# 14 Virtual Machines & Distributed Systems

- Virtual Machines
  - 介绍
    - Virtualization is technology that allows to create multiple simulated environments or dedicated resources from a single, physical hardware system.
      - 虚拟化是一种允许从单个物理硬件系统创建多个模拟环境或专用资源的技术
    - Software called a hypervisor connects directly to that hardware and allows to split a system into separate, distinct, and secure environments known as virtual machines (VMs).
      - 称为虚拟机管理程序的软件直接连接到该硬件，并允许将系统划分为称为虚拟机(vm)的独立、独特和安全的环境。
    - Virtual machine manager (VMM) or hypervisor – creates and runs virtual machines by providing interface that is identical to the host (except in the case of paravirtualization)
      - 虚拟机管理器(VMM)或管理程序—通过提供与主机相同的接口来创建和运行虚拟机(半虚拟化的情况除外)
    - Virtual machine implementations involve several components
      - 虚拟机实现涉及几个组件
      - ▪ Host – the physical hardware equipped with a hypervisor.
        - 主机——配备了管理程序的物理硬件。
      - ▪ Guest – an operating system
        - Guest—操作系统
      - ▪Single physical machine can run multiple operating systems concurrently, each in its own virtual machine
        - ▪单个物理机可以同时运行多个操作系统，每个操作系统都在自己的虚拟机中
    - - the hypervisor provides a layer between the hardware (the physical host machine) and the Virtual Machines (guest machines)hypervisor在硬件(物理主机)和虚拟机(来宾机)之间提供一个层。
      - hypervisor在硬件(物理主机)和虚拟机(来宾机)之间提供一个层。

**Non-virtual machine**   **Virtual machine**
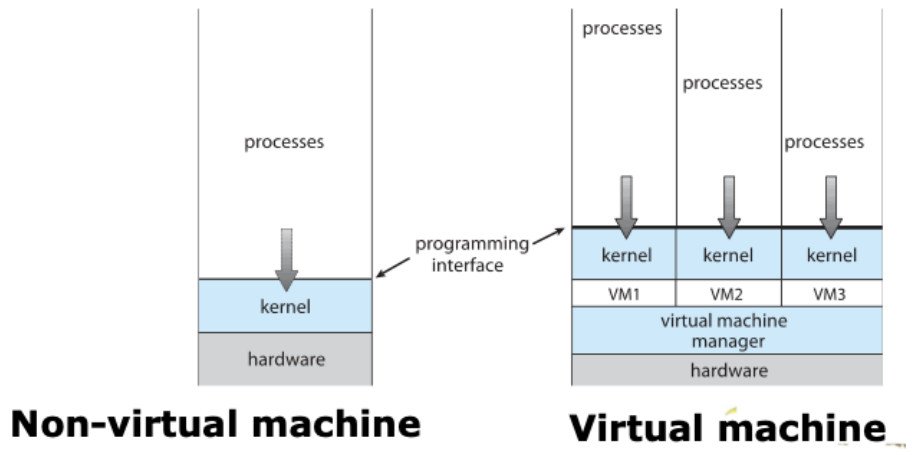
- Implementation of VMMs
  - 虚拟机管理器vmm的类型:
  - Types of virtual machine manager VMMs:
    - Type 0 hypervisors - Hardware-based solutions that provide support for virtual machine creation and management via firmware.
      - Type 0管理程序——基于硬件的解决方案，通过固件提供对虚拟机创建和管理的支持。
      - - No need an embedded host OS to support virtualization, runs in an "Un-Hosted" environment.
        - -无需嵌入式主机操作系统支持虚拟化，可在"非托管"环境中运行。
        - » IBM LPARs and Oracle LDOMs are examples
          - IBM lpar和Oracle ldom就是例子
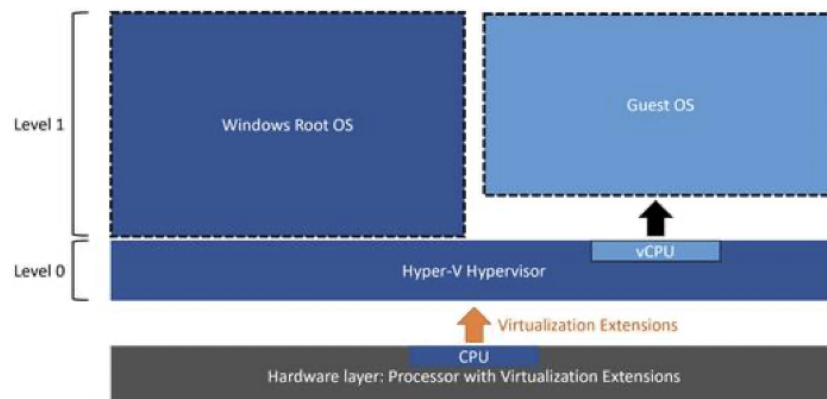
    - Type 1 hypervisors - Operating-system-like software built, is a layer of software run directly on the system hardware.
      - 类型1管理程序——类似于操作系统构建的软件，是直接在系统硬件上运行的一层软件。
      - » Including VMware ESX, Joyent SmartOS, and Citrix XenServer
        - 包括VMware ESX, Joyent SmartOS和Citrix XenServer
      - » Including Microsoft Windows Server with HyperV and RedHat Linux with KVM

- 包括Microsoft Windows Server with HyperV和RedHat Linux with KVM
  - Type 2 hypervisors - allows users to run multiple operating systems simultaneously on a single platform
    - Type 2管理程序——允许用户在单个平台上同时运行多个操作系统
    - » Including VMware Workstation and Fusion, Parallels Desktop, and OracleVirtualBox
   - 包括VMware Workstation和Fusion, Parallels Desktop和OracleVirtualBox
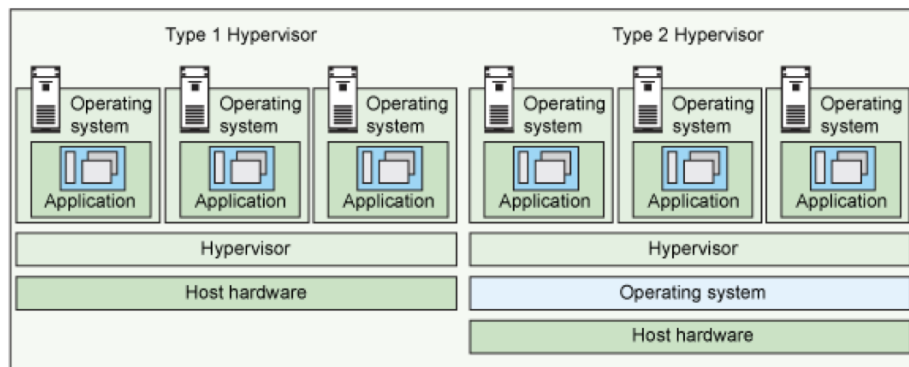
- Benefits
  - - the ability to share the same hardware yet run several different execution different operating systems concurrently.
    - -能够共享相同的硬件，但同时运行几个不同的不同操作系统。
  - - Host system protected from VMs, VMs protected from each other
    - —主机系统保护虚拟机，虚拟机相互保护
    - against virus - less likely to spread
      - 防病毒-不太可能传播
    - each virtual machine is almost completely isolated from all other virtual machines
      - 每个虚拟机几乎与所有其他虚拟机完全隔离
    - Disadvantage of isolation is that it can prevent sharing of resources.
      - 隔离的缺点是它会阻止资源共享
  - - a perfect for operating-system research and development.
    - -一个完美的操作系统研究和开发
    - - virtualized workstation allows for rapid porting and testing of programs in varying environments.
      - -虚拟化工作站允许在不同的环境中快速移植和测试程序。
    - - Consolidation involves taking two or more separate systems and running them in virtual machines on one system.
      - -整合包括采用两个或多个独立的系统，并在一个系统上的虚拟机上运行它们。

- can improve resource utilization and resource management.
  - -可以提高资源利用率和资源管理。
- -Live migration – move a running VM from one host to another.
  - —热迁移—将正在运行的虚拟机从一台主机迁移到另一台主机。
- Distributed Systems
  - 介绍
    - Distributed system is a loosely-coupled architecture, wherein processors are inter-connected by a communication network.
      - 分布式系统是一种松耦合的体系结构，其中处理器通过通信网络相互连接。
    - Processors variously called nodes , computers, machines, hosts
      - 处理器也被称为节点，计算机，机器，主机
        - 两个程序在两个不同的主机上运行
    - The processors and their respective resources for a specific processor in a distributed system are remote, while its own resources are considered as local.
      - 分布式系统中特定处理器的处理器及其各自的资源是远程的，而它自己的资源被认为是本地的。
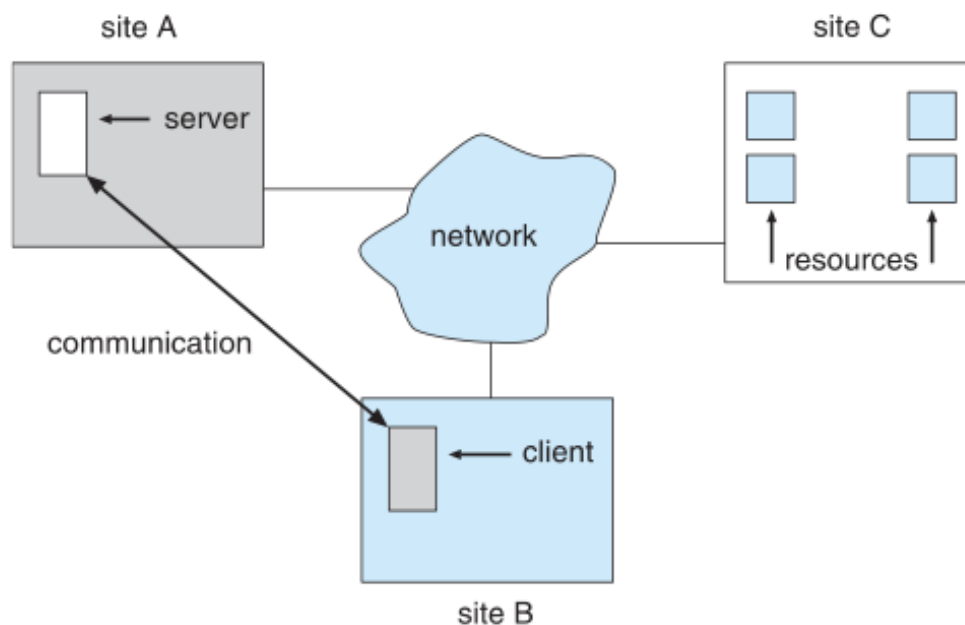
  - Reasons for Distributed Systems
    - Resource sharing
      - » Sharing and printing files at remote sites
        - 在远程站点共享和打印文件
      - » Processing information in a distributed database
        - 在分布式数据库中处理信息
      - » Using remote specialized hardware devices
        - »使用远程专用硬件设备

- Computation speedup – load sharing or job migration (are distributed and run concurrently on various nodes on the system)
  - 计算加速-负载共享或作业迁移(分布并并发运行在系统的各个节点上)
- Reliability – detect and recover from site failure, function transfer, reintegrate failed site; may utilize an alternative path in the network, in case of any failure.
  - 可靠性-检测并从站点故障中恢复，功能转移，重新整合故障站点;在出现故障的情况下，可以利用网络中的替代路径。
- Communication – exchange information at geographically-distant nodes
  - 通信——在地理上相距遥远的节点交换信息,克服了时间空间的困难
- Economy and Incremental growth - a number of cheap processors together provide a highly cost-effective solution for a computation-intensive application. The DS may be increased with the introduction of any new hardware or software resources.
  - 经济和增量增长——许多便宜的处理器一起为计算密集型应用程序提供了一个高成本效益的解决方案。DS可能会随着引入任何新的硬件或软件资源而增加
- Types of Network-oriented OS
  - Network Operating Systems
    - ➢ Remote logging into the appropriate remote machine (telnet, ssh)
      - 远程登录到相应的远程机器(telnet、ssh)
    - ➢ Remote File Transfer - transferring data from remote machines to local machines, via the File Transfer Protocol (FTP) mechanism
      - 远程文件传输-通过文件传输协议(FTP)机制，将数据从远程机器传输到本地机器
    - ➢ Users must establish a session
      - 用户必须建立会话
  - Distributed Operating Systems
    - ➢Data Migration – transfer data by transferring entire file, or transferring only those portions of the file necessary for the immediate task
      - 数据迁移-通过传输整个文件或仅传输当前任务所需的文件部分来传输数据
    - ➢ Computation Migration – transfer the computation, rather than the data, across the system
      - 计算迁移-跨系统传输计算，而不是数据
    - ➢ Process Migration – execute an entire process, or parts of it, at different sites
      - 流程迁移-在不同地点执行整个流程或部分流程

以上内容整理于 幕布文档