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Operating System

AI-602

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FRAGMENTATION AND SEGMENTATION CONCEPT

FRAGMENTATION

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

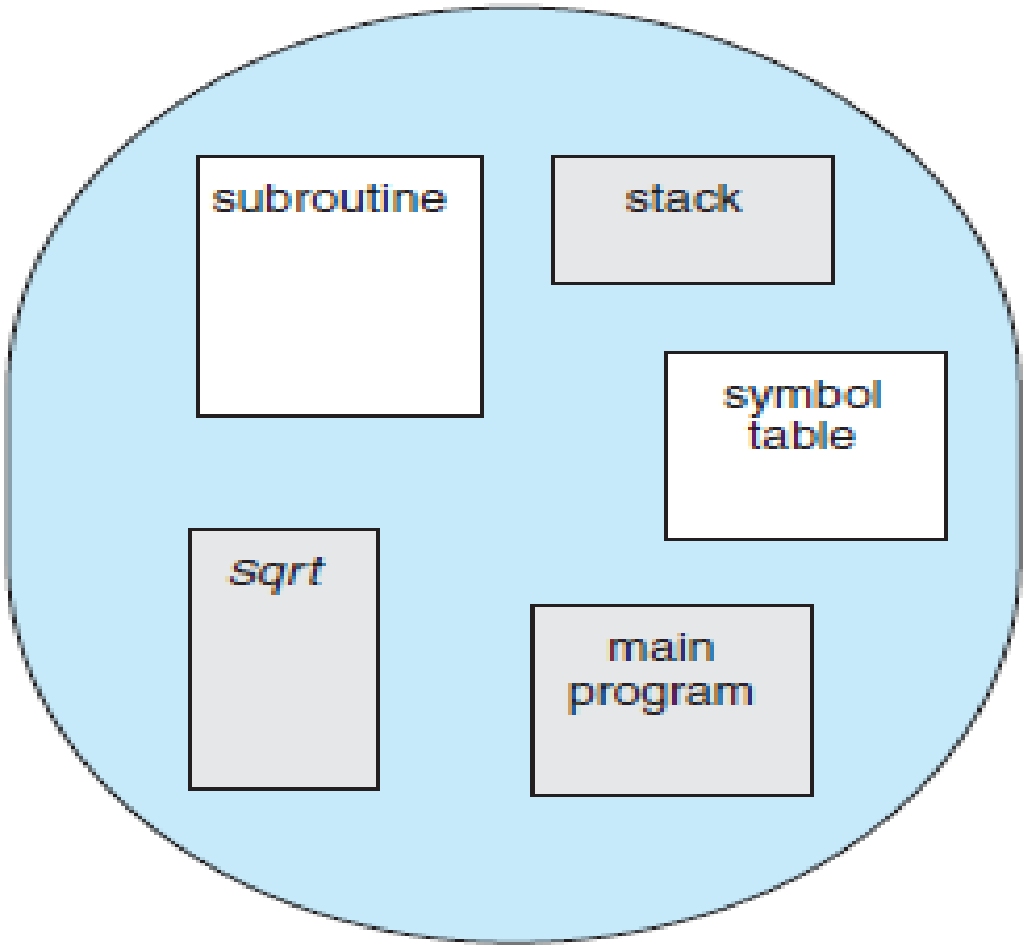
- The *addresses* specify both
  - The *segment name* and
  - The *offset* within the segment.

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

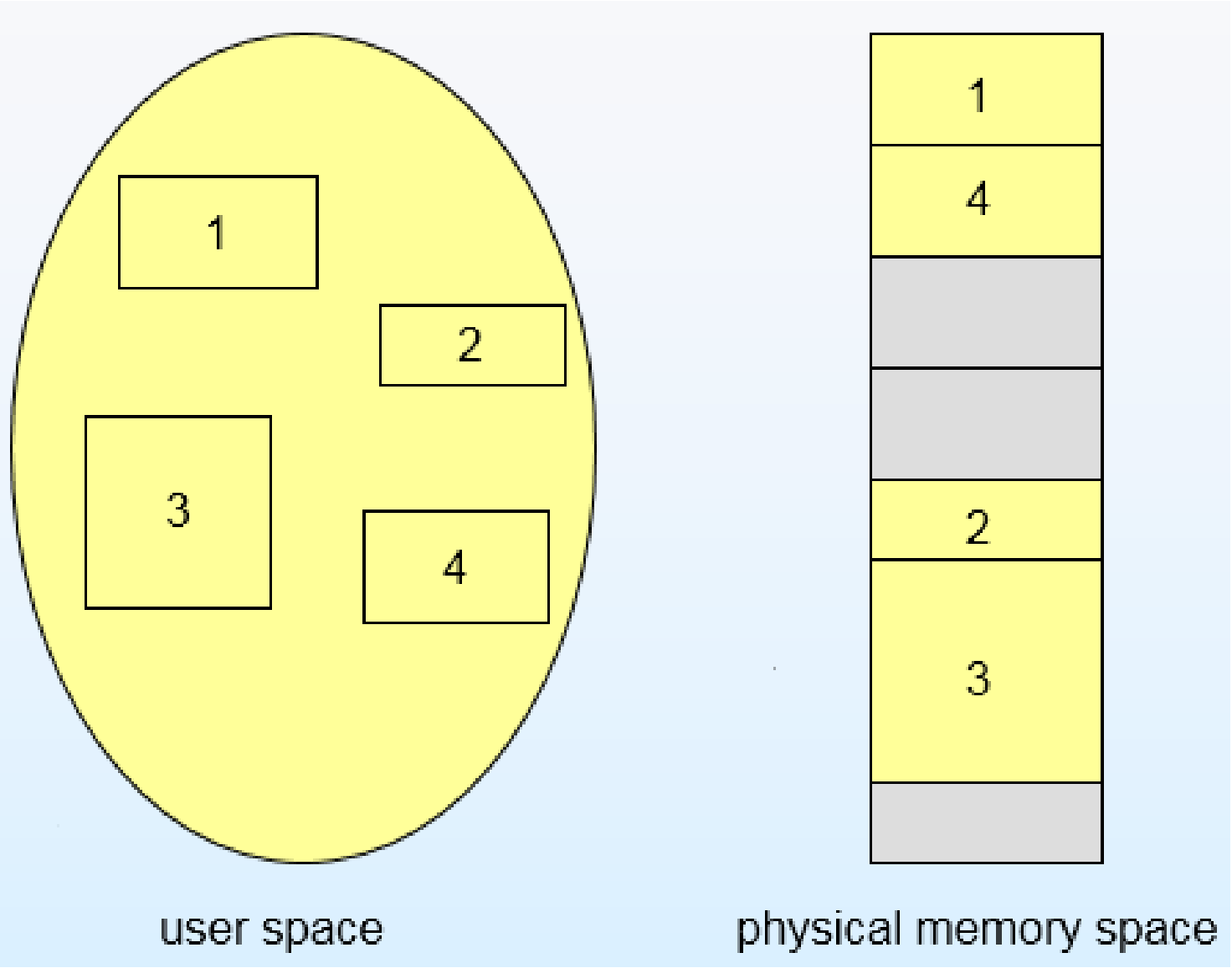
- Thus, a logical address consists of a two tuple:

<*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*.

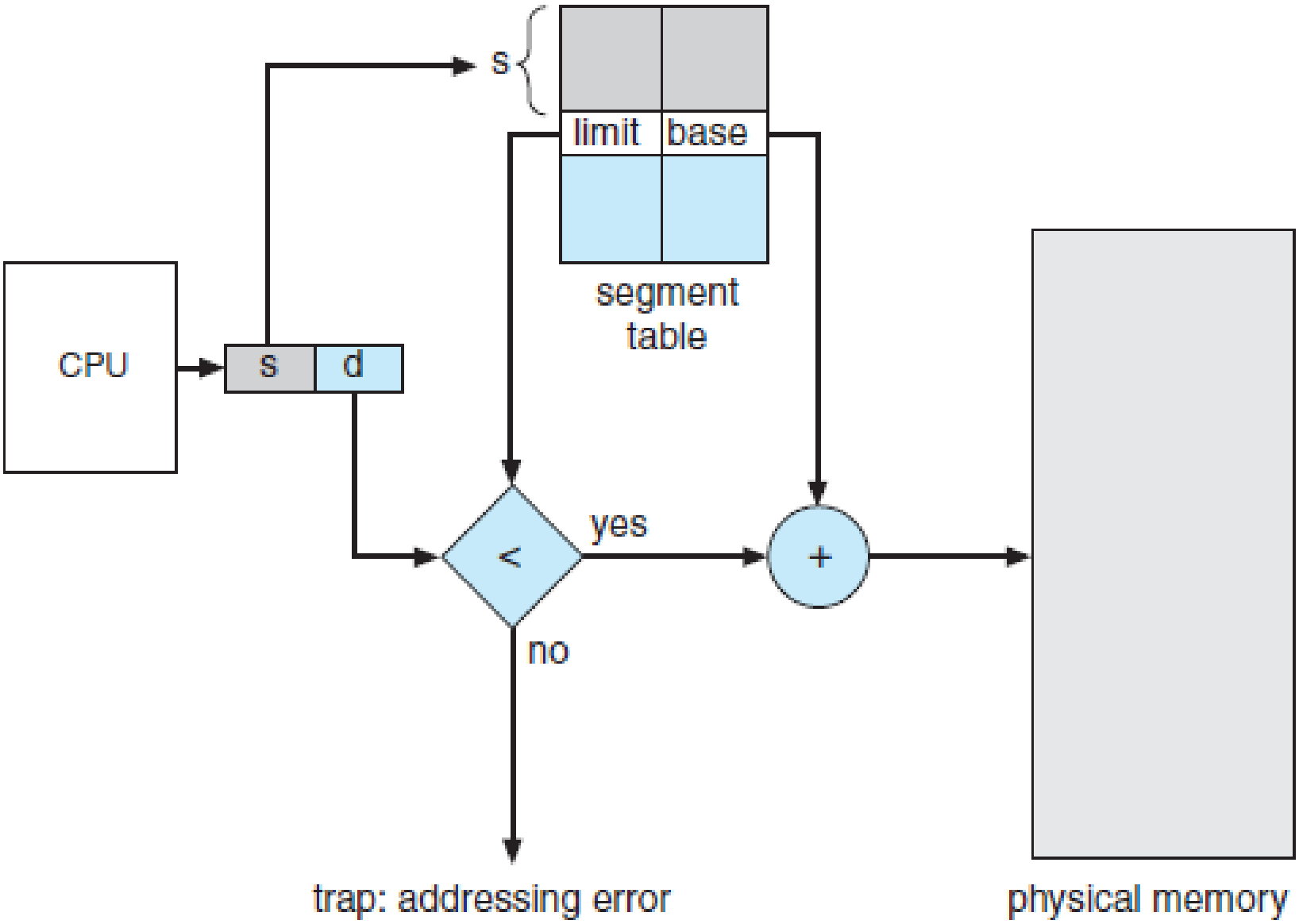
- Each entry in the segment table has
  - a *segment base* and
  - a *segment limit*

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.