UNIT-I

Understanding Hypervisor

Understanding Hypervisors

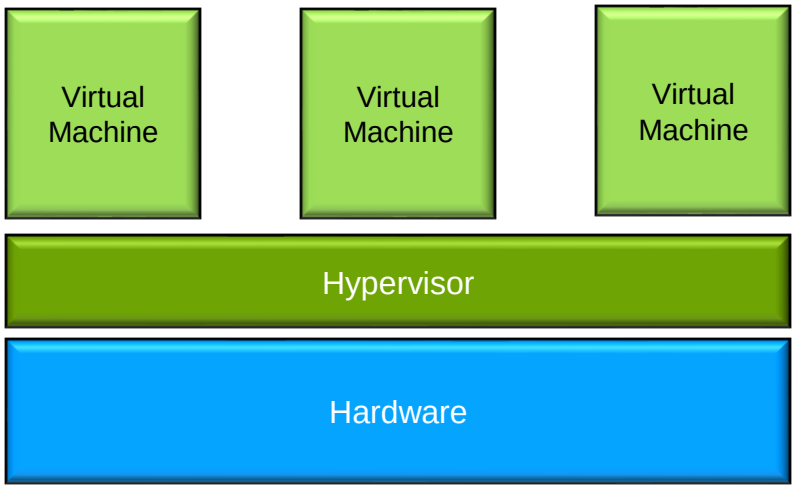
- In this discussion, we will learn what a hypervisor is, take a closer look at its beginnings more than 50 years ago on mainframe computers, and trace its history.
- You will examine the different hypervisor types, get a better understanding of what they do, and then compare some of the modern hypervisors that are available today.

Learning Objectives

- Describing a hypervisor.
- Understanding the role of a hypervisor.
- Comparing today's hypervisors.

Definition of a Hypervisor

- At the highest level, a hypervisor is an arbiter of resources.
- It is software that sits between the physical resources on a physical server and the virtual machines that run on that server.



Hypervisor Capabilities

- In addition to resource allocation, hypervisors provide a virtual environment for those workloads.
- They enable virtual networks and offer various forms of clustering for high availability.

Hypervisor Positioning

- The hypervisor is a layer of software that resides below the virtual machines and above the hardware.
- Without a hypervisor, an operating system communicates directly with the hardware beneath it.

Need for a Hypervisor

- Without a hypervisor, more than one operating system from multiple virtual machines would want simultaneous control of the hardware.
- This would result in chaos.

History of Virtualization

- The first virtualization was performed on IBM mainframes.
- Virtualization technology has been available on those platforms since the 1960s.

Early Virtual Machine Monitors

- The first VMMs were used for the development and **debugging** of operating systems.
- They provided a sandbox for programmers to test rapidly and repeatedly.

Evolution to Hypervisors

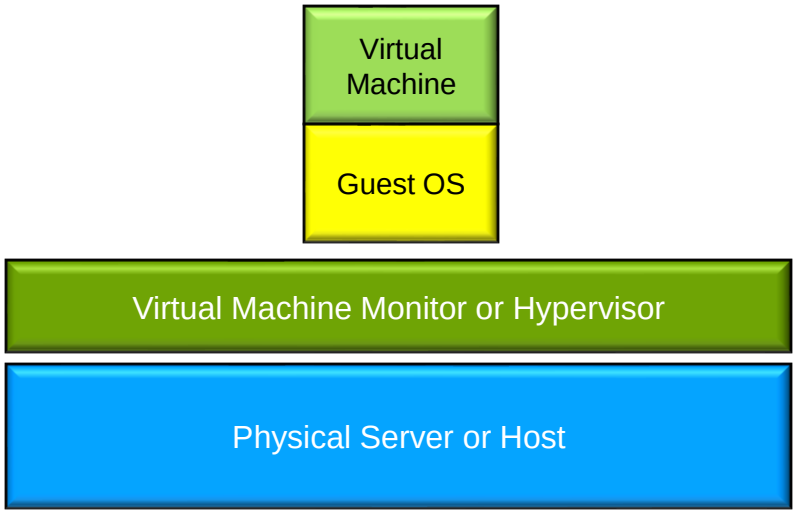
- Soon they added the ability to run multiple environments concurrently.
- This model is what evolved into today's hypervisors.

Why Call It a Hypervisor?

- Those days operating systems were called supervisors.
- This code could supersede them, hence the term hypervisor.

Structure of a VMM

- The structure of a VMM is fairly simple.
- It consists of a layer of software that lives between the hardware and the virtual machines.

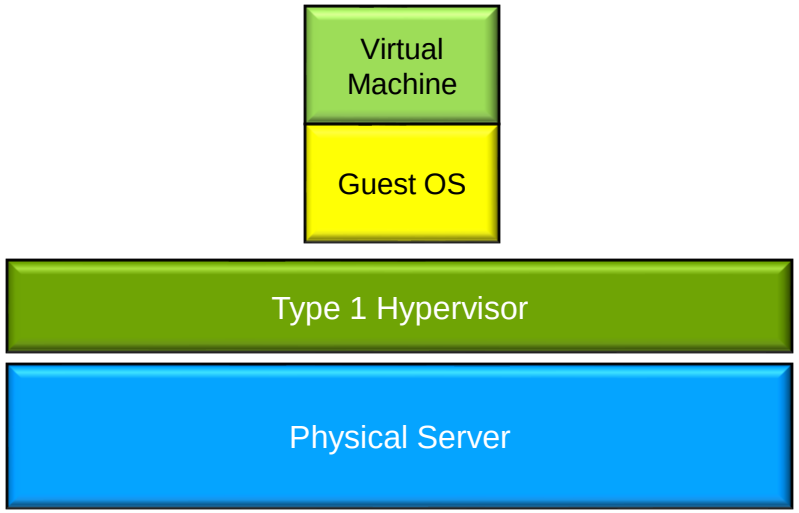


Classes of Hypervisors

- There are two classes of hypervisors.
- Their names, **Type 1** and **Type 2**, give no clue at all to their differences.

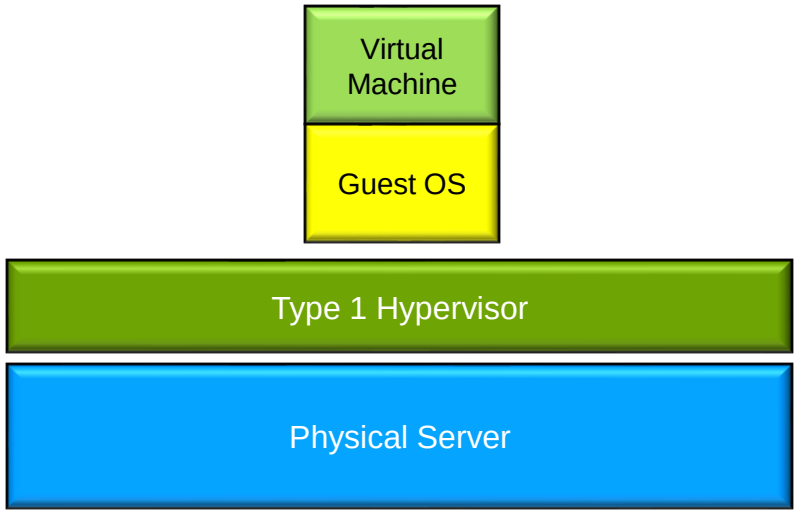
Type 1 Hypervisors

- A Type 1 hypervisor runs directly on the server hardware.
- This is also referred to as a bare-metal implementation.



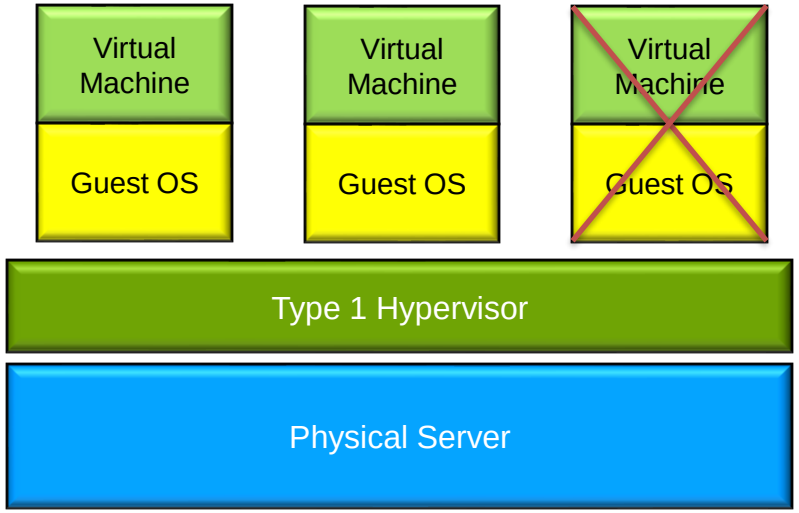
Advantages of Type 1 Hypervisors

- Because there is no other intervening layer of software, it is more efficient.
- Type 1 hypervisors are also considered to be more secure.



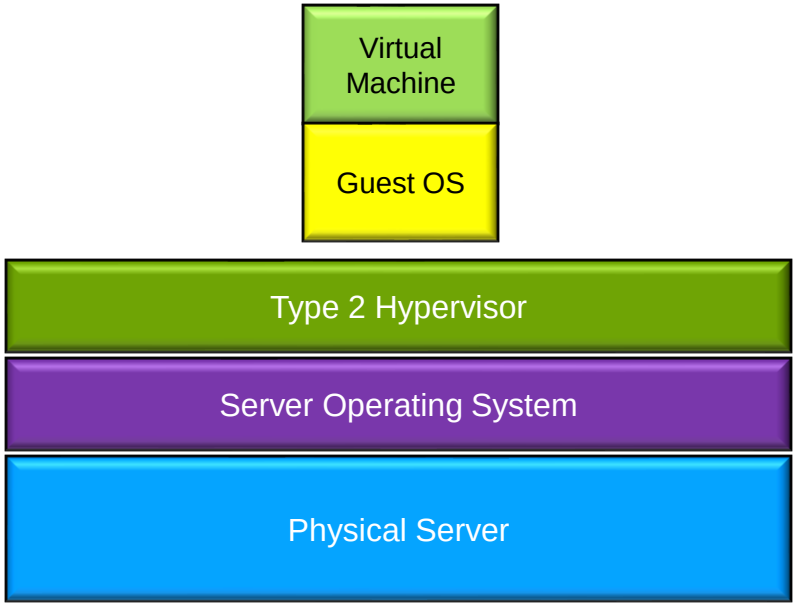
Guest Isolation

- A virtual machine can damage only itself.
- Other guests continue processing, and the hypervisor is unaffected.



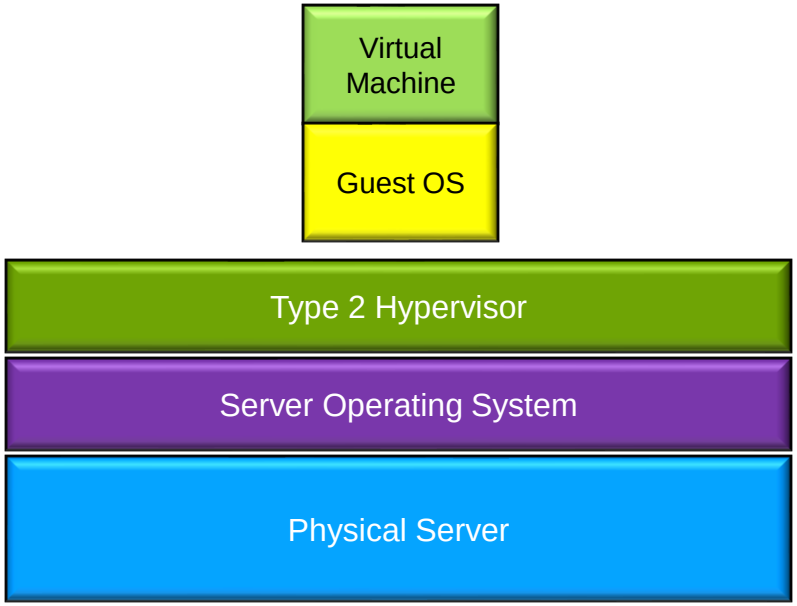
Type 2 Hypervisors

- A Type 2 hypervisor itself is an application that runs atop a traditional operating system.
- The first x86 offerings were Type 2.



Type 2 Hypervisor Characteristics

- They support a large range of hardware.
- They are easy to install and deploy.



Limitations of Type 2 Hypervisors

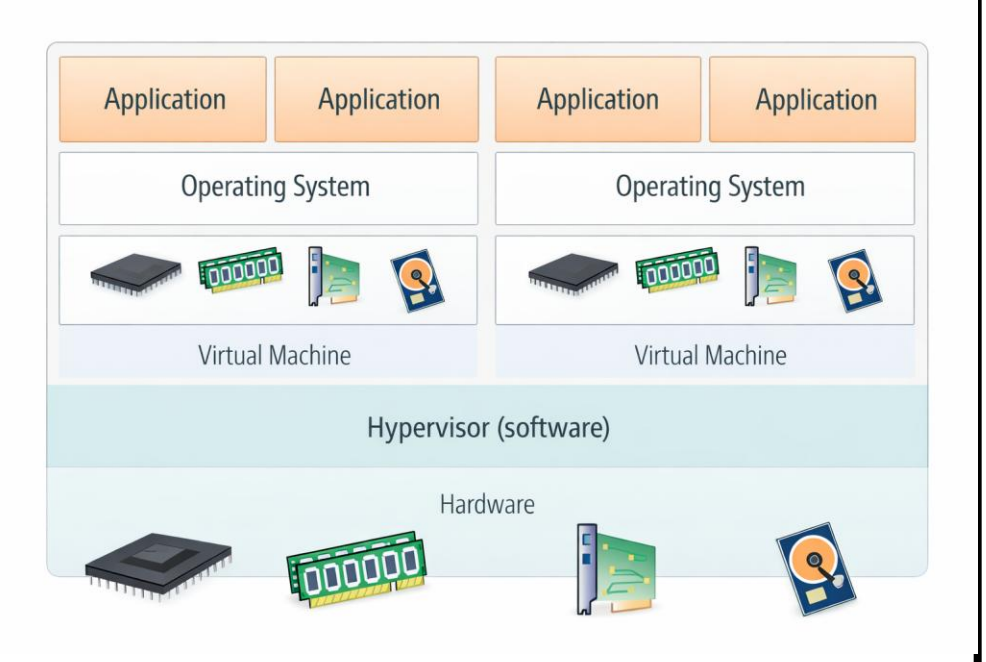
- Type 2 hypervisors are not as efficient.
- There are more points of failure.

Role of a Hypervisor

- Provide an environment identical to the physical environment.
- Provide that environment with minimal performance cost.
- Retain complete control of the system resources.

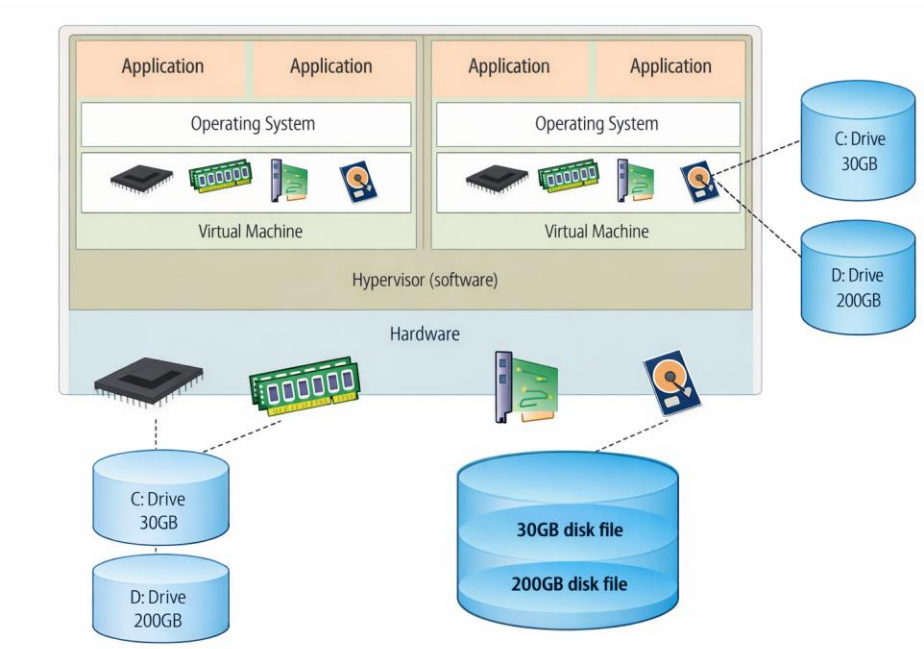
Hardware Abstraction

- The hypervisor fools the guest into believing that it can actually see and directly interact with the physical devices.
- Each guest is presented with only a fraction of the resources.



Resource Allocation

- The hypervisor traps calls and translates them into physical equivalents.
- It manages storage, network, memory, and CPU resources.



Modern Hypervisors

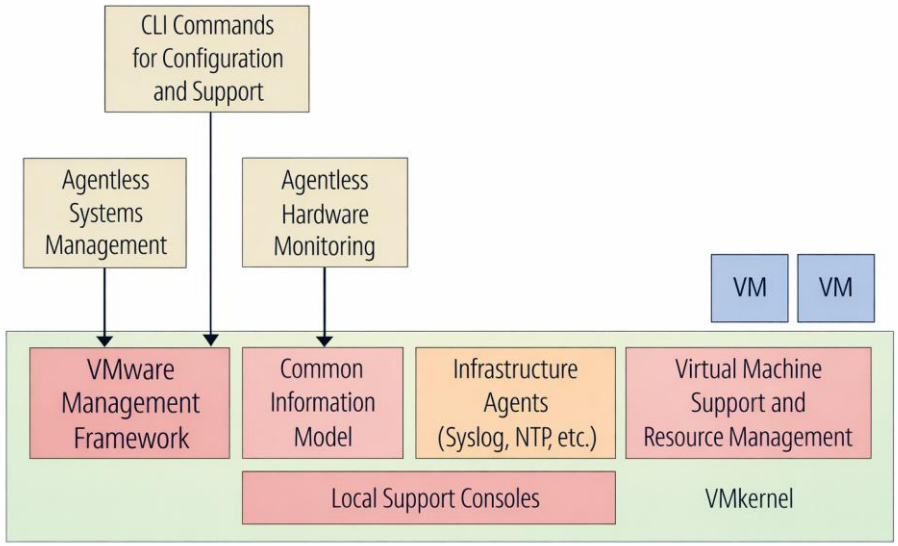
- There are many solutions available to choose from for a virtualization strategy.
- Different opportunities often have different solutions.

VMware ESX

- VMware was the first company to develop a commercially available x86 virtualization solution.
- VMware still holds close to 70 percent of the market.

VMware ESXi

- **VMotion**, introduced in 2003, allows the migration of a running VM from one physical host to another physical host without interrupting the OS or the applications running on that guest.

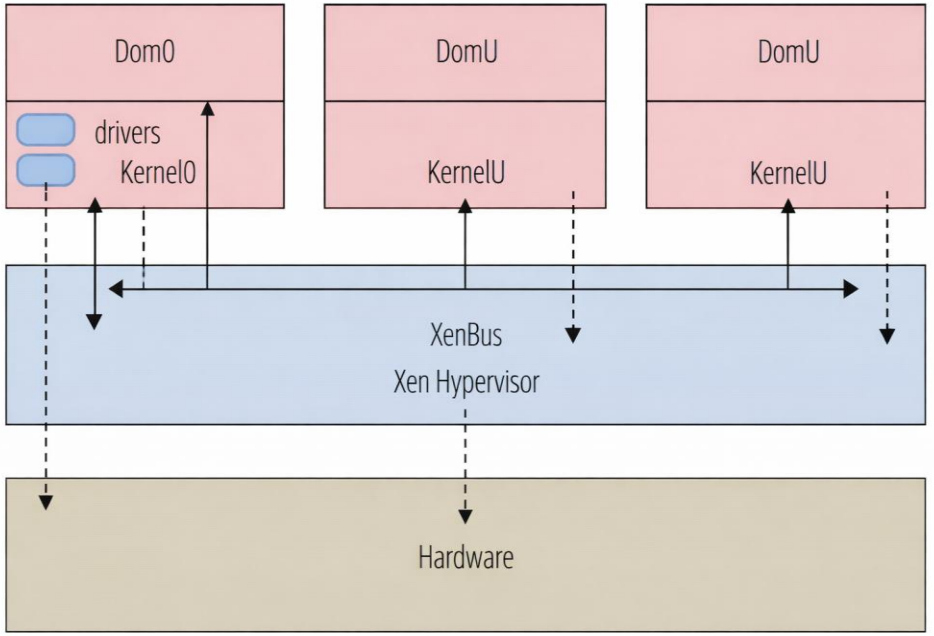


Xen Hypervisor

- The Xen hypervisor began as a research project at the University of Cambridge in 1990.
- It later became an open-source project.
- Oracle VM and AWS also used Xen.
- Implementation differs from Vmware.
- The Xen model has a special guest called Domain 0, also referred to as Dom0

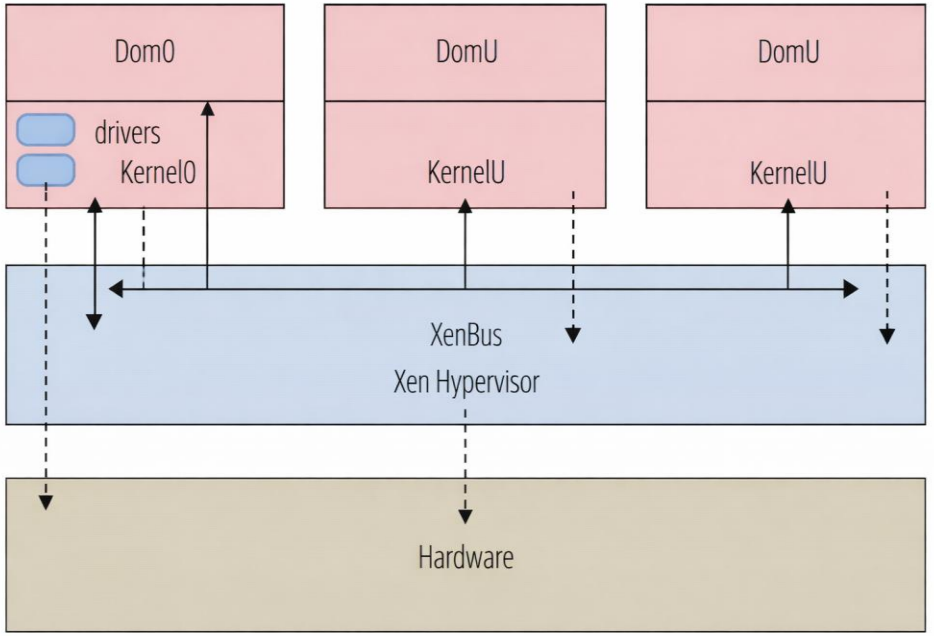
Xen Hypervisor

- When OS patching needs to occur, a reboot of Dom0 will interrupt all of the other guests, even if the patches were not related to the virtualization functions.



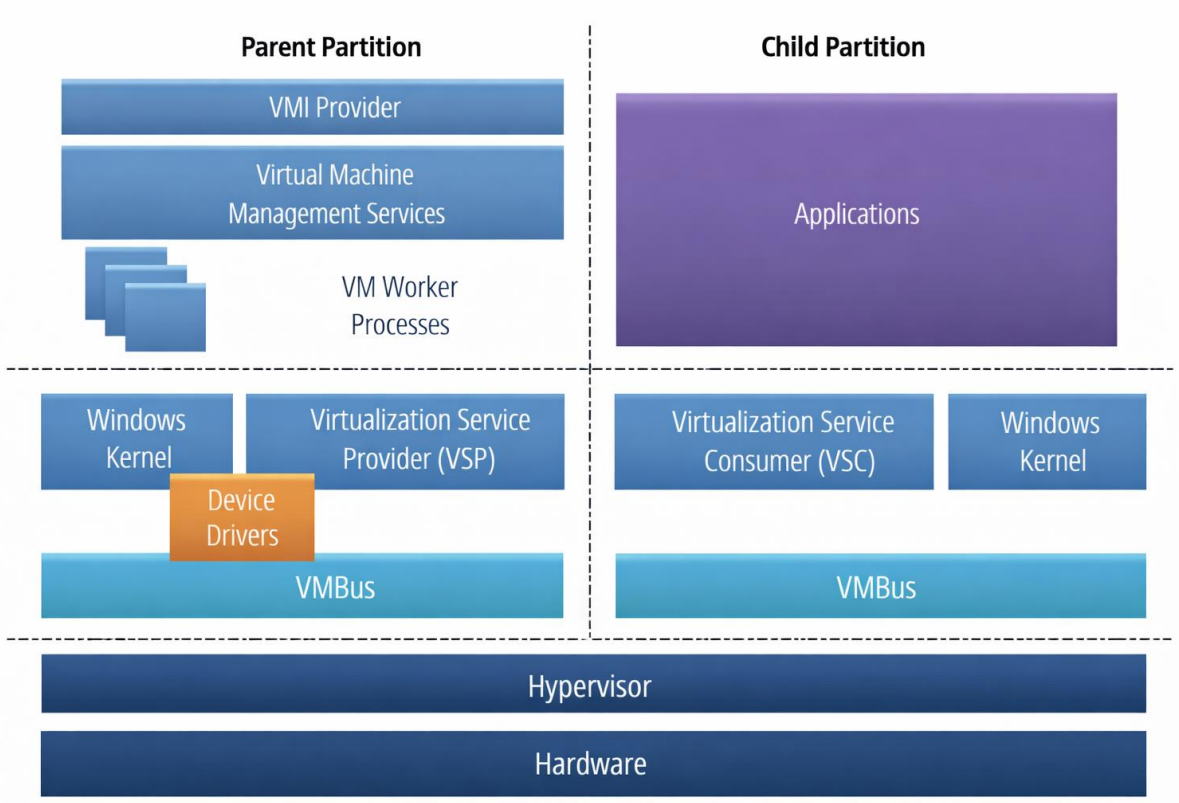
Xen Hypervisor

- Because Dom0 is also a guest, it consumes resources and contends for resources with the other guests in the system that could lead to performance issues if Dom0 is either short of resources or using guest resources.



Microsoft Hyper-V

- Hyper-V was released in 2008 as part of the Windows Server operating system.
- It is a Type 1 hypervisor.



Other Hypervisors

- Oracle VM, Red Hat KVM, AWS Nitro, and Nutanix AHV are examples.
- Most are based on open-source technologies.

Essentials and Beyond

- Hypervisors are the glue of virtualization.
- They are the foundation for cloud computing.