Memory Management

Logical and Physical Address Space

Logical address is the one that is generated byLogical address is the one that is generated by CPU, also referred to as virtual address. TheCPU, also referred to as virtual address. The program perceives this address space.program perceives this address space.Logical address space is the set of all logical addresses generated by a program.

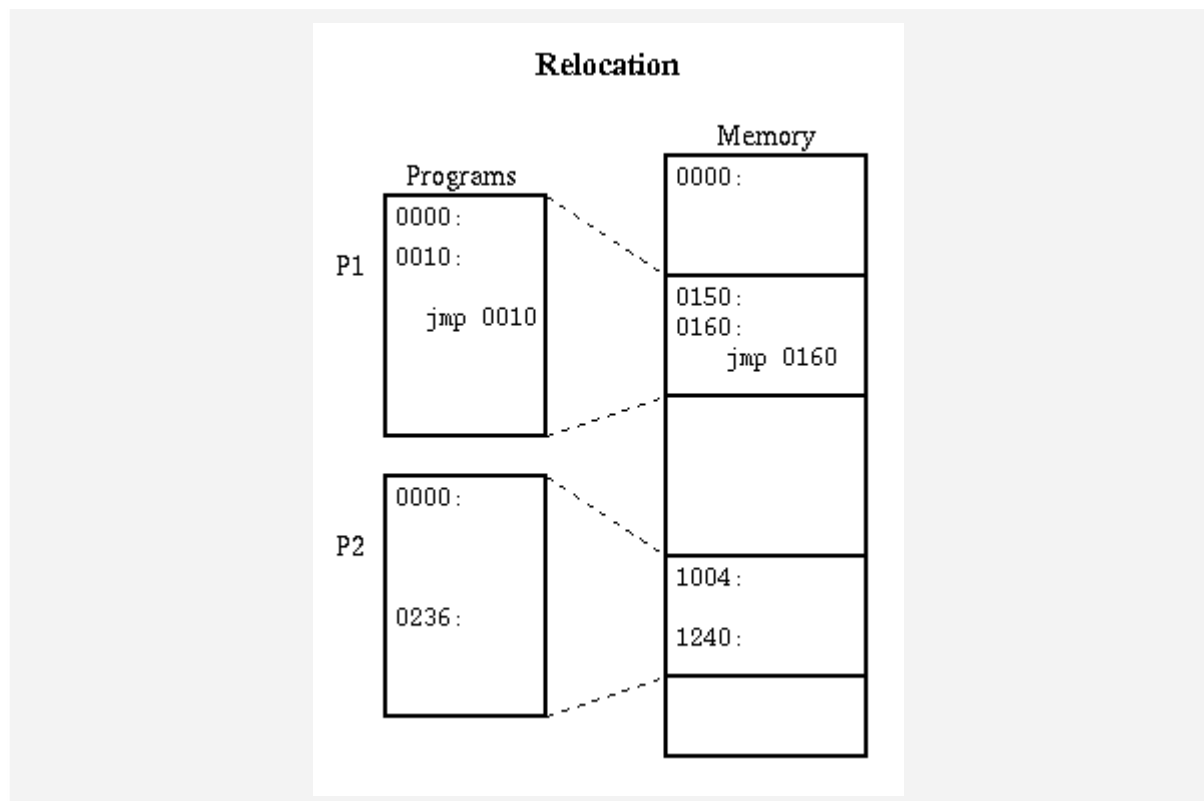Physical address is the actual addressPhysical address is the actual address understood by computer hardware i.e., memory understood by computer hardware i.e., memory unit. Logical to physical address translation unit.Physical address space is the set of all physical addresses generated by a program.

Program Relocation

The term program relocatability refers to the ability to load and execute a given program into memory.Relocation is a way to map virtual addresses into physical addresses.
When a task is loaded in main memory since there are several instructions inside the process so here addresses of these different instructions inside the process are relocatable addresses which are converted into actual addresses by the loader in software approach.
But there is some problem with this approach: suppose if a process is first loaded then removed and then after loaded again so in this situation the loader will get confused.
So to avoid this problem the operating system uses another method for relocation.
Instead of using this load time binding operating system used runtime binding.

Relocation

Programs

P1
```
0000:
0010:
    jmp 0010
```

P2
```
0000:
0236:
```

Memory
```
0000:
0150:
0160:
    jmp 0160
1004:
1240:
```

Static Relocation

At load time, the OS adjusts the addresses in a process to reflect its position in memory. This method is the slow process because it involves software translation. It is used only once before the initial loading of the program.

Once a process is assigned a place in memory and starts executing it, the OS cannot move it.
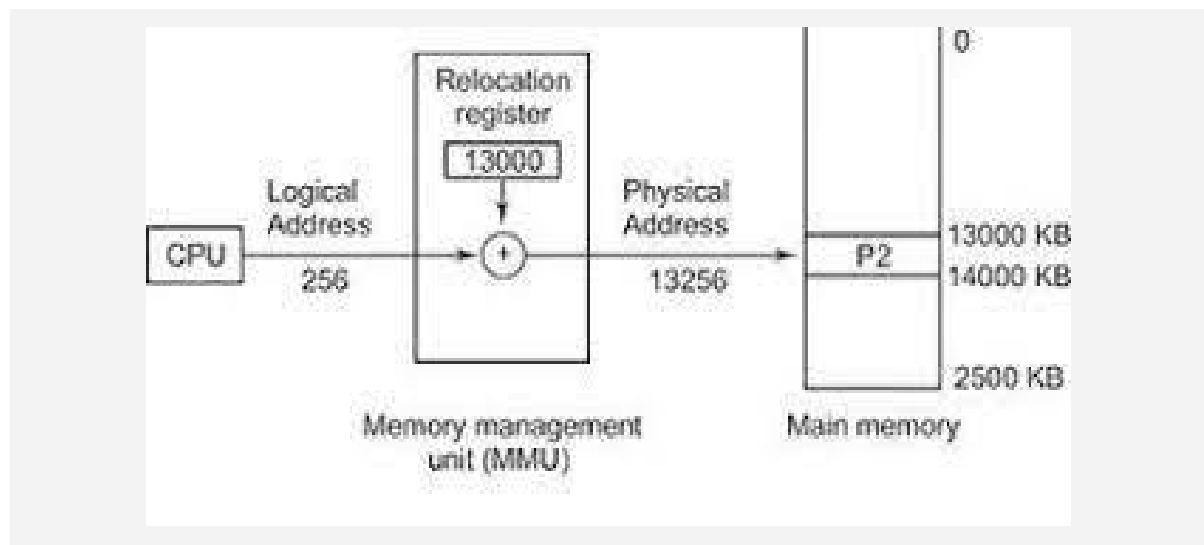
Dynamic Relocation:

hardware adds relocation register (base) to virtual address to get a physical address.

hardware compares address with limit register (address must be less than base).

If test fails, the processor takes an address trap and ignores the physical address

Relocation Register

Relocation register is a special register in the CPU used for program relocation means mapping of logical addresses used by the program to physical addresses of the system's main memory.

For example, if the base(relocation register content) is at 14000, then an attempt by the user to address location 0 is dynamically relocated to location 14000 and an access to location 346 is mapped to location 14346.