Hypervisor & Virtual Resources

Role of Hypervisor

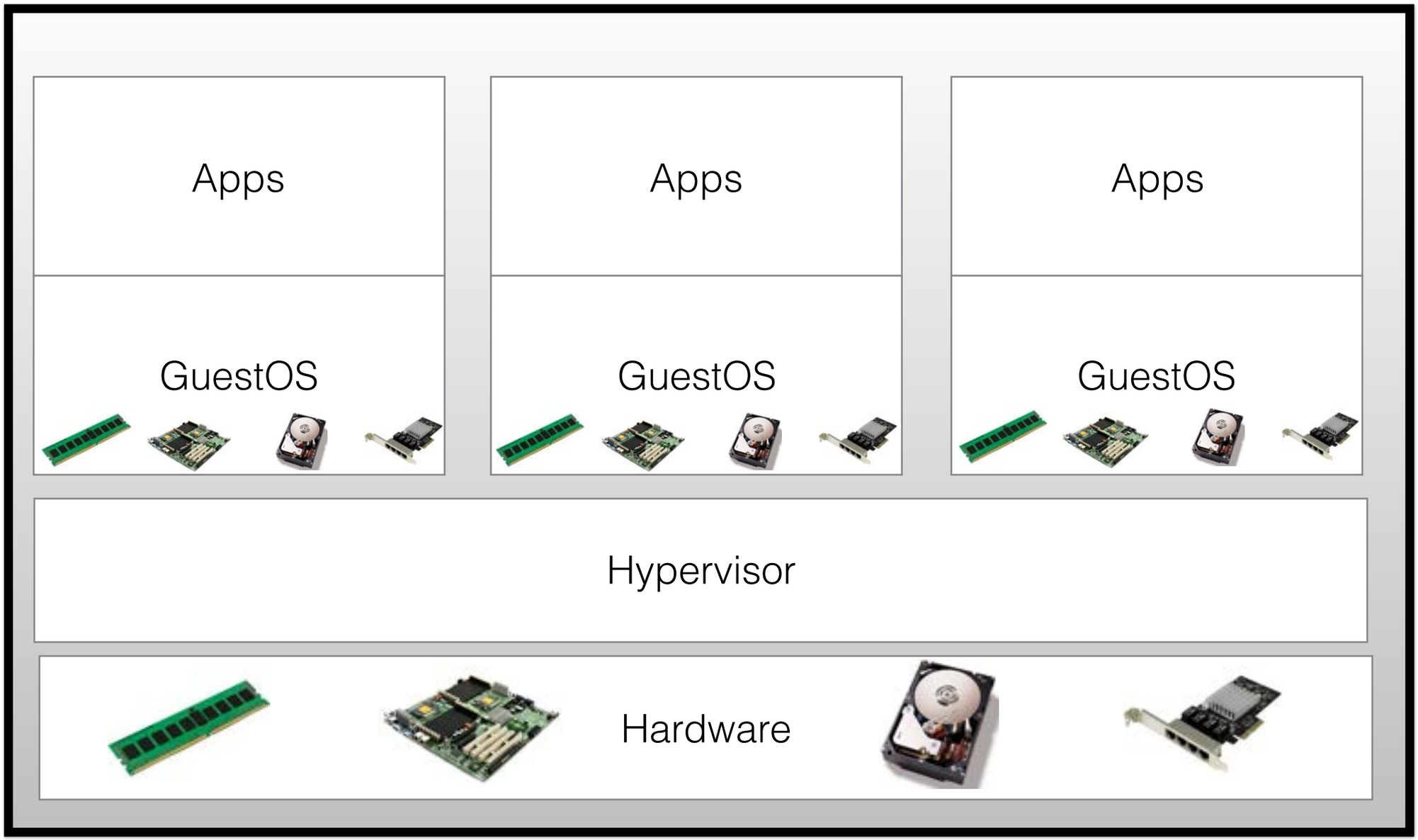
- Arbitrator of resources
- Sits between the physical and virtual resources
- Allocates resources
- Provides virtual environment for workloads

- Without hypervisor OS communicates directly with hardware resources
- Without hypervisor multiple OS would like to access hardware resources simultaneously.

Traffic Cop

- Gives illusion to the Guest OS that it has direct access to hardware resources
  - Use disk drives, Memory, Network, etc.
- Balance the workload
  - Each guest makes constant demands
  - Hypervisor provides timely response to each request
    - Ensuring adequate resources for all virtual machines

Hardware Abstraction

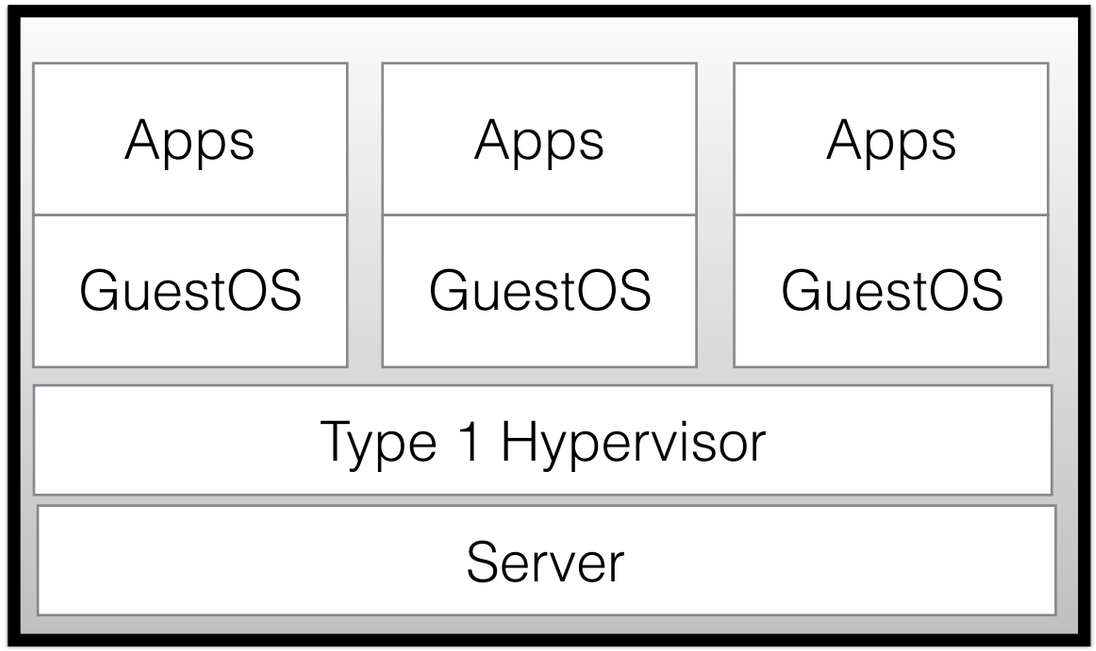


Types

- Two classes of hypervisors:
  - Type 1
  - Type 2

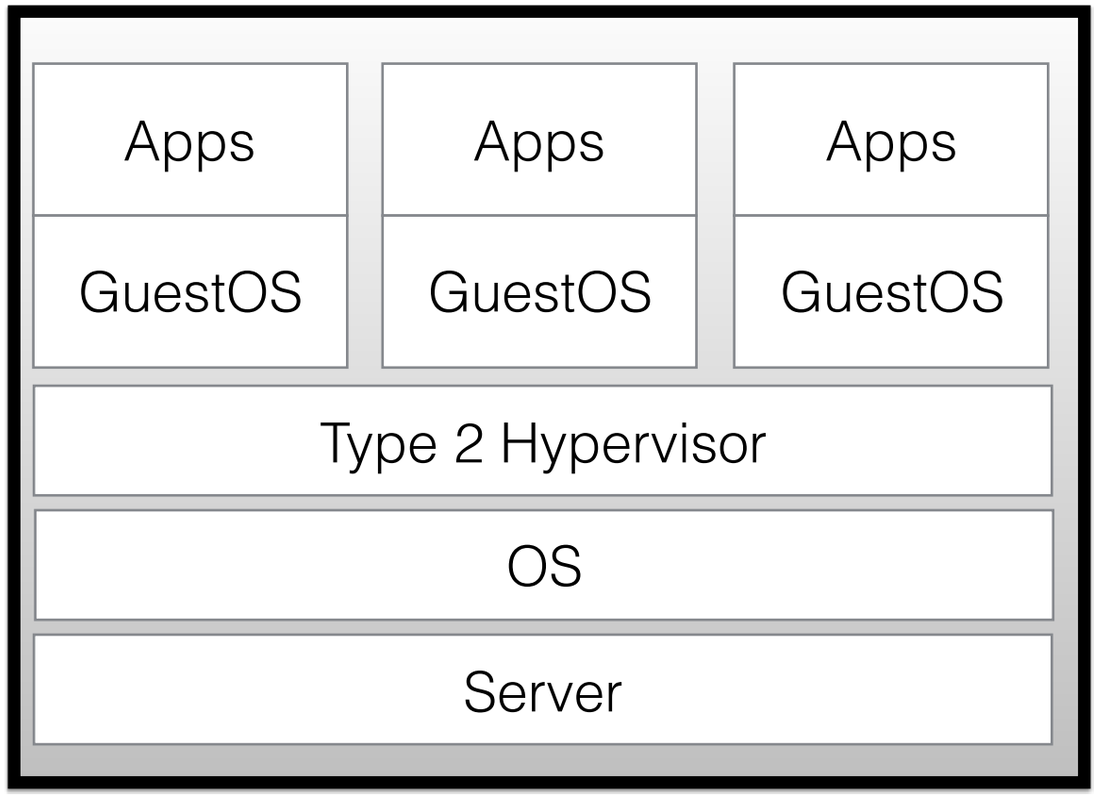
Type 1

- Runs directly on the hardware
- More secure and more available
- Offers better performance to the guests
- Generates less overhead
  - No intermediate layer of OS
  - More Virtual machines can run on the box



Type 2

- Runs like an application on OS
- Can support large range of hardware — OS dependent
- Not as efficient as Type 1
    - Extra layer between itself and the hardware
    - Every operation from guest OS travels from Hypervisor to OS to Hardware
- Less reliable — Underlying OS can impact the hypervisor and VMs
- Good for desktop development environment
    - Single developer working on multiple VMs.



VMWare ESX (Type 1)

- First commercially available hypervisor (1998) for the x86 platform
- Currently market leader in user share and maturity of offerings
- Architecture not tied to an operating system
- Initial deployment included:
  - Hypervisor
  - Service Console
    - Linux-based console sits alongside the Hypervisor
    - Acted as management interface to Hypervisor
- Subsequently removed Service console — Security & Size
  - ESXi

Xen (Type 1)

- Began as a Cambridge University research project
- First released in 2002 as an open source project
- Currently exists as an open source project
- The core has been used by a number of vendors including Citrix and Oracle
- Implementation different from VMWare architecture
- Special guest — Domain 0 (Dom0)
  - Guest is booted when hypervisor is booted
  - Has special admin privileges

Microsoft Hyper-V (Type 1)

- First release in 2008, but virtualization was available through Virtual Server in 2005
- Different nomenclature
  - Virtualized workloads are called partitions
- Similar architecture to Xen
  - Device drivers part of the parent partition (similar to Dom0)
  - Like Dom0 parent partition runs an OS
- Parent partition is based on Microsoft Windows
  - Creates and manage child partitions and handle management functions

Other Solutions

- Red Hat KVM
- Initially XEN, now kernel based (KVM)
- Oracle VM is XEN based
- Many other commercial and free solutions available but the space is still evolving

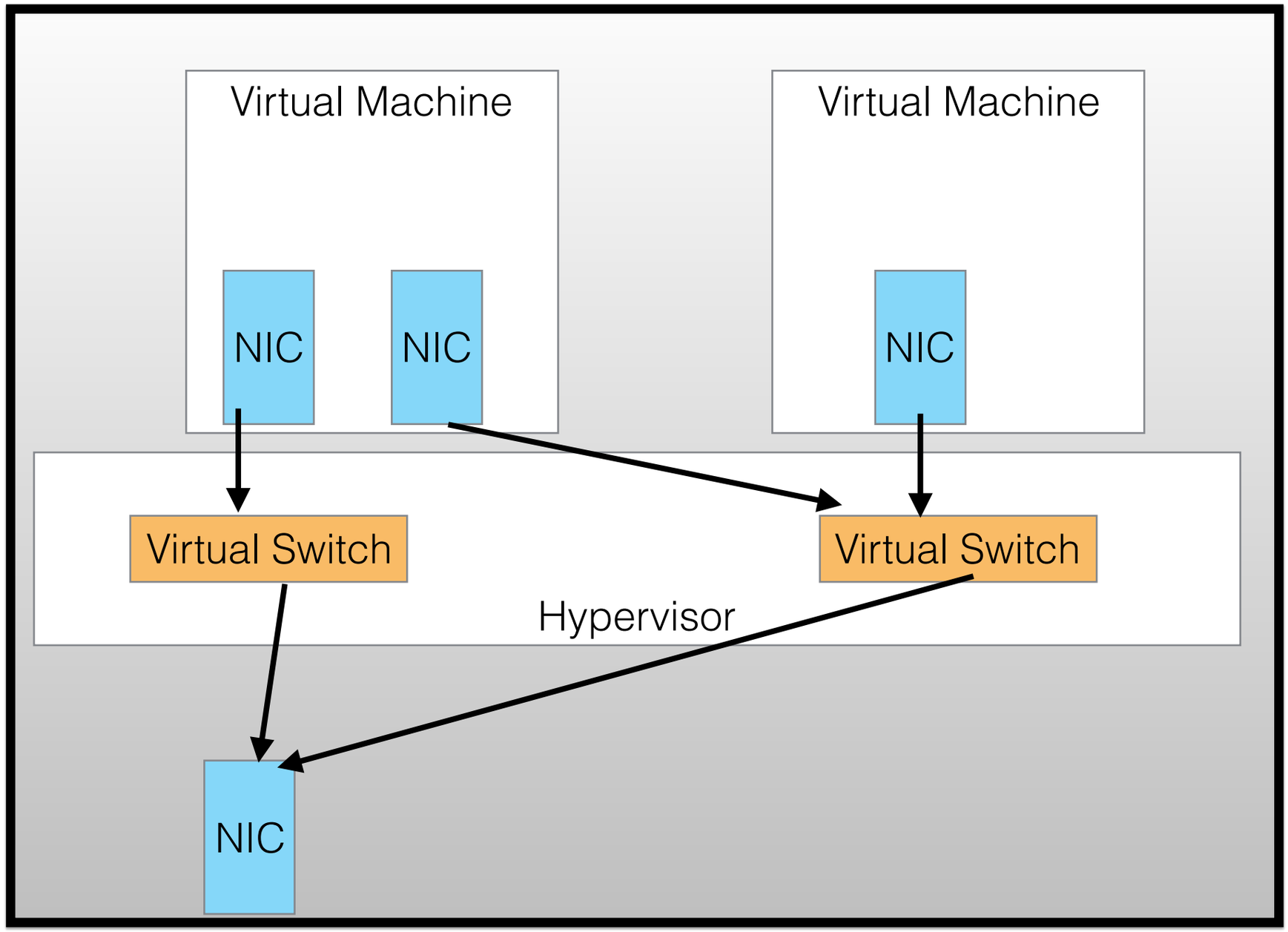
Virtual Machines (VM)

- Has many characteristics of a physical server
  - Supports OS
  - Configured with a set of resources
- VM is nothing more than a set of files
  - Configuration File
    - describes resources that the VM can utilize.
  - Virtual disk files

Virtual Resources

- Virtual CPUs (vCPUs) are scheduled slices on Physical CPUs (pCPUs)
- A processor core is equivalent to a vCPU
- A VM's memory is mapped to physical memory but managed by the hypervisor
- A VM can only see and utilize the amount of memory it has been allocated.
- Like vCPUs, you can only adjust the amount of allocated memory
- There are many memory optimization features available.
- The resource most systems run out of first

Virtual Networking



Virtual Storage

- VM talks to virtual SCSI driver
- Hypervisor passes data blocks to/from physical storage
- VM don’t have to worry about how they are connected to the storage device
  - Fibre channel, iSCSI, NFS, etc.