Cloud Computing Concepts

CS 3132

Dr. Anand Kumar Mishra

NIIT University

Characteristics of virtualized environments

A brief history of virtualization

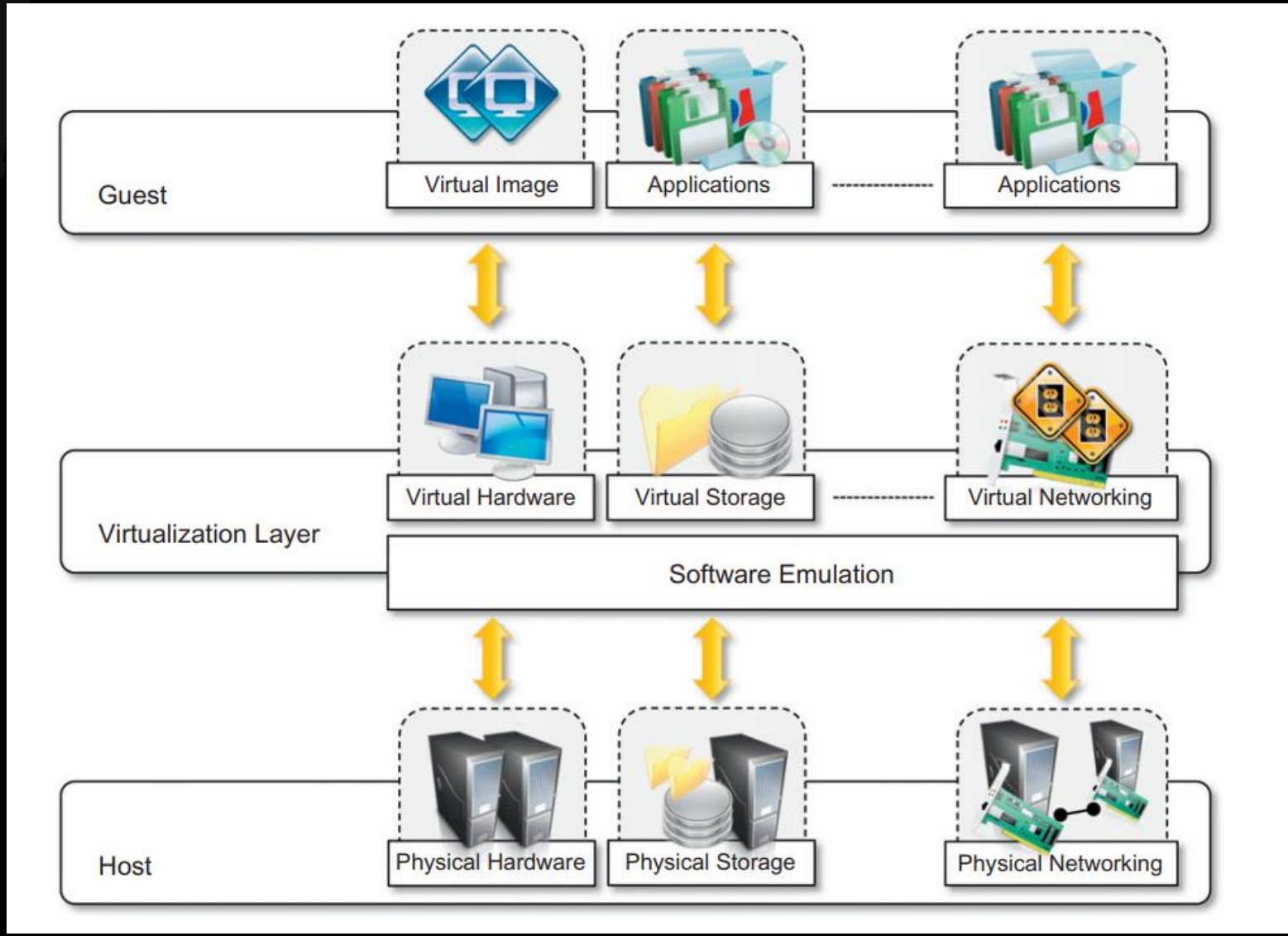
- Batch processing – routine task
  - Predefined sequence of commands, programs and data as a single unit
  - A number a jobs in memory and executes them without any manual information
  - FCFS based processing
- Time-sharing - isolate the users within OS;
  - Inadvertently leading to other operating systems like UNIX, which eventually gave way to Linux

A brief history of virtualization

- 1990s
  - Most enterprises had physical servers and single-vendor IT stack
    - That didn’t allow legacy apps to run on a different vendor’s hardware
  - As companies updated their IT environments with less-expensive commodity servers:
    - OS, and applications from a variety of vendors were bound to underused physical hardware
      - Each server could only run 1 vendor-specific task
- Virtualization - Solution to 2 problems:
  - Companies could partition their servers *and*
  - Run legacy apps on multiple OS
- Servers started being used more efficiently
  - Reducing the costs associated with purchase, set up, cooling, and maintenance

Characteristics of virtualized environments

- In a virtualized environment there are three major components: guest, host, and virtualization layer
- The guest represents the system component that interacts with the virtualization layer rather than with the host



The virtualization reference model

Characteristics of virtualized environments

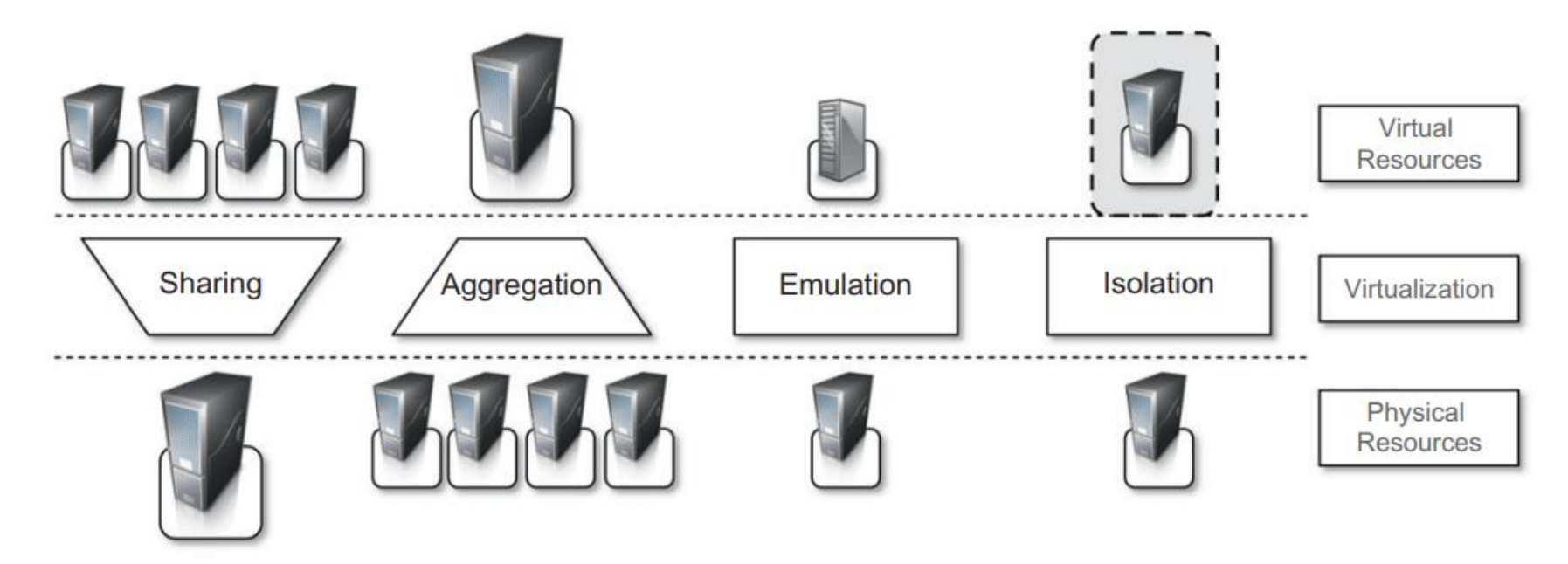
- **Increased security**
- **Managed Execution**
  - **sharing, aggregation, emulation, and isolation**
- **Portability**

Characteristics of virtualized environments

- **Increased security:**
  - The ability to control the execution of a guest in a completely transparent manner opens new possibilities for delivering a secure, controlled execution environment
  - All the operations of the guest are generally performed against the VM, which then translates and applies them to the host
  - This level of indirection allows the virtual machine manager to control and filter the activity of the guest, thus preventing some harmful operations from being performed

Characteristics of virtualized environments

- **Managed execution:**
  - sharing,
  - aggregation,
  - emulation,
  - isolation



Functions enabled by managed execution

Characteristics of virtualized environments

- **Managed execution: Sharing**
  - Virtualization allows the creation of a separate computing environments within the same host

Characteristics of virtualized environments

- **Managed execution: Aggregation**
  - A group of separate hosts can be tied together and represented to guests as a single virtual host
  - This function is naturally implemented in middleware for distributed computing
    - With a classical example represented by cluster management software, which harnesses the physical resources of a homogeneous group of machines and represents them as a single resource

Characteristics of virtualized environments

- **Managed execution: Emulation**
  - Emulation, in a software context, is the use of an application program or device to imitate the behavior of another program or device.
  - Guest programs are executed within an environment that is controlled by the virtualization layer, which ultimately is a program
    - This allows for controlling and tuning the environment that is exposed to guests
  - For instance, a completely different environment with respect to the host can be emulated, thus allowing the execution of guest programs requiring specific characteristics that are not present in the physical host

Characteristics of virtualized environments

- **Managed execution: Isolation**
  - Virtualization allows providing guests with a completely separate environment, in which they are executed
    - —whether they are operating systems, applications, or other entities
  - Isolation brings several benefits;
    - It allows multiple guests to run on the same host without interfering with each other
    - It provides a separation between the host and the guest
    - The virtual machine can filter the activity of the guest and prevent harmful operations against the host

Characteristics of virtualized environments

- **Portability**
  - It allows having your own system always with you and ready to use as long as the required virtual machine manager is available
  - In the case of a hardware virtualization solution:
    - The guest is packaged into a virtual image that, in most cases, can be safely moved and executed on top of different VMs
    - Except for the file size, this happens with the same simplicity with which we can display a picture image in different computers.
    - Virtual images are generally proprietary formats that require a specific virtual machine manager to be executed