Cloud Computing NETW1009

Lecture 4

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Lecture 4: Cloud Data Centers III

Recall what we discussed last lectures..

- Cloud Data Centers
- Compute Systems
- Storage Systems
- Network Systems
- Virtualization
- Compute Systems Virtualization

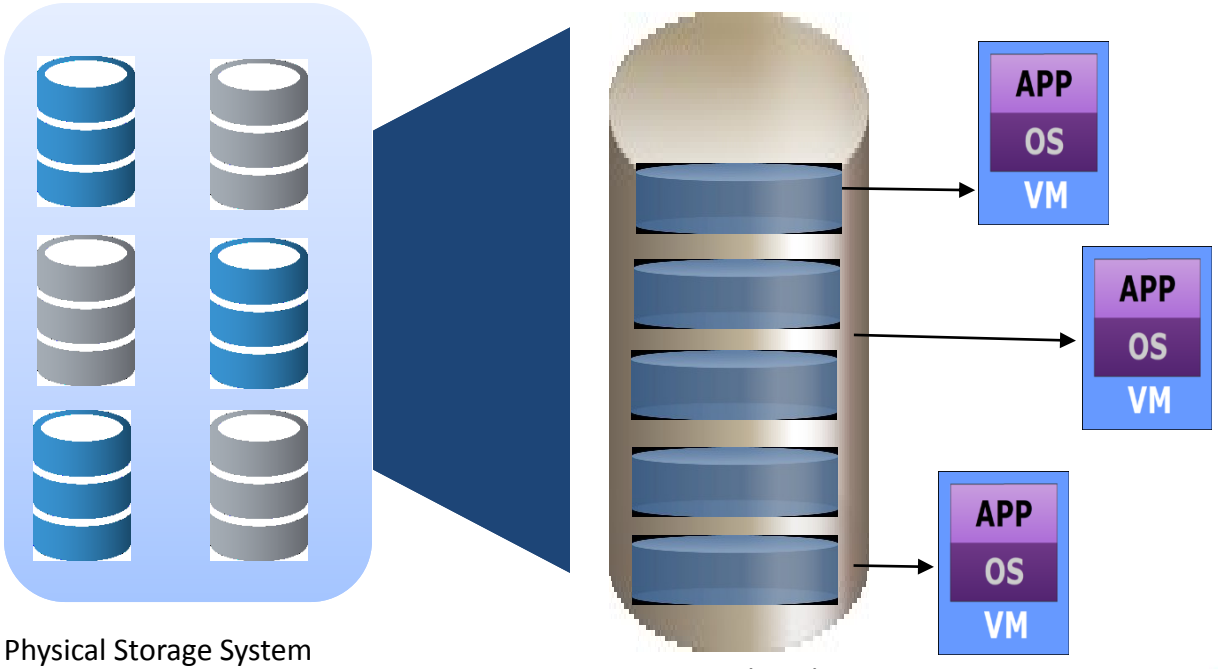
Lecture Outline

- Storage Virtualization
- LUNs & Storage Provisioning
- Network Virtualization
- Resource Pooling
- Software Defined Infrastructure
- Infrastructure Deployment Methods
- Best of Breed/ Converged/ Hyper-converged Infrastructures

Storage Virtualization

Storage Virtualization

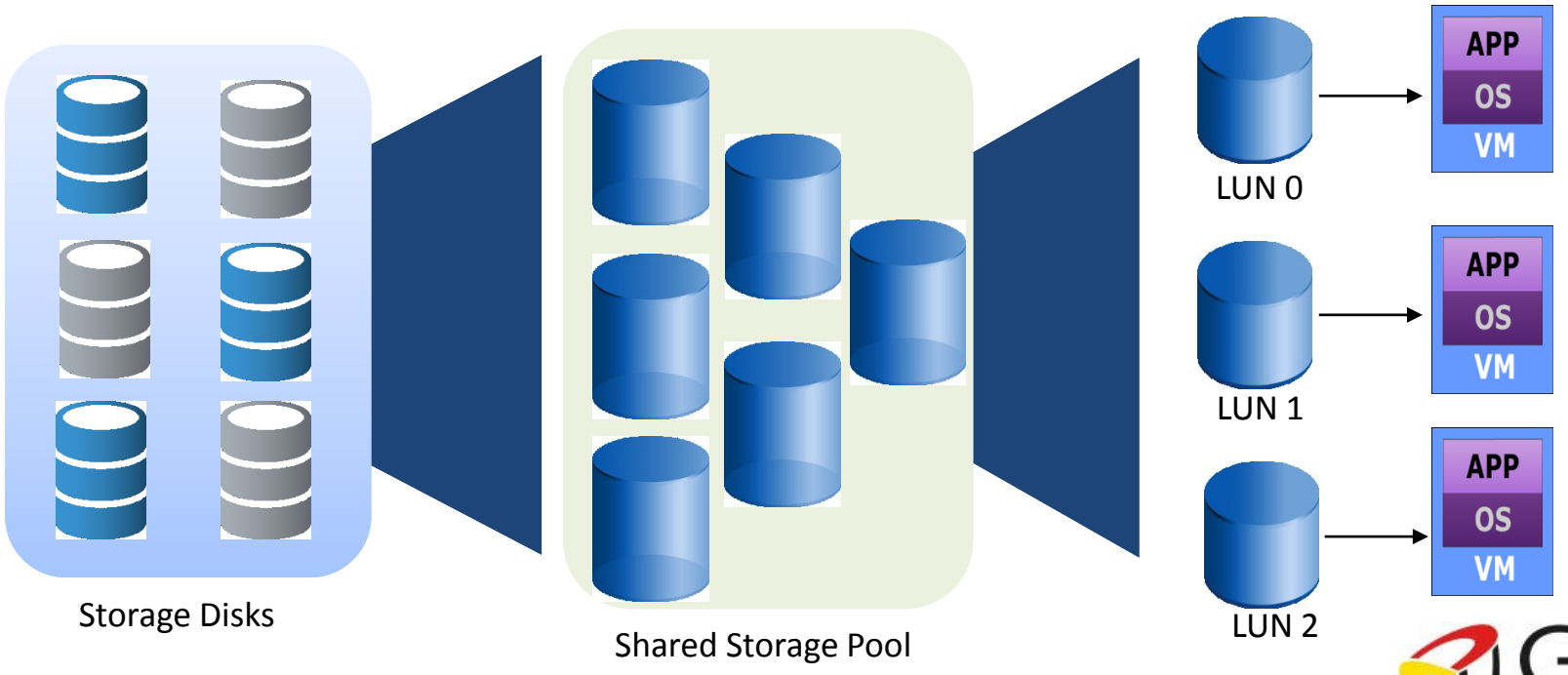
The technique of abstracting physical storage resources to create virtual storage resources.



Logical Unit Number (LUN)

Logical unit number (LUN)

Abstracts the identity and internal functions of storage systems and appear as physical storage to the compute system.

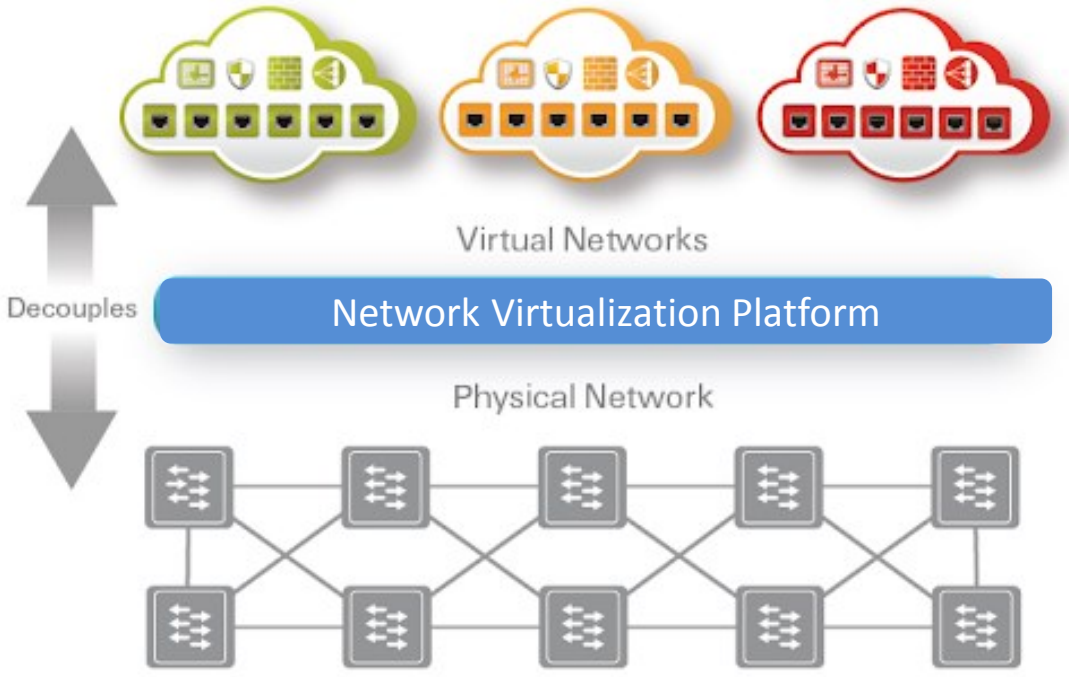


LUN Provisioning - Thin Provisioning

Network Virtualization

Network Virtualization

The technique of abstracting physical network resources to create virtual network resources.



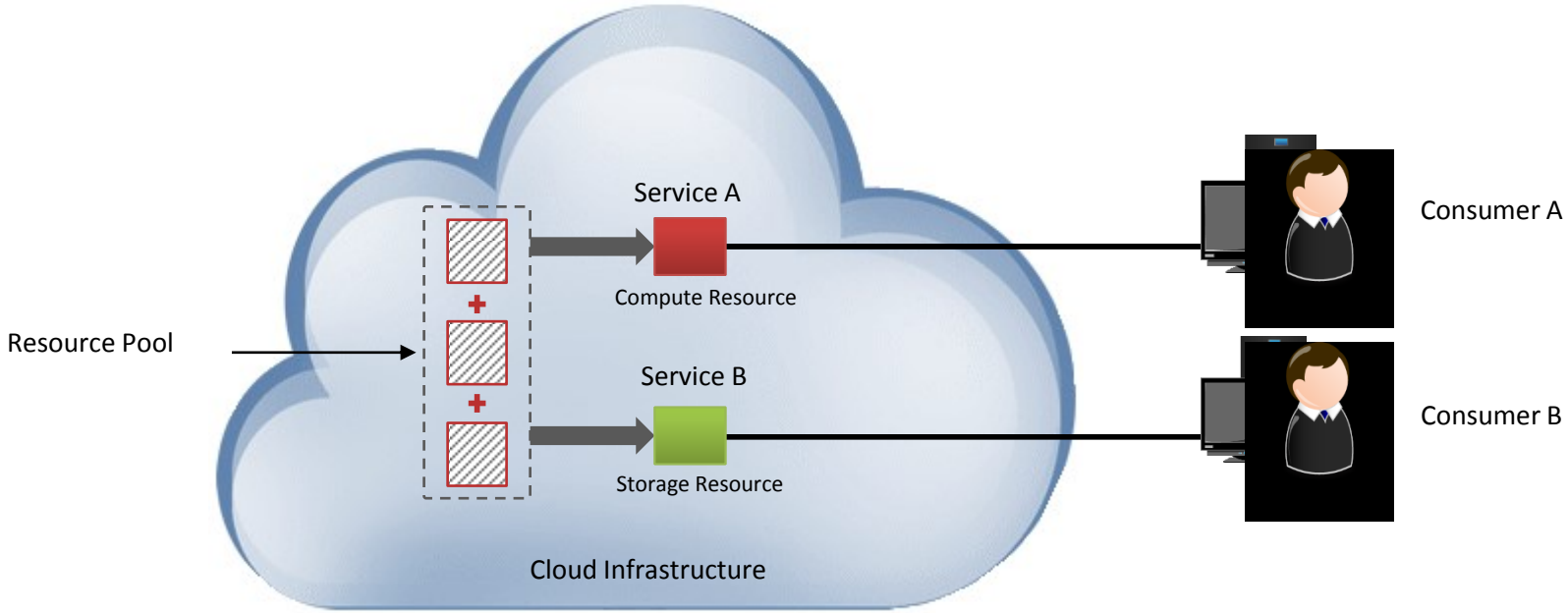
Virtual Network Types

Virtual LAN (VLAN)	• Consists of virtual and/or physical switches, which divide a LAN into smaller logical segments
Private VLAN (PVLAN)	• Extension of VLAN standard • Segregates nodes within a VLAN into secondary VLANs
Virtual Extensible LAN (VXLAN)	• OSI Layer 2 overlay network built on an OSI Layer 3 network • Overlay network is a virtual network that is built on top of existing network
Stretched VLAN	• Extends a VLAN across sites • Enables nodes in two different sites to communicate over a WAN
Virtual SAN (VSAN)	• Enables communication between a group of nodes with a common set of requirements

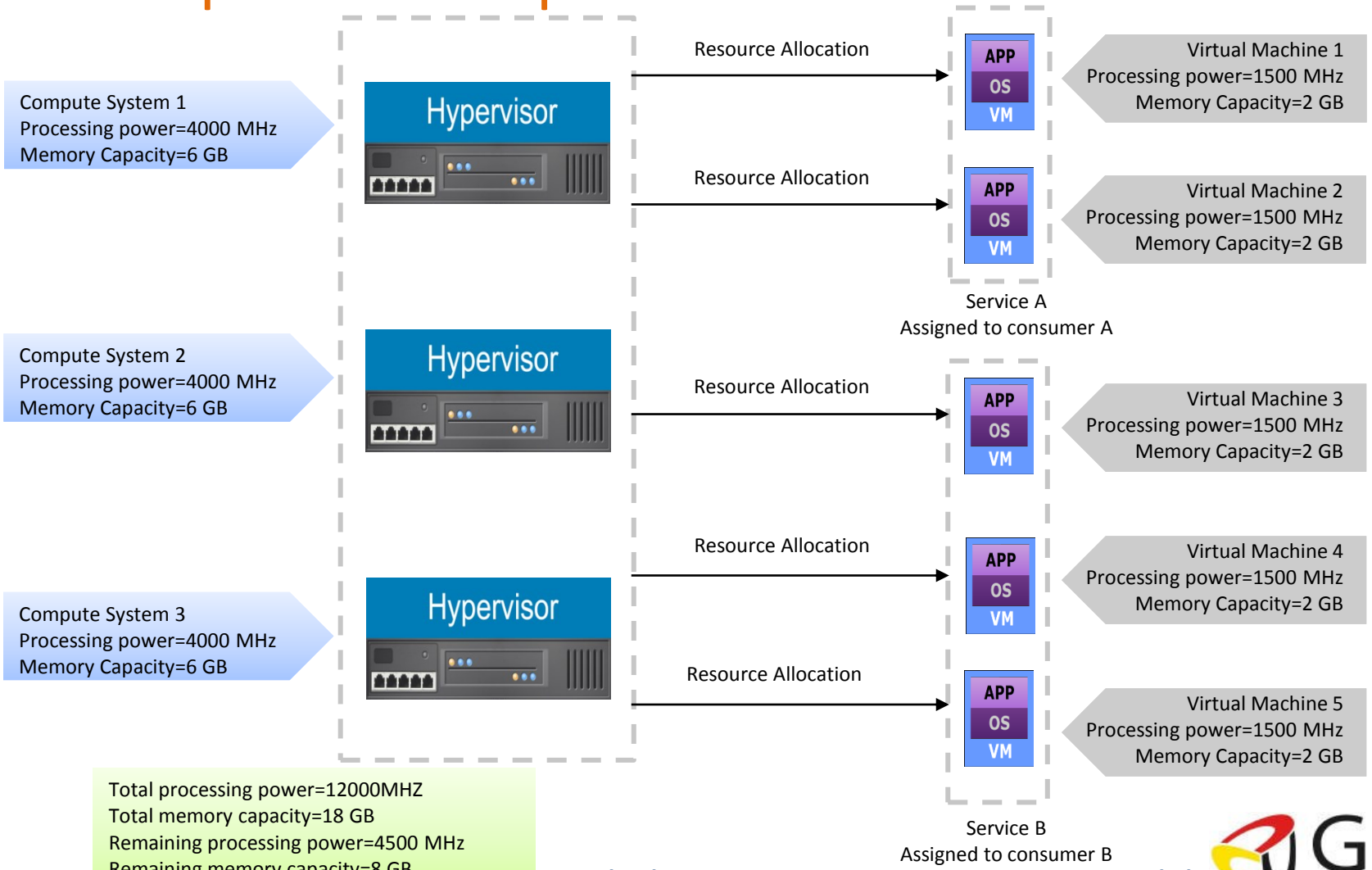
Resource Pooling

Resource Pooling

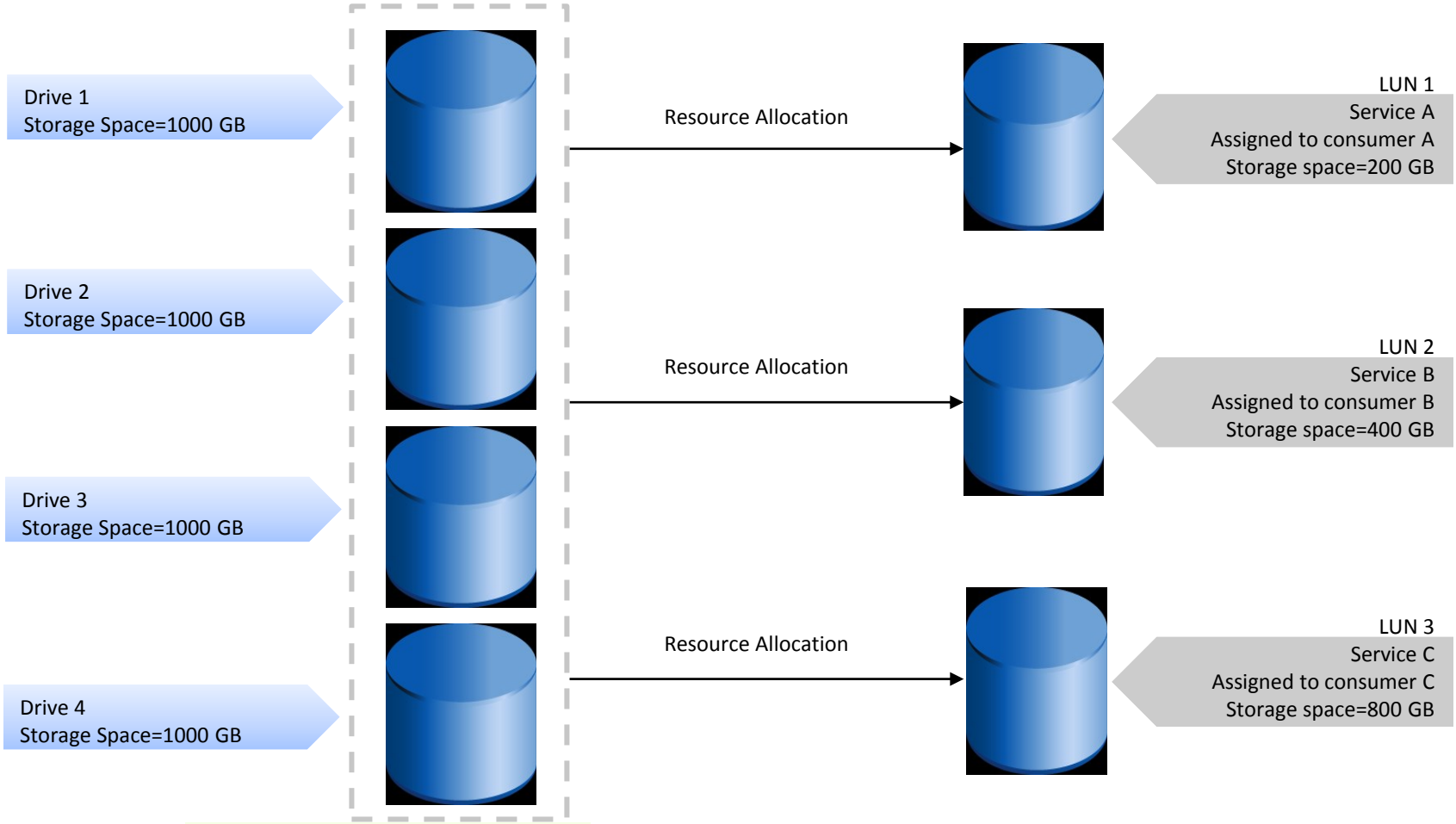
The provider's resources are pooled to serve multiple consumers using a multitenant model.



Resource Pooling: Compute - Example

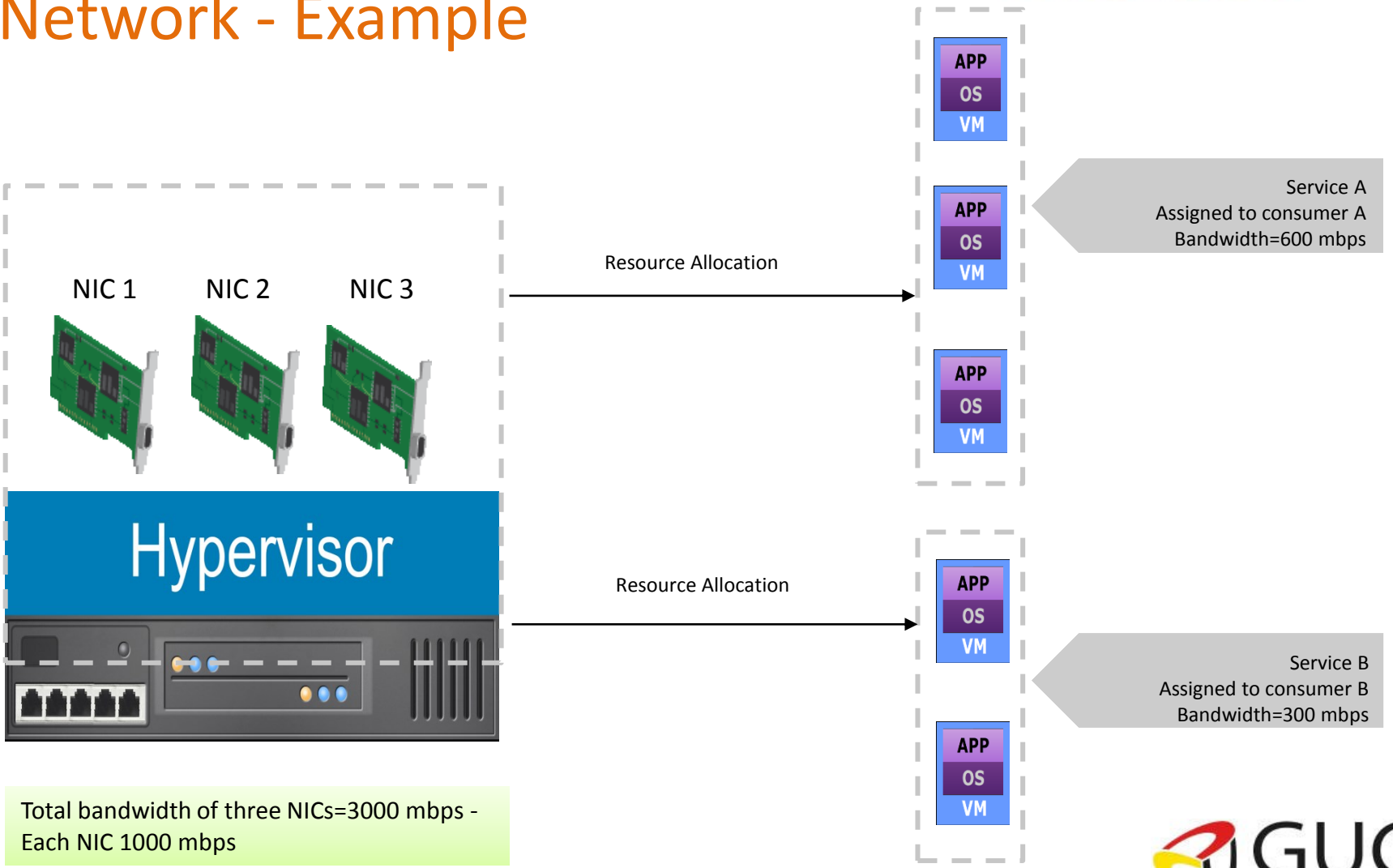


Resource Pooling: Storage - Example



Total storage space=4000 GB
Allocated storage space=1400 GB
Remaining storage space=2600 GB

Resource Pooling: Network - Example



Total bandwidth of three NICs=3000 mbps - Each NIC 1000 mbps

Resource Pooling : Challenges

Big Data

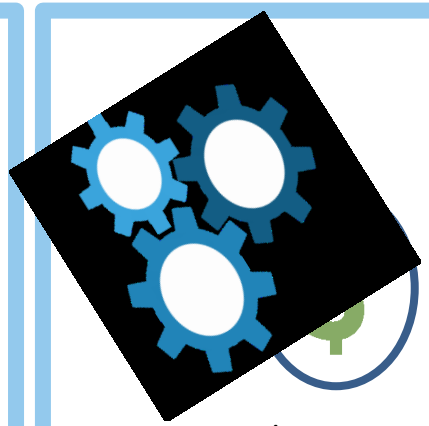
Cloud

Social

Mobile

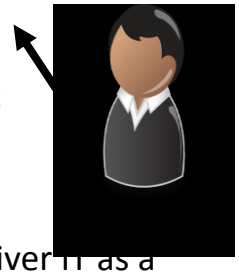
Third Platform Application

IT Infrastructure



IT Budget

Service Catalog



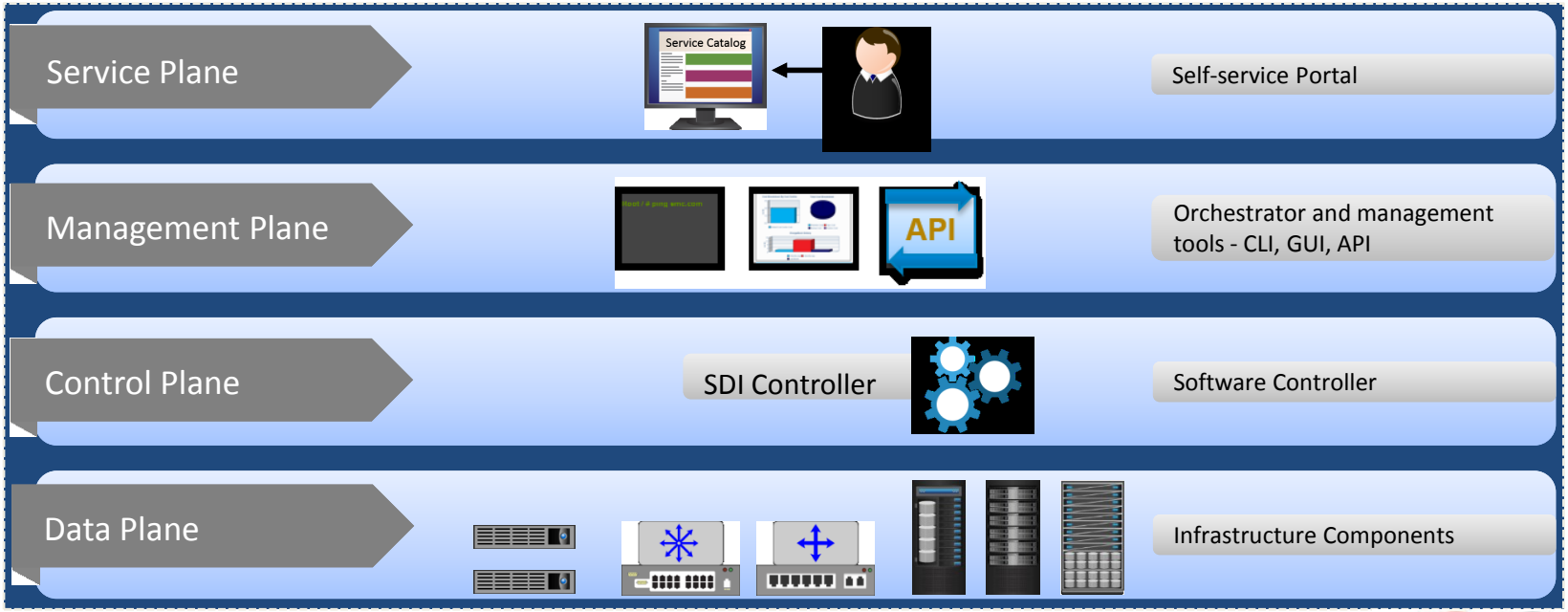
Deliver IT as a Service

Solution:
Software-defined Infrastructure

Software-defined Infrastructure

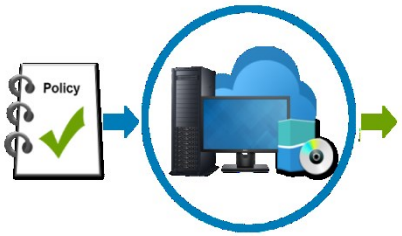
Software-defined infrastructure (SDI)

All IT infrastructure resources are virtualized, abstracted, and delivered as a service. Automated software controls the entire infrastructure.



Software-defined Infrastructure Attributes

Abstraction and Pooling

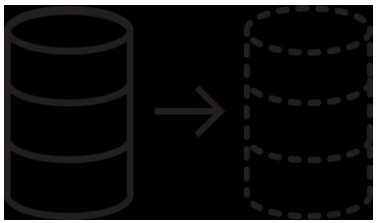


Au Provisioning

Unified Management

Self-Servic

Metering



Open and Extensible

Software-defined Compute

Software-defined Compute (SDC)

SDC is an approach to provision compute resources using compute virtualization technology enabled by the hypervisor.

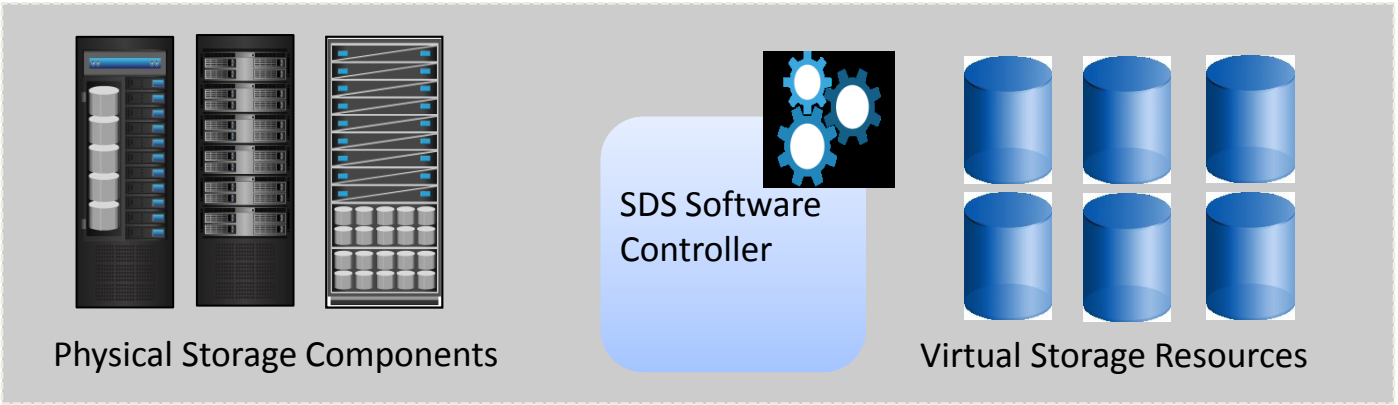
Physical Compute Components

- Hypervisor decouples the application and the OS from the hardware and encapsulates them in an isolated virtual container called a virtual machine (VM).
- Hypervisor controls the allocation of hardware resources to the VMs based on policies, which means the hardware configuration of a VM is maintained using the software.

Software-defined Storage

Software-defined Storage (SDS)

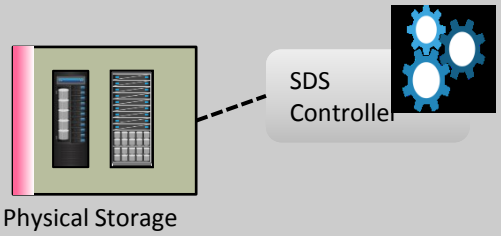
SDS is an approach to provision storage resources in which a software (SDS controller) controls storage-related operations independent of the underlying physical storage infrastructure.



- SDS controller abstracts the physical details of storage and delivers virtual storage resources.
- SDS controller controls the allocation of storage capacity based on policies.

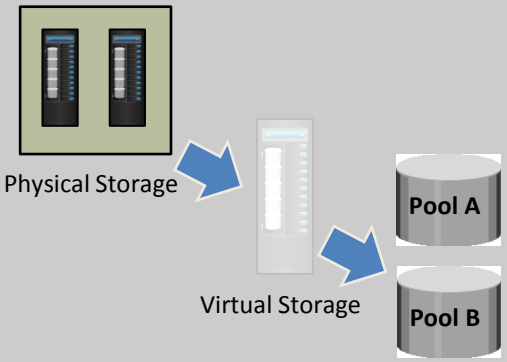
Software-defined Storage Controller Functions

Storage Discovery



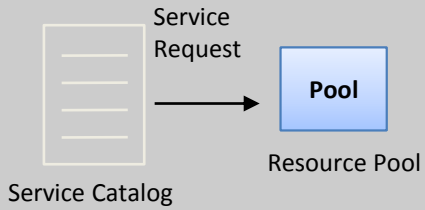
SDS controller discovers physical storage systems to gather data and bring them under its control and management.

Resource Abstraction and Pooling



SDS controller abstracts physical storage systems into virtual storage systems and virtual storage pools as per policies.

Service Provisioning

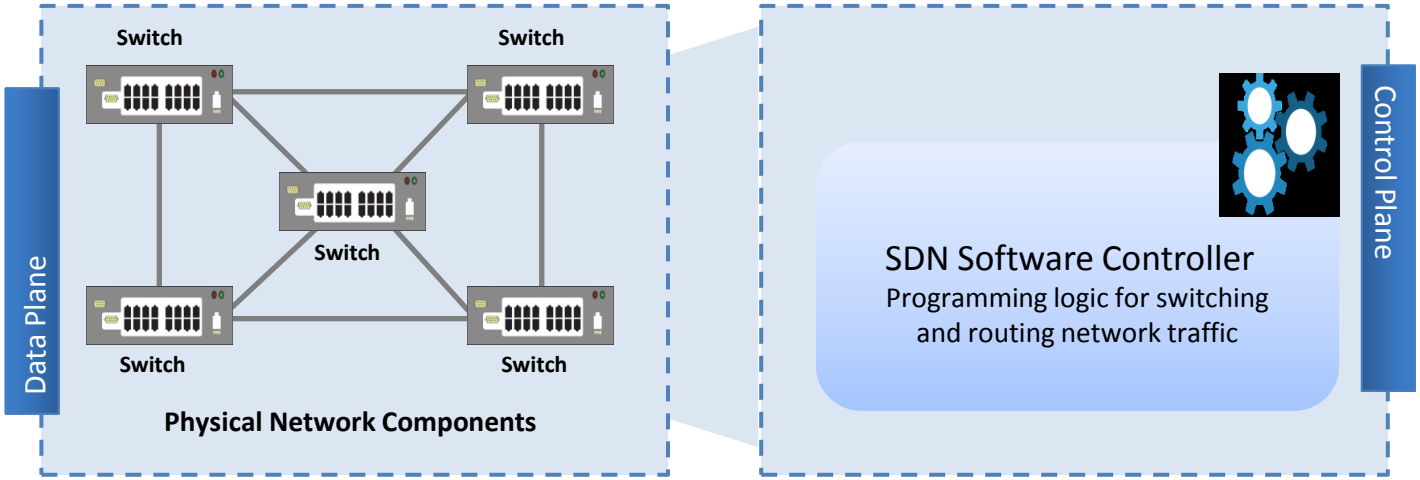


SDS controller automates the storage provisioning tasks and delivers virtual storage resources based on the service request issued through a service catalog.

Software-defined Network

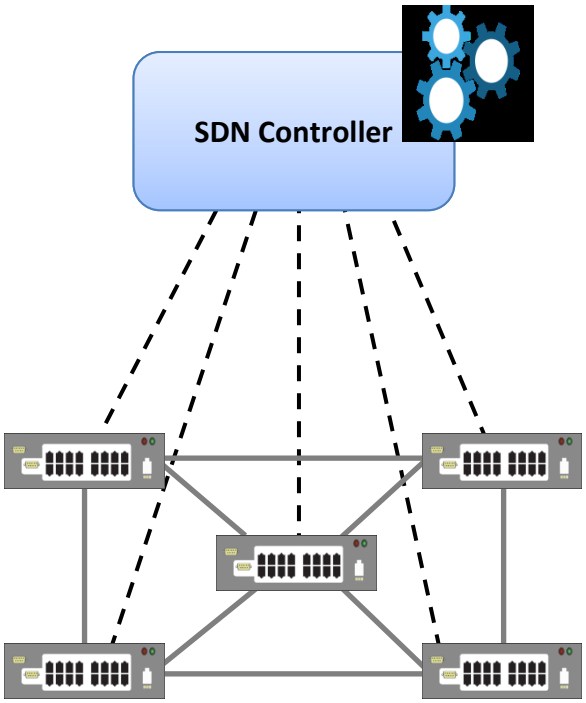
Software-defined Network (SDN)

It is a networking approach that enables an SDN controller to control the switching and routing of the network traffic independent of the underlying network.



- SDN controller abstracts the physical details of the network components and separates the control plane functions from the data plane functions.
- SDN controller provides instructions for data plane to handle network traffic based on policies.

Software-defined Network Controller Functions



Physical Network Components

Network Discovery

SDN controller interacts with network components to discover information on their configuration, topology, capacity, utilization, and performance.

Network Component Management

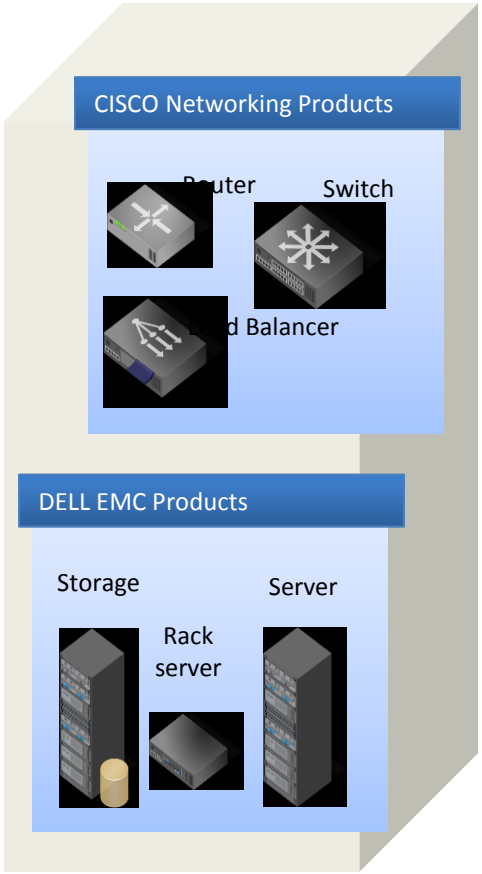
SDN controller configures network components to maintain interconnections among the components and isolate network traffic through virtual networks.

Network Flow Management

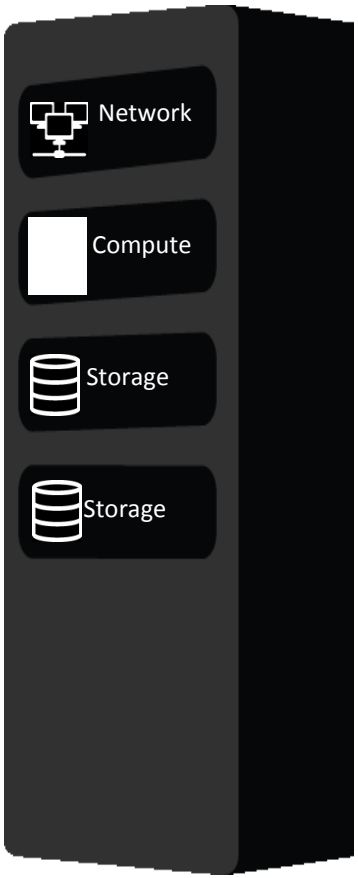
SDN controller controls the network traffic flow between the components and chooses the optimal path for network traffic.

Infrastructure Deployment Models

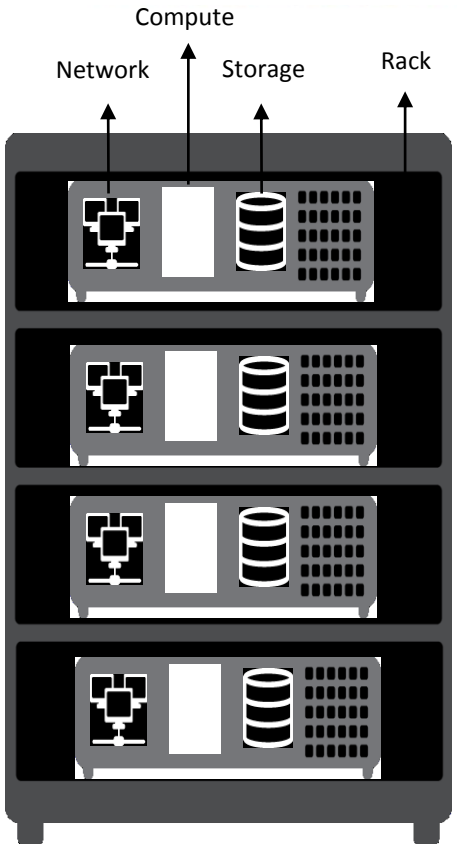
Deployment Options



Best-of-Breed Infrastructure



Converged Infrastructure

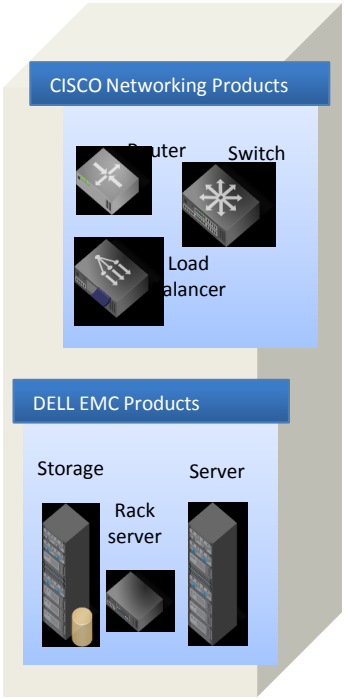


Hyper-Converged Infrastructure

Best-of-Breed Infrastructure

Best-of-Breed Infrastructure

Integrates different hardware and software components from different vendors to built a cloud infrastructure.

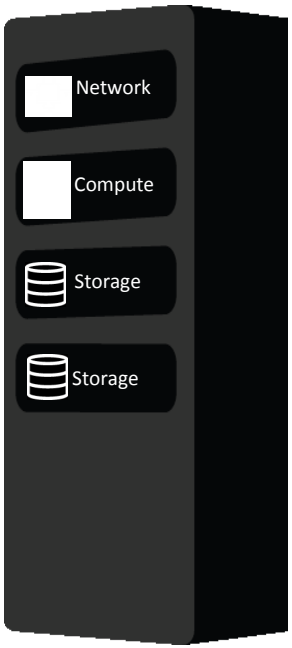


- Brownfield deployment option
- Enables repurposing the existing infrastructure components
- Enables organizations to choose and switch vendors easily
- Requires organization to spend significant amount of IT staff time

Converged Infrastructure

Converged Infrastructure

All the infrastructure elements such as compute, storage, network, virtualization, and management are bundled together.



Converged Infrastructure

30%
Increase in IT operational efficiency

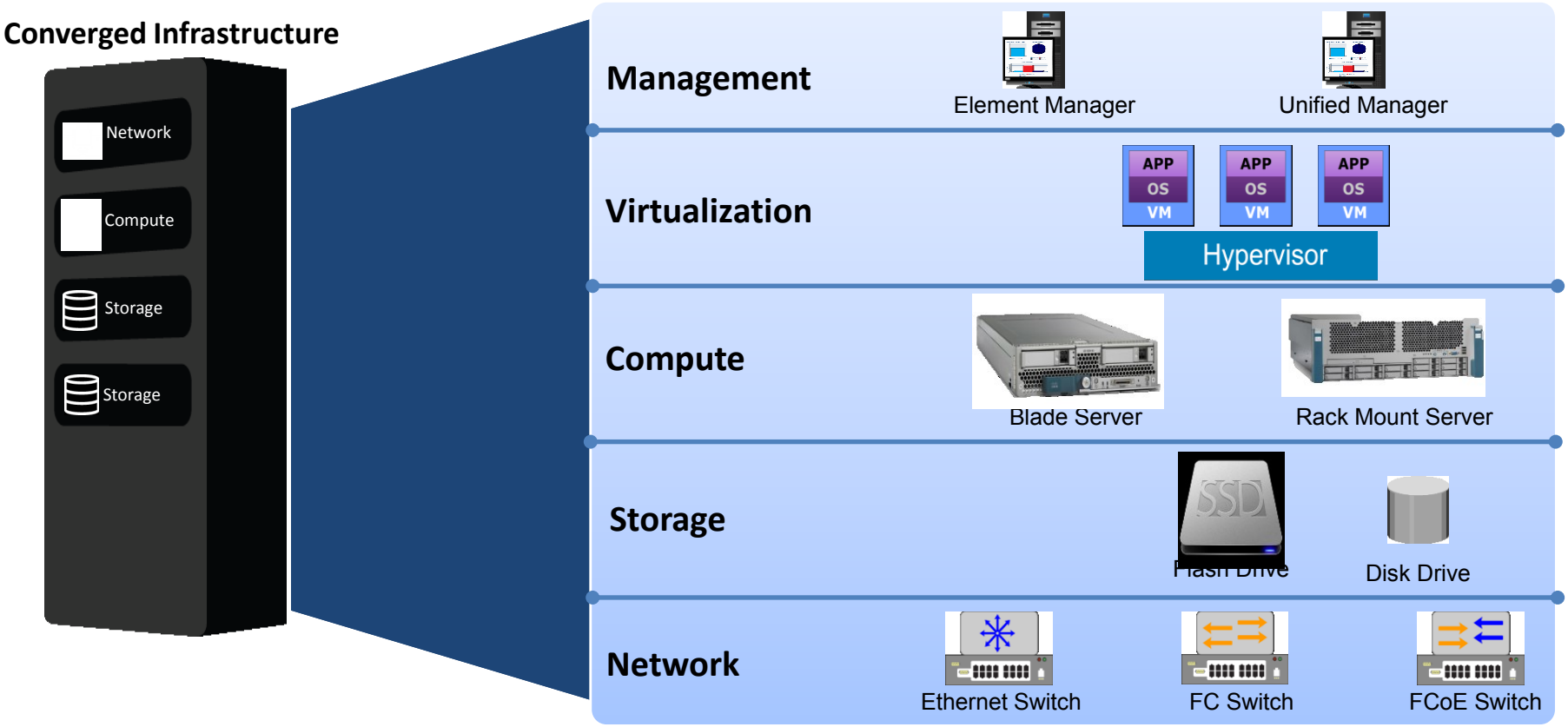
25%
Increase in application developer productivity

Set up new systems
4.6x
Faster

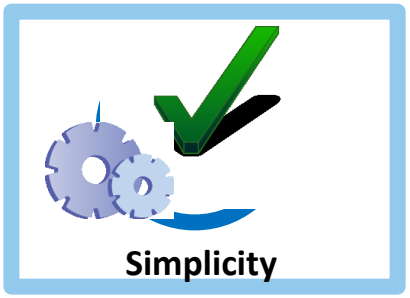
20 minutes
To deploy a full virtualized environment

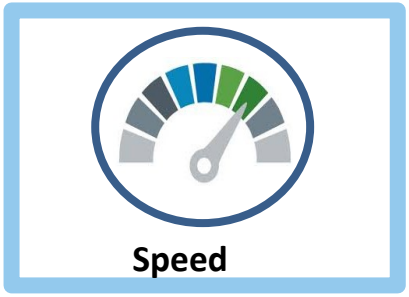
30%
Lowers TCO

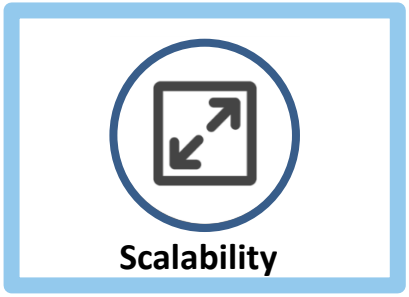
Architecture of Converged Infrastructure



Converged Infrastructure Benefits







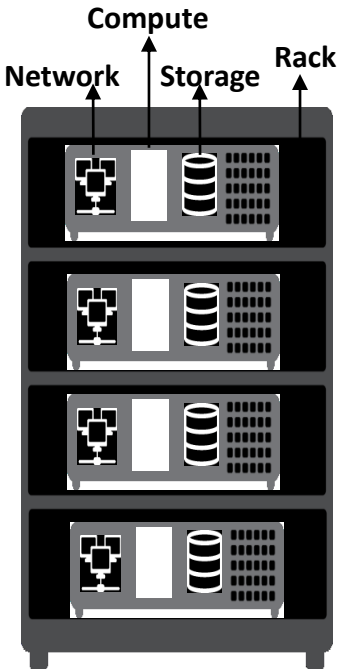
Best-of-breed Infrastructure vs. Converged Infrastructure

Best-of-Breed Infrastructure	Converged Infrastructure
Provides flexibility to choose components from leading vendors	Provides limited flexibility although some vendors give options to choose vendors
Prevents vendor lock-in	Imposes vendor lock-in
Incurs significant cost and time to deploy an infrastructure	Reduces the time to deploy an infrastructure and improves time-to-market
Takes long time to scale	Enables rapid scalability
Provides siloed, decentralized management with multiple tools	Provides a single management software and end-to-end management
Has higher power and space requirement	Has lower power and space requirement

Hyper-Converged Infrastructure

Hyper-converged Infrastructure

All the components that are present in converged infrastructure are integrated in a scalable rack or appliance.



Hyper-Converged Infrastructure

Set up new systems
4.6x faster

Scale in 5 minutes
Lowers TCO by
30%

Deploy a fully virtualized environment in
20 minutes

Hyper-Converged Infrastructure – Case Studies

Why is Hyper-converged Infrastructure blasting off?

Over 60% of companies have deployed or deploys HCI within two years.

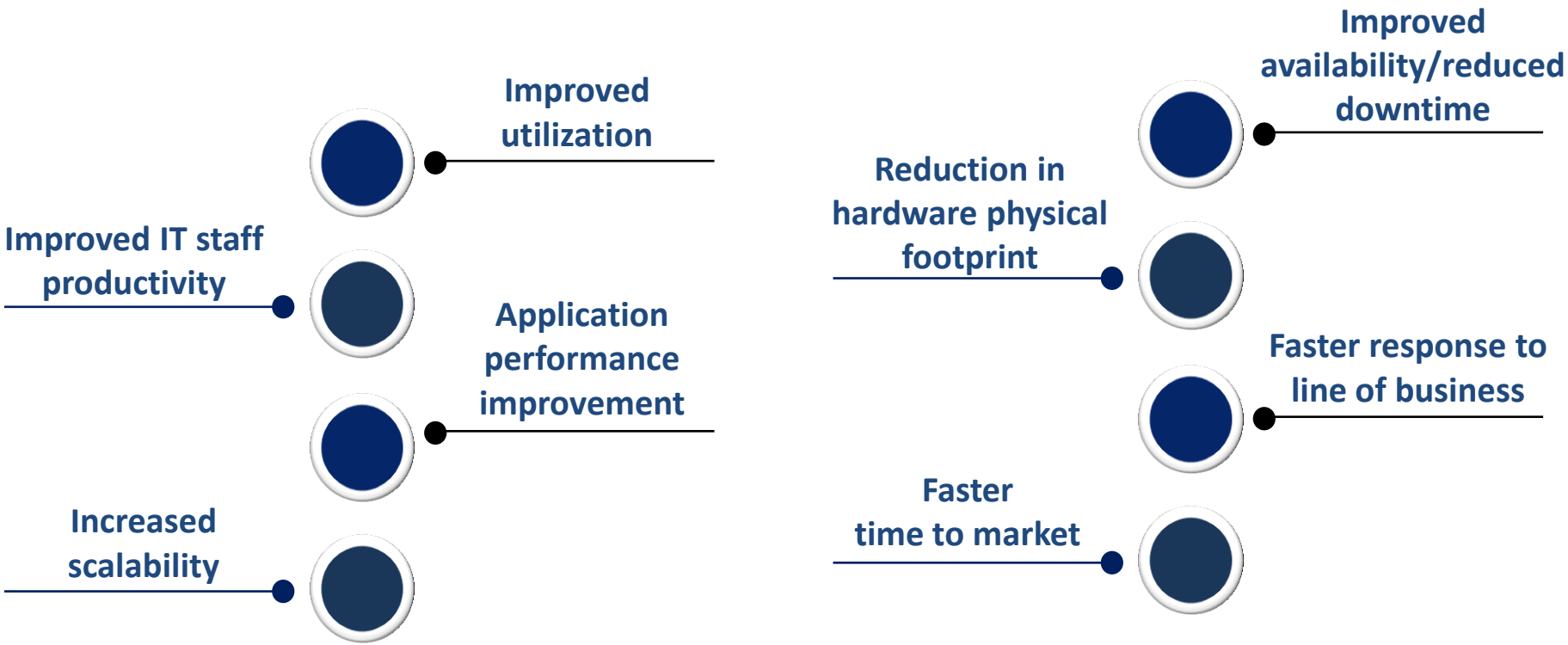
For some simple reasons

Up to 30% lower total cost of ownership versus traditional SAN

87% say that HCI has made them more agile

Up to 400% more expensive to use on-demand AWS versus VxRail HCI

Benefits of deploying Converged and Hyper-converged Infrastructure



References

- “Cloud Infrastructures and Services - CIS” Course by Dell Technologies
- “Information Storage and Management – ISM” Course by Dell Technologies
- “IT Solutions for Digital Businesses - Virtualization and the Journey to the Modern Digital Workspace” Course by Vmware

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