Programme : S. Y. B. Sc.

Subject : Computer Science

Semester : IV

Paper Code : CSC 104

Paper Title : Computer Organization and Operating systems

Unit 8 : Memory Management

Module Name : Physical and Virtual address

Module Number : 30

Physical Address space

- Physical Address identifies a physical location of required data in a memory.
- The user never directly deals with the physical address but can access by its corresponding logical address.
- The user program generates the logical address and thinks that the program is running in this logical address but the program needs physical memory for its execution, therefore, the logical address must be mapped to the physical address by Memory Management Unit before they are used.
- The term Physical Address Space is used for all physical addresses corresponding to the logical addresses in a Logical address space.

Virtual (Logical) address space

- Logical Address is generated by CPU while a program is running.
- The logical address is virtual address as it does not exist physically, therefore, it is also known as Virtual Address.
- Logical address is used as a reference to access the physical memory location by CPU.
- The term Logical Address Space is used for the set of all logical addresses generated by a program.
- The hardware device called Memory-Management Unit is used for mapping logical address to its corresponding physical address.

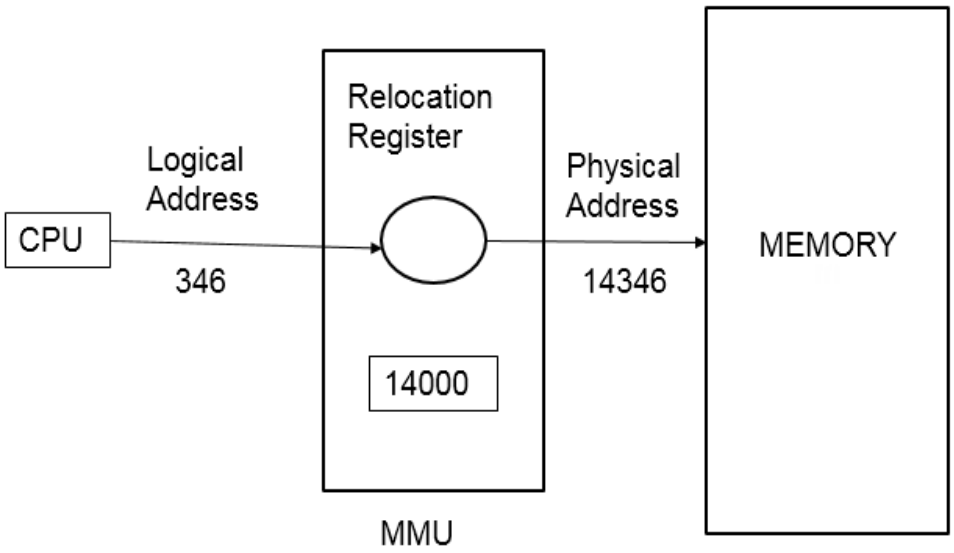

Fig : Dynamic relocation using a relocation register

The run-time mapping from virtual to physical addresses is done by a hardware device called the memory-management unit (MMU).We can choose from many different methods to accomplish such mapping, we illustrate this mapping with a simple MMU scheme that is a generalization of the base-register scheme The base register is now called a relocation register. The value in the relocation register is added to every address generated by a user process at the time the address is sent to memory.
For example, if the base is at 14000, then an attempt by the user to address location 0 is dynamically relocated to location 14000; an access to location 346 is mapped to location 14346.

The user program never sees the real physical addresses. The program can create a pointer to location 346, store it in memory, manipulate it, and compare it with other addresses—all as the number 346. Only when it is used as a memory address (in an indirect load or store, perhaps) is it relocated relative to the base register. The user program deals with logical addresses. The memory-mapping hardware converts logical addresses into physical addresses. The final location of a referenced memory address is not determined until the reference is made.

Difference between Physical and logical Address space

- The logical address is generated by the CPU while the program is running whereas the physical address is computed by the Memory Management Unit (MMU).
- Identical logical addresses are generated by Compile-time and Load time address binding methods whereas they differs from each other in run-time address binding method.

Comparison Chart

Parameter	LOGICAL ADDRESS	PHYSICAL ADDRESS
Basic	generated by CPU	location in a memory unit
Address Space	Logical Address Space is set of all logical addresses generated by CPU in reference to a program.	Physical Address is set of all physical addresses mapped to the corresponding logical addresses.
Visibility	User can view the logical address of a program.	User can never view physical address of program.
Generation	generated by the CPU	Computed by MMU
Access	The user can use the logical address to access the physical address.	The user can indirectly access physical address but not directly.