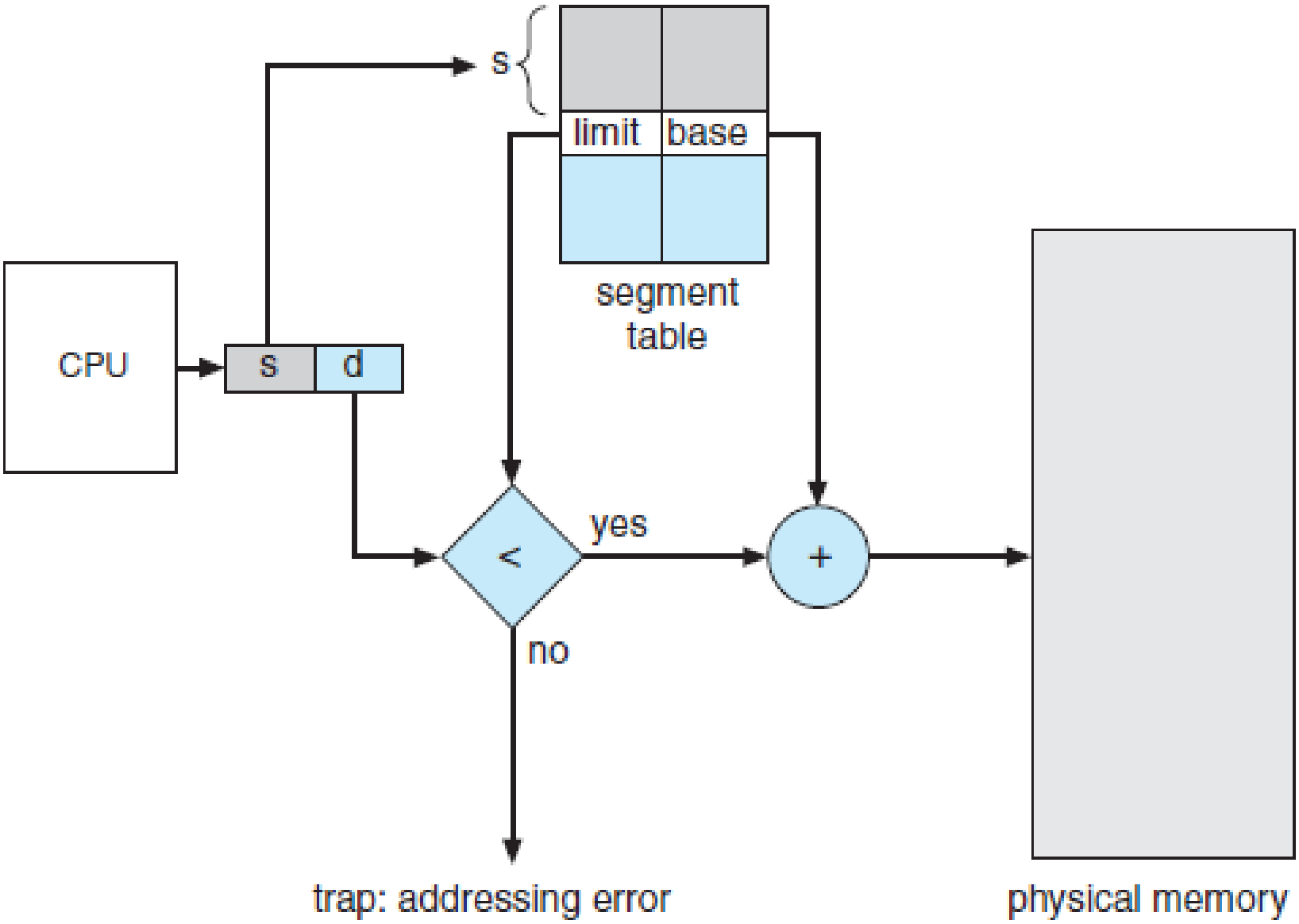
- Each entry in the segment table has
  - a *segment base* and
  - a *segment limit*

Segmentation Hardware 2/3

- The segment base contains:
  - The *starting physical address* where the segment resides in memory, and
  - The *segment limit* specifies the length of the segment

Physical address= Base address + offset

Segmentation Hardware 3/3



Example 1/3

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

What are the physical addresses of the following:

1. **0,430**
2. **1,10**
3. **2,500**
4. **3,400**
5. **4,112**

- 1. 0,430

  430<600

  So, PA=BA + Offset

  = 219+430

  = 649

Example 2/3

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

What are the physical addresses of the following:

1. **0,430**
2. **1,10**
3. **2,500**
4. **3,400**
5. **4,112**

- 2. 1,10

  10<14

  So, PA=BA + Offset

  = 2300+10

  = 2310

- 3. 2,500

  500>100 Trap

Example 3/3

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

What are the physical addresses of the following:

1. **0,430**
2. **1,10**
3. **2,500**
4. **3,400**
5. **4,112**

- 4. 3,400

  400<580

  So, PA=BA + Offset

  = 1327+400

  = 1727

- 5. 4,112

  112>96 Trap

References

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley.

2. William Stallings, “Operating Systems: Internals and Design Principles”, 6th Edition, Pearson Education.

3. D M Dhamdhere, “Operating Systems: A Concept based Approach”, 2nd Edition, TMH.

Thank You.