

Virtualisation and virtual machines

- Virtualisation
- Virtual machines (VMs)
 - System VMs
 - Hypervisors or virtual machine monitor
 - Process VMs
 - JVM
- VMWare
- Cloud computing

Virtual Machines

- A **virtual machine (VM)** is a s/w implementation of a machine that executes programmes like a real machine
- 2 types:
 - A **system (or hardware) virtual machine** provides a complete system platform which supports the execution of a complete OS
 - A **process (or application) virtual machine** supports a single process
- S/W running inside a VM is limited to the resources and abstractions provided by the VM

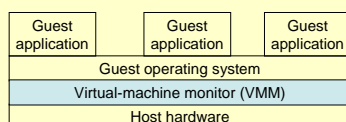
Virtualisation

- Virtualisation is the abstraction of computer resources
- Many different types:
 - Platform virtualisation
 - It separates an OS from the underlying resources
 - OS-level virtualisation
 - Used in virtual hosting environments
 - Useful for securely allocating finite h/w resources amongst a large number of mutually-distrusting users
 - Resource virtualisation

System Virtual Machines

- Allow the sharing of the physical machine resources between different VMs, each running its own OS
- Low-level abstraction
- the s/w layer providing the virtualisation is called a **virtual machine monitor (VMM)** or **hypervisor**
- A **hypervisor** can run on h/w (Type 1 or **native VM**) or on top of an OS (Type 2 or **hosted VM**)
- The s/w running above the virtual machine abstraction is called guest s/w
- Advantages:
 - Multiple OS environments can co-exist on same computer
 - The VM can provide an instruction set architecture that is a bit different from the real machine

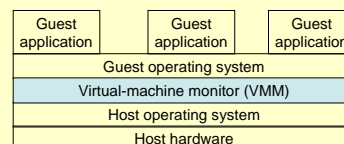
Virtual-machine structures or Hypervisors – Type I



Type I VMM (Hypervisor)

- In Type I VMM the host platform is the bare h/w

Virtual-machine structures or Hypervisors – Type II



Type II VMM (Hypervisor)

- in Type II VMM the host platform is the host OS

Process Virtual Machines

- Runs as a normal application inside an OS and supports a single process
- It is created when a process is started and destroyed when it exits
- Aim is to provide a platform-independent programming environment that abstracts away details of the underlying h/w or OS and allow a programme to execute in the same way on any platform
- High-level abstraction (~ high-level programming language)
- Use an interpreter
- E.g. Java virtual machine

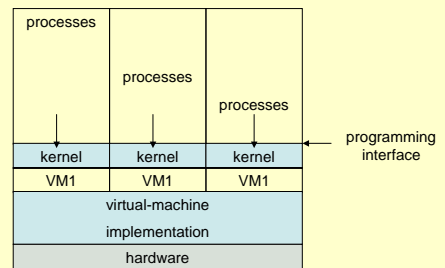
System Virtual Machines

- Virtual machine (VM) ~ layered approach
 - treats h/w and the OS kernel as though they were all h/w
- A virtual machine provides an interface *identical* to the underlying bare h/w
- A s/w programme that emulates a h/w system
- In a Virtual Machine - each process "seems" to execute on its own processor with its own memory, devices, etc.
- The resources of the physical machine are shared.
 - Virtual devices are sliced out of the physical ones.
 - Virtual disks are subsets of physical ones.

Virtual Machines (VMs)

- Advantages:
 - Useful for running different OS simultaneously on the same machine.
 - Protection is excellent
 - Virtual privileged instructions are trapped
 - Good for OS research and development
- Disadvantages:
 - but no sharing possible.
 - VMs are difficult to implement because of the need to provide an exact copy to the underlying machine

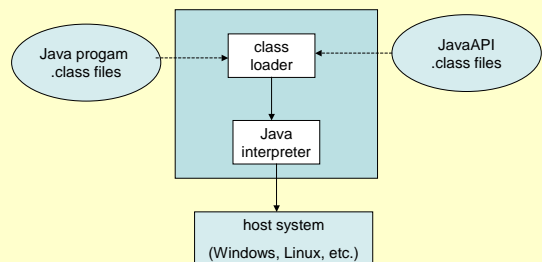
Virtual Machines



Java Virtual Machine

- Compiled Java programs are platform-neutral bytecodes executed by a Java Virtual Machine (JVM)
- JVM consists of:
 - Class loader
 - Class verifier
 - Runtime interpreter
 - Just-In-Time (JIT) compilers increase performance

Java Virtual Machine



VMWare

- Market leader in VM s/w
- VMware s/w provides a completely virtualised set of h/w to the guest OS
 - Virtualised h/w for video adaptor, network adaptor, hard disk adaptor
 - Provides pass through drivers for guest USB, serial and parallel devices
- Highly portable between computers as every host looks nearly identical to the guest
- VMware Virtualisation
 - <http://www.youtube.com/watch?v=Pg2sRV5ay08>

Cloud Computing

- Dynamically scalable (virtualised) resources are provided as a service over the Internet
- Users need not have knowledge of, expertise in, or control over the technology infrastructure “in the cloud”
- Incorporates
 - infrastructure as a service
 - Platform as a service
 - s/w as a service
 - Web 2.0
 - Business apps online, accessed from a web browser, with s/w and data stored on servers

Cloud Computing

