Processes

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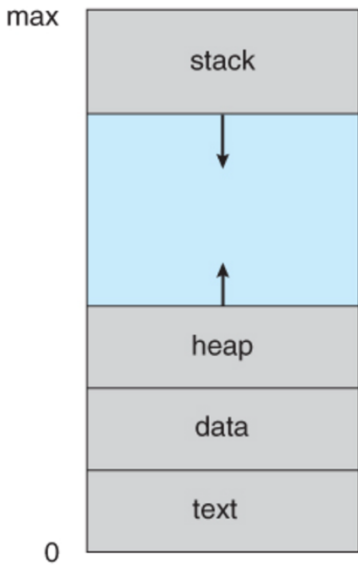
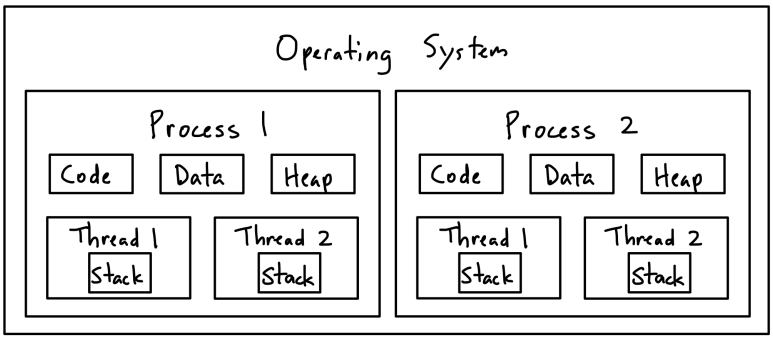
- A **process** is a program loaded into main memory, ready for execution.
- The OS assigns **isolated memory** to each process, ensuring no process sneaks into another's memory like a nosy neighbor. This memory is divided into four segments:



1. **Stack**: Contains local variables, parameters, and return addresses.
2. **Heap**: Used for dynamic memory allocation. (The program's storage unit.)
3. **Data**: Stores global variables, arrays, and structures. It's split into:
   - **BSS (Block Started by Symbol)**: For uninitialized variables.
   - **Data**: Contains initialized variables.
4. **Text**: The program's compiled machine code.

- **Memory Growth**:
  - The stack and heap grow toward each other.
    - **Stack Overflow**: When the stack crosses the line into the heap.
    - **Heap Overflow**: When the heap pushes into the stack.

Threads



- A **process** contains at least one thread.
- A **thread** is the smallest unit of execution within a process and shares the process's memory space.
- Each thread has its own stack within the allocated memory of the process.
- **Thread Levels**:
    - Threads operate at both **user-level** and **kernel-level**.
    - In a multi-threaded environment, thread management can follow these models:
        - **Many-to-One**
        - **One-to-One**
        - **Many-to-Many**
          (Honestly, I skipped reviewing these because I know I won't remember during an interview.)

Process Control Block (PCB)

- The **Process Control Block (PCB)** is a data structure used by the OS to manage process metadata. It's like the process's personal file folder, filled with everything the OS needs to know.
- Key elements of the PCB include:
    - **PID (Process ID):** A unique identifier for the process.
    - **Parent PID:** The ID of the parent process.
    - **Child PID:** The ID of any child processes.
    - **PC (Program Counter):** The location of the next instruction to execute.
    - **Memory Limits:** Defines the boundaries of the process's memory.
    - **Other Metadata:** Includes process state, scheduling info, and I/O status.