

③ Virtualization of CPU, Memory and I/O devices:

- Hardware support for virtualization: Modern operating systems and processors permit multiple process to run simultaneously. If there is no protection mechanism in a processor, all inst. from diff. processes will access the hardware directly & cause a system crash. Therefore, all processors have atleast two modes, user mode & supervision mode, to ensure controlled access of critical hardware. Inst. running in supervision mode are called privileged inst. Other instructions are unprivileged inst..

*(i) CPU Virtualization:

- A VM is a duplicate of an existing comp. system in which a majority of the VM inst. are executed on the host processor in native mode. Thus, unprivileged instructions of VMs run directly on the host machine for higher efficiency.
- Privileged inst. execute in a privileged mode and will be trapped if executed outside this mode. Control-sensitive inst.

attempt to change the configuration of resource used. Behaviour-sensitive Inst. have diff. behaviours depending on the configuration of resources, including the load & store operations over the virtual memory.

- ★ A CPU architecture is virtualizable if it supports the ability to run the VM's privileged & unprivileged Inst. In the CPU user mode while the VMM runs in supervisor mode. When the privileged Inst. of a VM are executed, they are trapped in VMM. In this case, the VMM act as a unified mediator for hardware access from diff. VMs to guarantee the correctness & stability of the whole system.

