# Segmented Memory Model - Detailed Summary

**1. Rationale:**

- Older processors (8080 and 8085) used a linear memory model, limited to 64KB of memory.

- The Intel 8088 processor needed more memory, so the segmented memory model was introduced.

- This model allows backward compatibility with the 8085 while expanding memory access to 1MB.

**2. Why Segmented Memory?**

- Programs are logically divided into code, data, and stack.

- The linear memory model could not separate these components, while the segmented memory model does.

- Each logical section is accessed via a separate segment, creating distinct 'windows'.

**3. Mechanism of Segmented Memory Model:**

- The memory is divided into functional windows for code, data, and stack.

- Segment registers (CS, DS, SS, ES) control these windows.

- Each window is 64KB in size but can move within the 1MB memory space.

**4. Registers and Memory Windows:**

- The segment registers hold the base address of the memory window.

- Offset registers (IP, BP, SP) provide the location within that window.

- For example, CS (Code Segment) holds the base, and IP (Instruction Pointer) holds the offset.

**5. Physical Address Calculation:**

- To access 1MB of memory, a 20-bit address is needed.

- The segment register is shifted 4 bits to the left (multiplied by 16) and the offset is added.

- Example: CS = 1DDD and IP = 0100 gives a physical address of 1DED0.

**6. Paragraph Boundaries:**

- Segments start at 16-byte boundaries, called paragraph boundaries.

- For example, CS = 0001 starts at memory address 00010 (16 in decimal).

**7. Overlapping Segments:**

- Overlapping segments occur when different segment registers point to the same memory.

- For example, CS, DS, SS, and ES may all hold the same value, meaning they access the same memory block.

- Partially overlapping segments access the same memory through different segment:offset pairs.

**8. Logical vs. Physical Addressing:**

- Logical address: A segment:offset pair (e.g., CS:IP).

- Physical address: The actual memory address after calculating segment and offset.

- Multiple logical addresses can map to the same physical address.