



ECAP470: CLOUD COMPUTING

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Learning Outcomes



After this lecture, you will be able to,

- ✓ learn about virtualization concepts and the need for virtualization
- ✓ explore the features of virtualization and the working of virtualization in cloud

Virtualization

- In recent years, computing has become more complex and requires large infrastructure. Organizations invest a huge amount in buying additional physical infrastructure as and when there is a need for more computing resources.

Virtualization

- At the same time, the resource utilization and return on investment (ROI) on buying the additional infrastructure are very low.
- To increase the resource utilization and ROI, the companies started using the technology called virtualization where a single physical infrastructure can be used to run multiple Operating Systems (OSs) and applications.

Virtualization

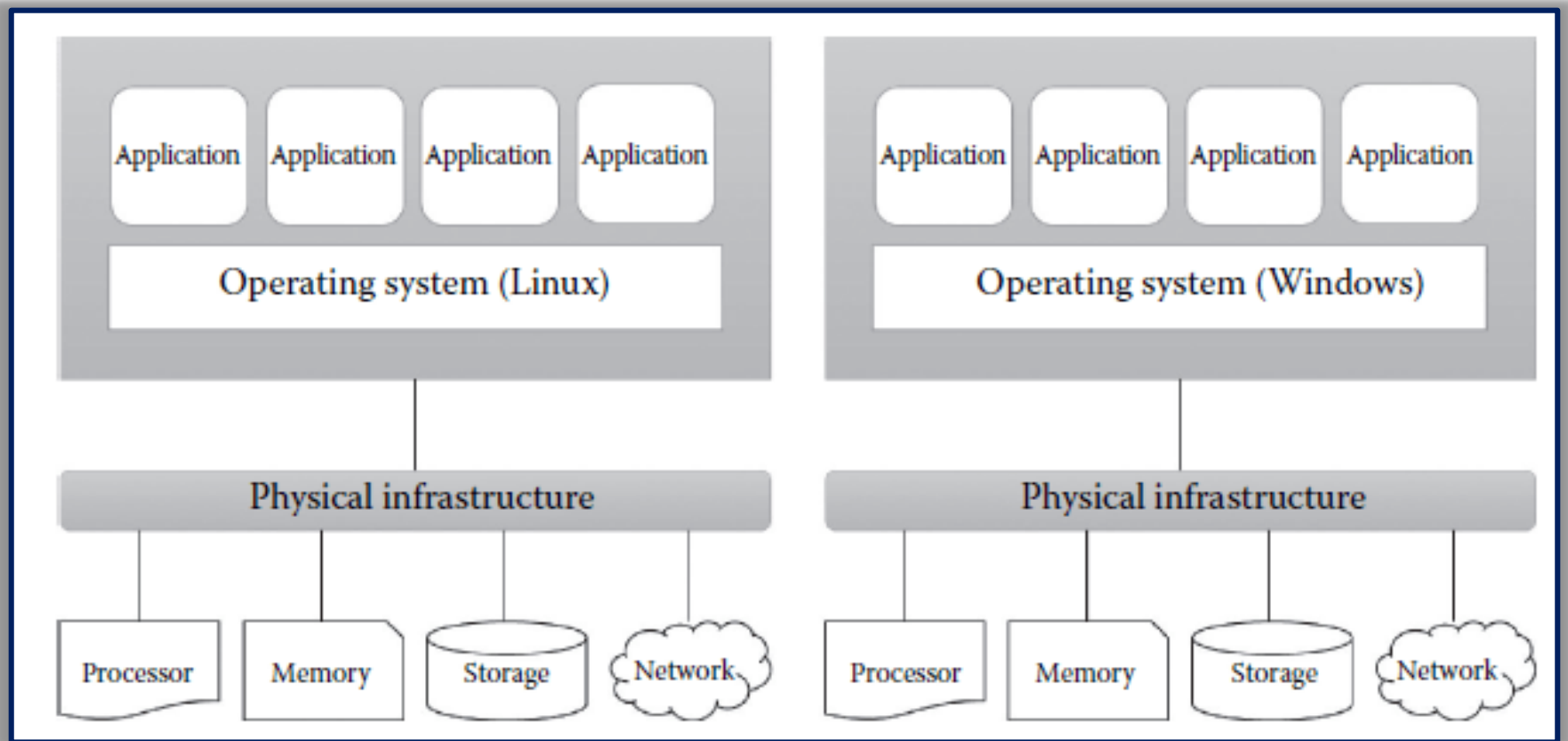
- Technology that **transforms hardware into software.**
- Allows to run multiple OSs as virtual machines.
- Each copy of an operating system is installed in to a virtual machine.



Virtualization

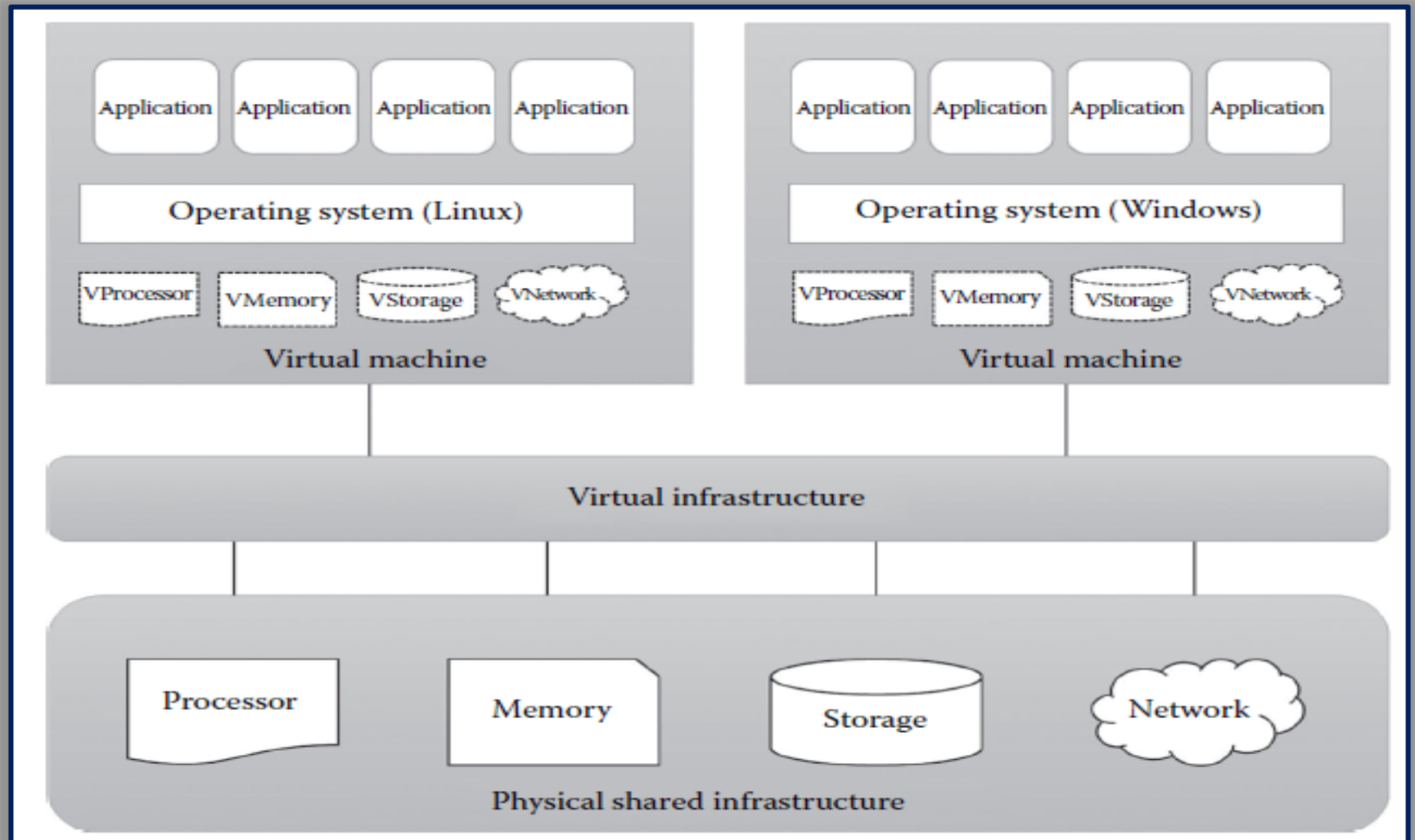
- Technology that enables the single physical infrastructure to function as a multiple logical infrastructure or resources.
- Virtualization allows the creation of a secure, customizable, and isolated execution environment for running applications, even if they are untrusted, without affecting other users' applications.

Before and After Virtualization



Before Virtualization

Before and After Virtualization



After Virtualization

Virtual Machine (VM)

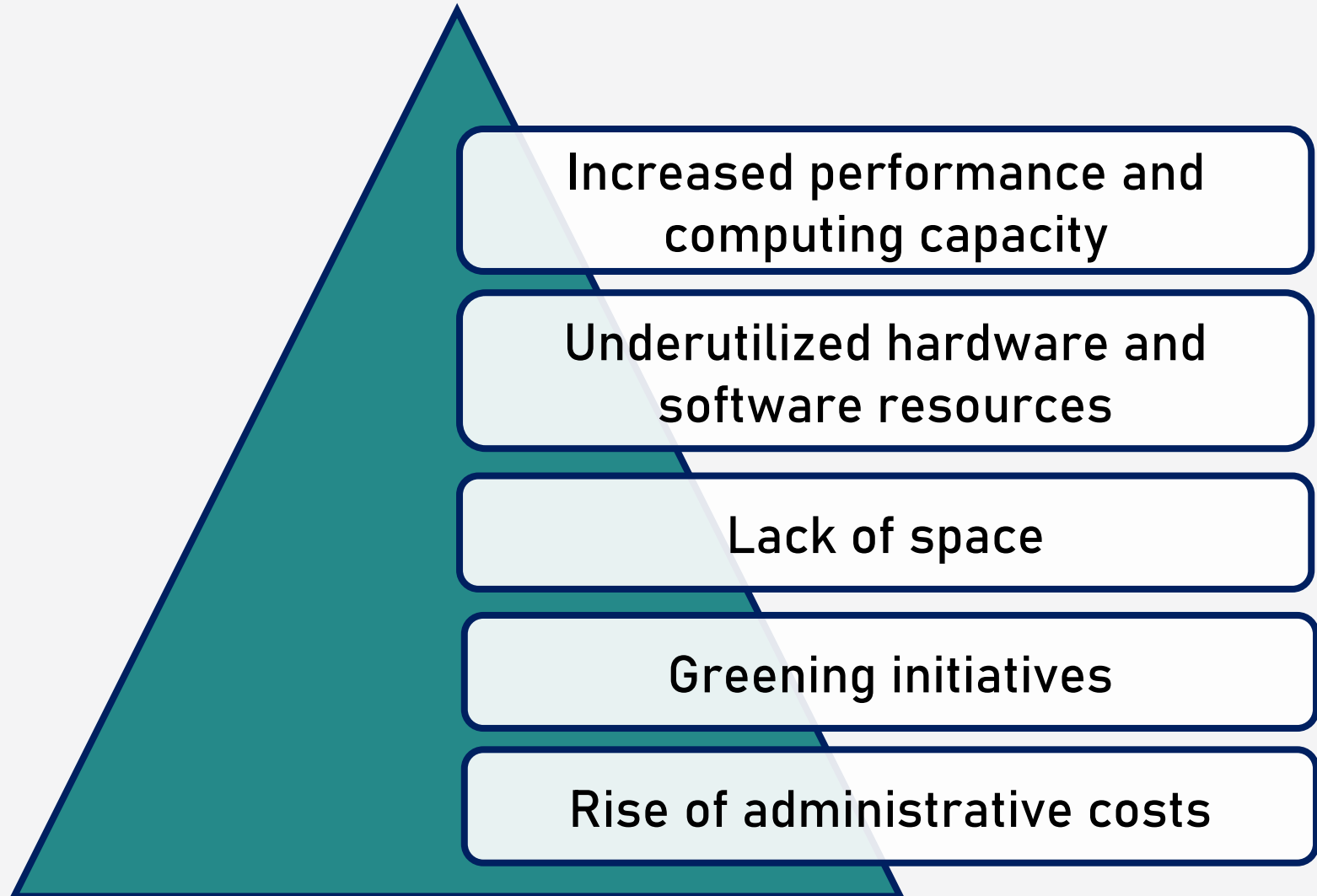
- Isolated guest operating system installation within a normal host operating system.
- From the user perspective, VM is software platform like physical computer that runs operating systems and apps.
- VMs possess hardware virtually.



Virtualization Scenario Example



Factors Driving the Need of Virtualization



Need for Virtualization

- Share same hardware among independent users.
- Reduced hardware footprint through consolidation
- Sandbox/migrate applications
- Decouple applications from underlying Hardware

Features of Virtualization

1. Virtualization Raises Abstraction

- Similar to Virtual Memory.
- Similar to Hardware Emulators.
- No botheration about the physical hardware details.

Features of Virtualization

2. Virtualization Requirements

- Efficiency Property.
- Resource Control Property.
- Equivalence Property.

Virtualized Environments

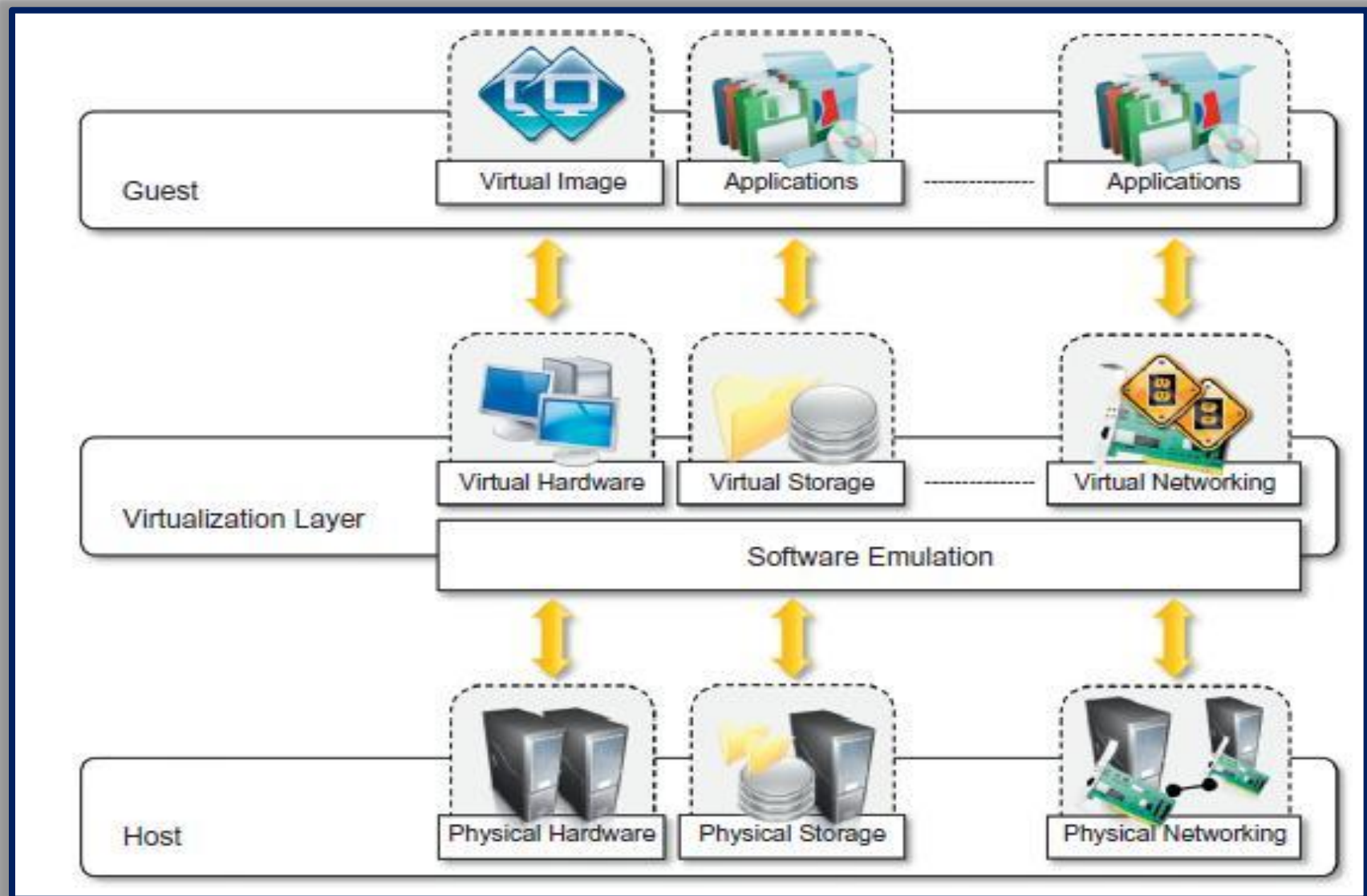
Virtualization is a broad concept that refers to the creation of a virtual version of something, whether hardware, a software environment, storage, or a network.

Components of Virtualized Environments

In a virtualized environment, there are **three major components**:

- Guest
- Host
- Virtualization Layer

Components of Virtualized Environments



How Does Virtualization Work?

- Virtualization layer is installed.

Uses Bare-metal or Hosted Hypervisor architecture.

Virtualization Architecture

Hosted Architecture

- Firstly, host OS is installed.
- Piece of software called a hypervisor or virtual machine monitor (VMM) is installed on top of host OS.
- Allows the users to run various guest OSs within their own application windows.
- Example: VMware Workstation, Oracle Virtual Box , Microsoft Virtual PC.

Bare-Metal Architecture

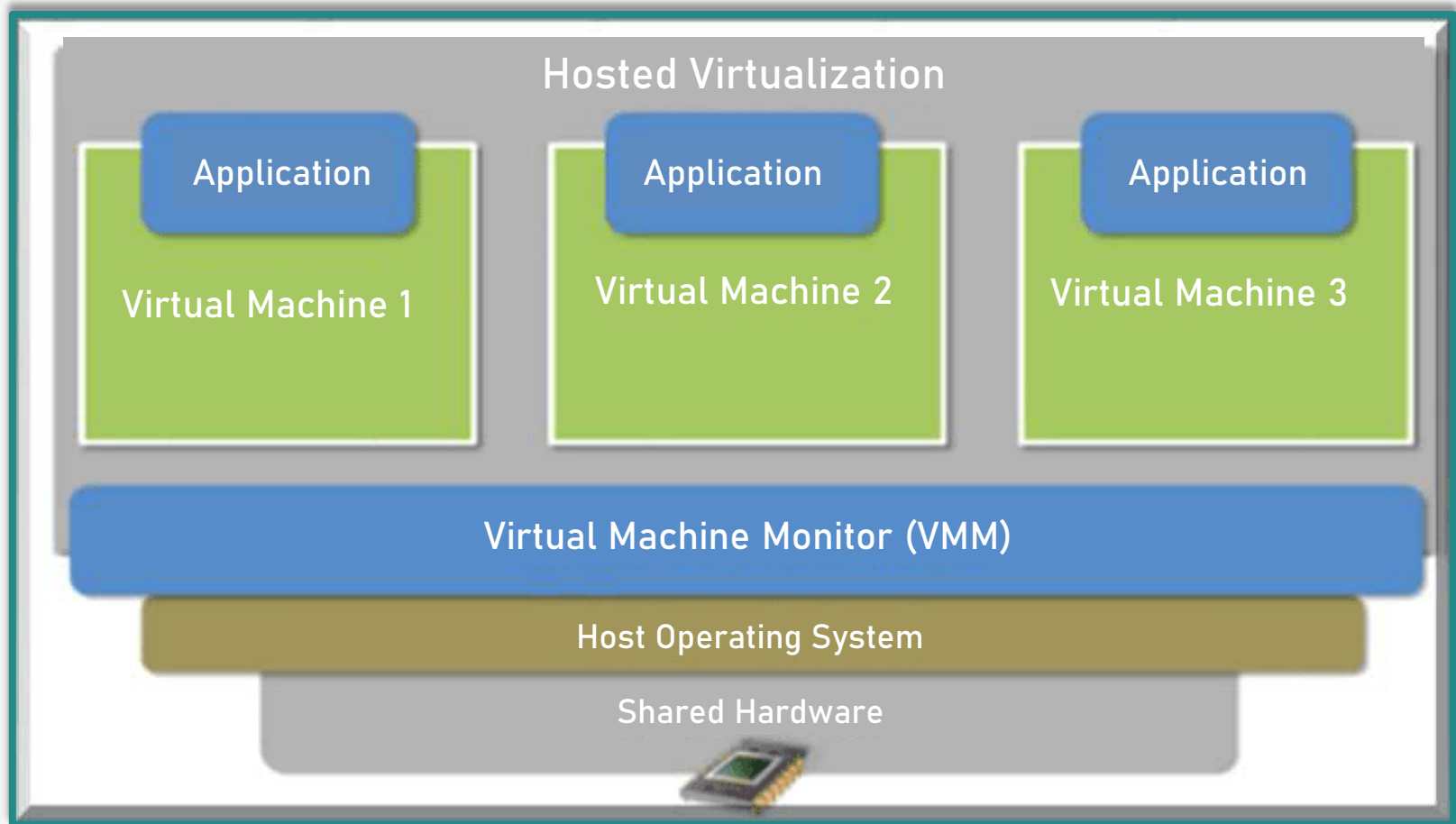
- In this architecture, type1 hypervisor or VMM is installed on the bare hardware.
- VMM communicates directly with system hardware rather than relying on a host operating system.
- Example: VMWARE ESX, VMWARE ESXi, Microsoft Hyper-V.

Hosted Virtualization Architecture

- Requires OS (windows or linux) installed on the computer.
- Virtualization layer is installed as application on OS.

VMWare Server is free application supported by windows or Linux.

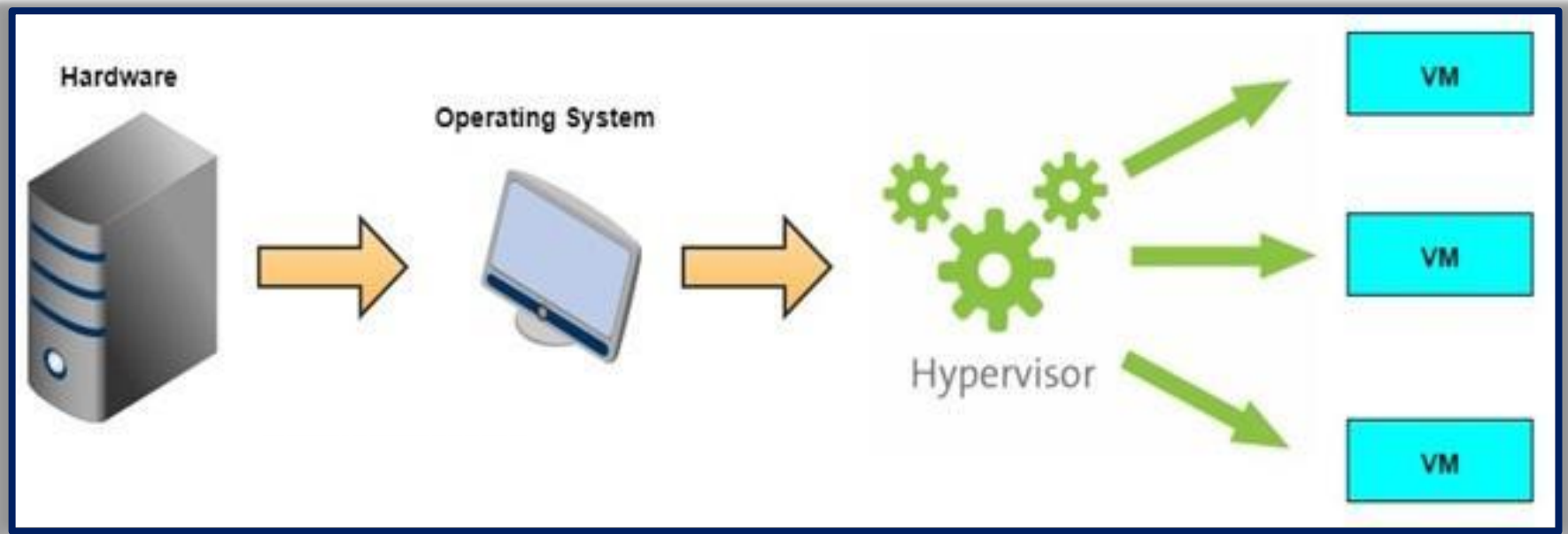
Hosted Virtualization Architecture



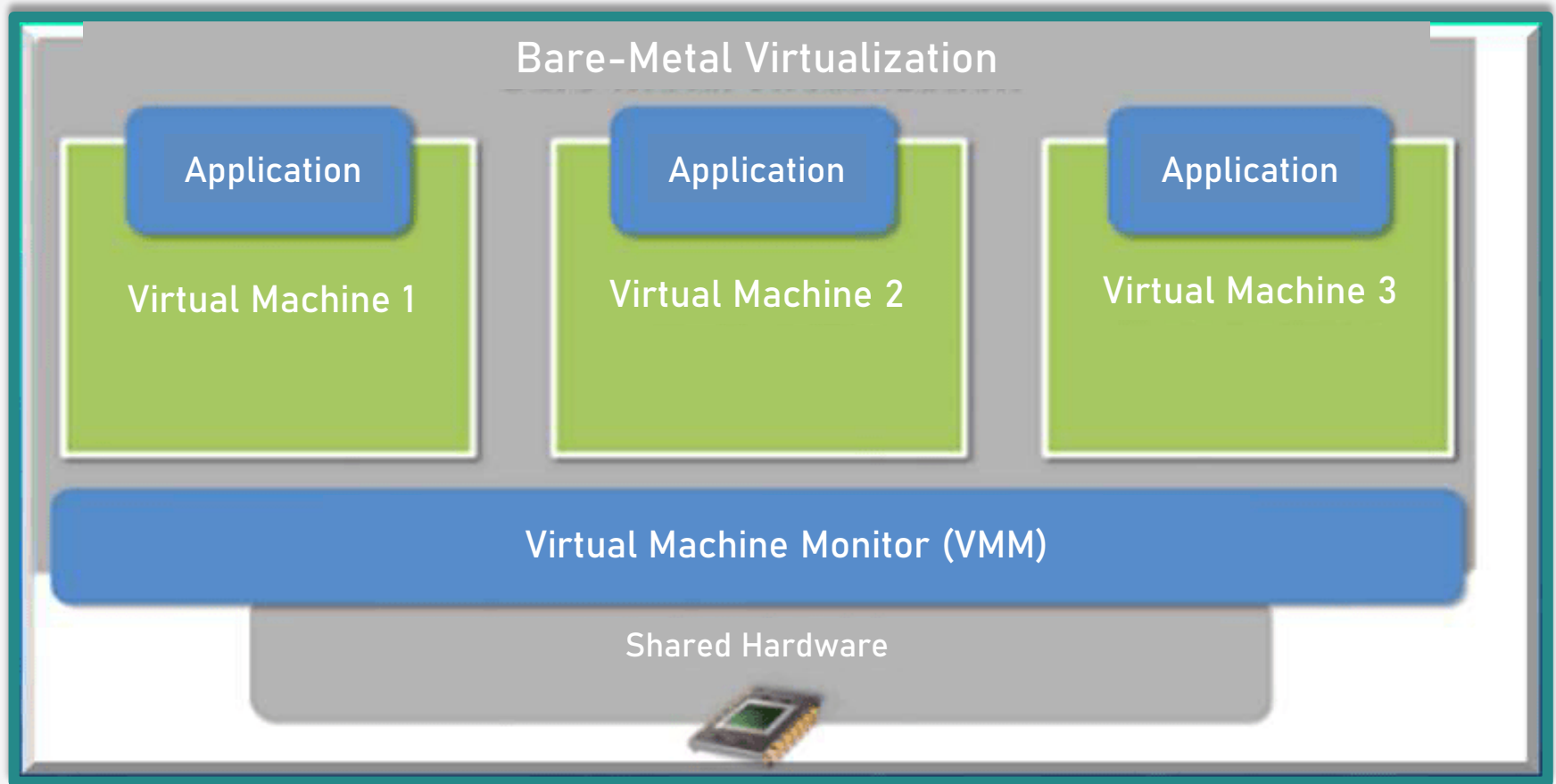
Hosted VM Monitor is Installed on Top of Host OS

Hosted Virtualization Architecture

- Advantages
- Disadvantages



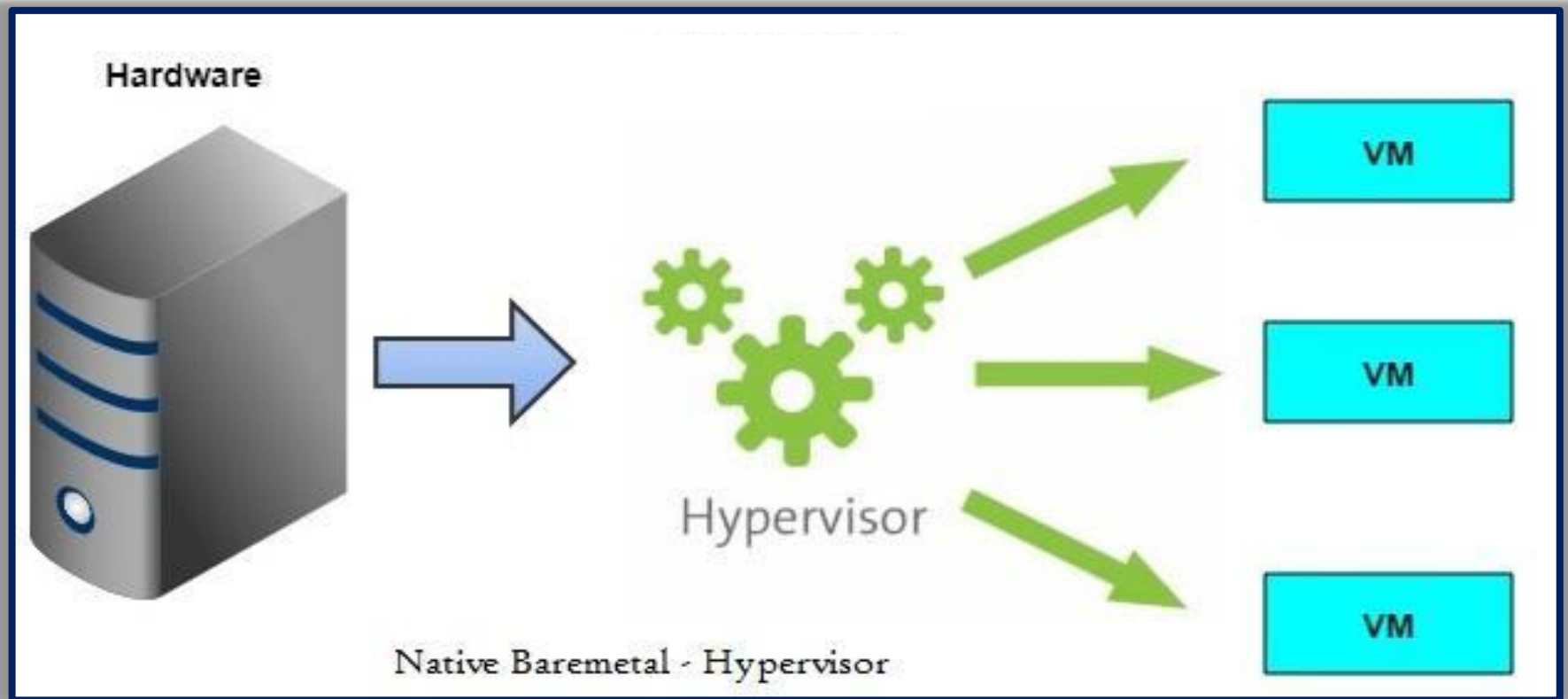
Bare-Metal Architecture



Bare-Metal VM Monitor is Installed directly on System Hardware

Bare-Metal Architecture

- Advantages
- Disadvantages



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That's all for now...