Year	Subject Title	Sem	Sub. Code
2018-19 Onwards	CLOUD COMPUTING	III	18MIT34C

UNIT-IV: Cloud Infrastructure: Introduction – storage virtualization – storage area networks-network- attached storage – cloud server virtualization – networking essential to the cloud. **Cloud and SOA:** Introduction – SOA Journey to Infrastructure – SOA and the cloud – SOA Defined – SOA and infrastructure as a service – SOA based cloud infrastructure steps – SOA Business and IT services. (Chap 8,9)

TEXT BOOK

1. Dr. Kumar Saurabh "Cloud Computing-Unleashing Next Gen Infrastructure to Application", 3rd Edition, Wiley India Pvt Ltd, 2014.

Chap 8: Cloud Infrastructure:

- Storage virtualization
- Storage Area Networks
- Network Attached service
- Cloud server virtualization
- Networking essentials to the cloud

Storage virtualization

- Storage virtualization in Cloud Computing (also sometimes called software-defined storage or a virtual SAN) is nothing but the sharing of physical storage into multiple storage devices which further appears to be a single storage device. It can be also called as a group of an available storage device which simply manages from a central console. This virtualization provides numerous benefits such as easy backup, achieving, and recovery of the data.

- This whole process requires very less time and works in an efficient manner. Storage virtualization in Cloud Computing does not show the actual complexity of the Storage Area Network (SAN). This virtualization is applicable to all levels of SAN.

https://data-flair.training/blogs/storage-virtualization-in-cloud-computing/#:~:text=in%20Cloud%20Computing%3F-,Storage%20virtualization%20in%20Cloud%20Computing%20is%20nothing%20but%20the%20sharing,manages%20from%20a%20central%20console

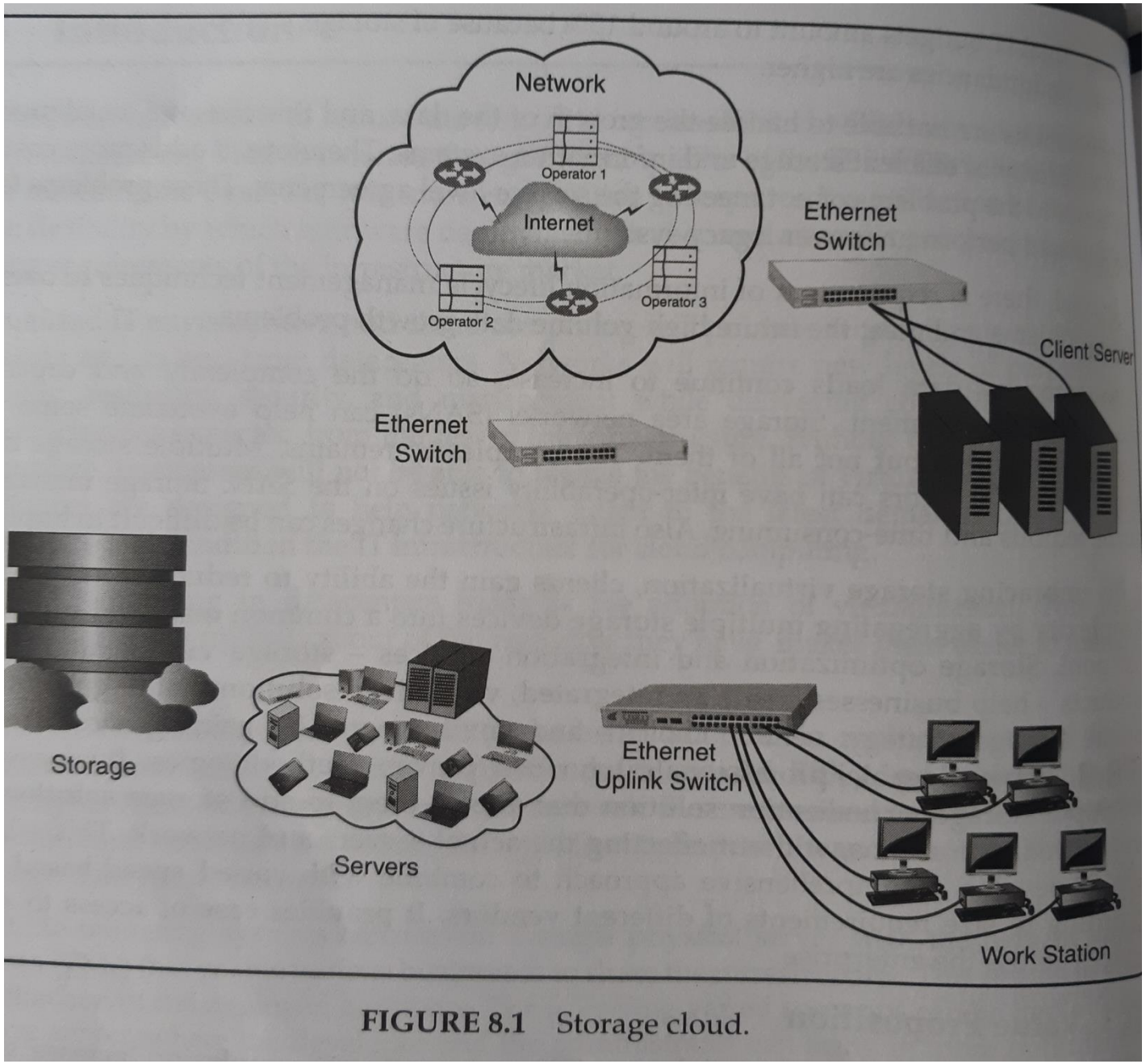


FIGURE 8.1 Storage cloud.

Benefits of Storage Virtualization

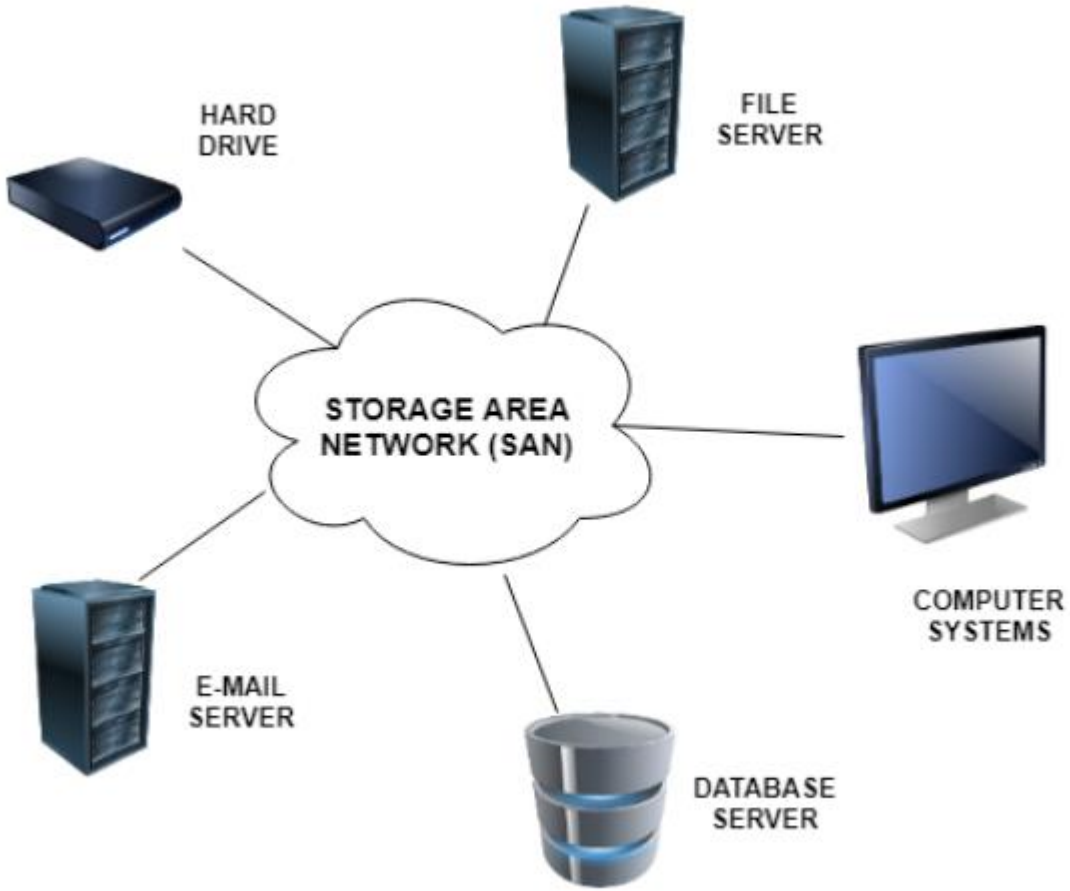
i) Easy Retrieval and Upload of Data: In storage virtualization, the data quickly retrieve from virtual storage. It is as easy as accessing a file on the local computer. The data store very easily with the help of some application and an internet connection which is an easy task.

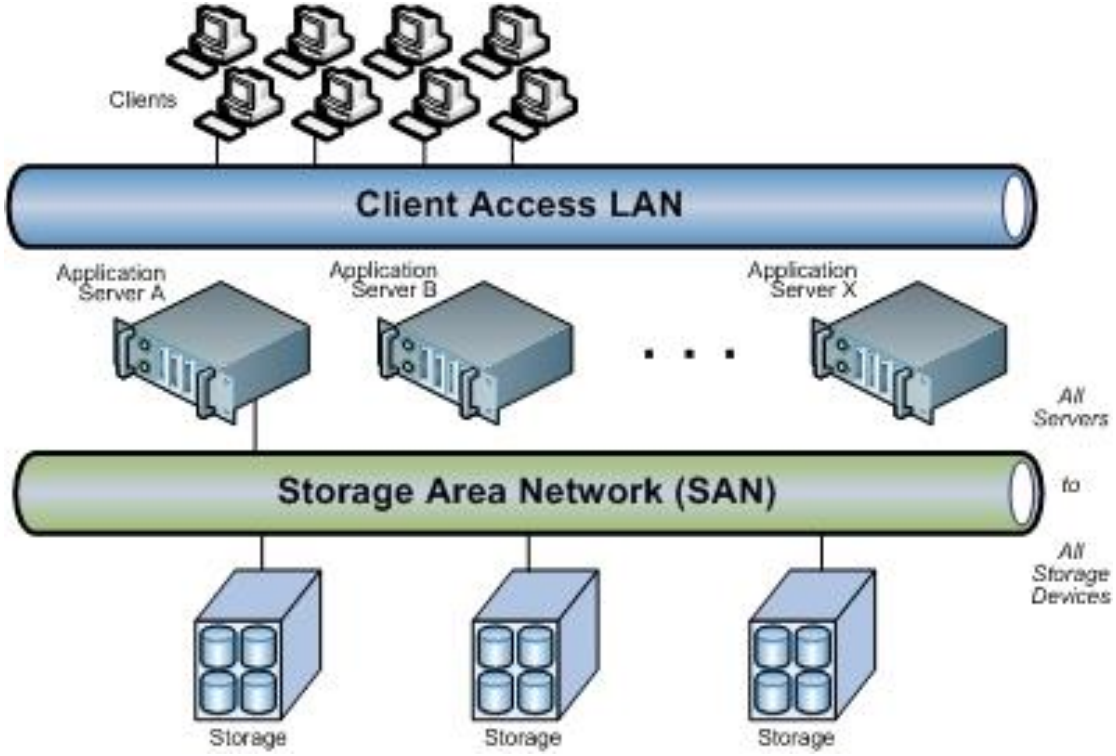
ii. Better Management: The data can be migrated based upon the utilization such as the data which is frequently used can be stored on a high-performance storage system. However, the data which is rarely used can be placed on a bit slower system. This is an example of a battery management system and the customer won't face any issue regarding storage.

iii. Security: In storage virtualization, the data stores in different place and secure with maximum security. If any disaster takes place the data can be retrieved from some other place and it won't affect the customer. The security has the ability to meet the real utilization necessities rather than providing additional storage.

Storage Area Networks

- Storage Area Networks are typically used to provide access to data storage. These make sure that storage devices such as disks, tape drives etc. can be accessed by an operating system as system storage devices.
- Storage Area Networks are quite cheap and so are used both by large and small businesses.


HARD
DRIVE
FILE
SERVER
STORAGE AREA
NETWORK (SAN)
COMPUTER
SYSTEMS
E-MAIL
SERVER
DATABASE
SERVER



SANs are typically composed of hosts, switches, storage elements, and storage devices that are interconnected using a variety of technologies, topologies, and protocols. SANs may also span multiple sites.

A SAN presents storage devices to a host such that the storage appears to be locally attached. This simplified presentation of storage to a host is accomplished through the use of different types of virtualization.

Components of Storage Area Networks

The different components in storage area networks are –

Host Layer: All the servers that provide access to the storage area network collectively constitute the host layer. These servers have host bus adapters that allow the operating system to connect to the storage devices via the storage area network.

Fabric Layer: The networking devices in the storage area networks constitute the fabric layer. These include routers, gateways, bridges, cables etc. All these devices help move data in the storage area network, from source to destination.

Storage Layer: The storage devices in the storage area network together form the storage layer. These devices include database server, file server, hard disk, magnetic tape etc. All the storage devices contain a number known as the logical unit number (LUN). They can be uniquely identified in the storage area network using this number.

Advantages of Storage Area Networks

The different advantages of storage area networks are –

- The storage devices are independent of the system and their data is accessed using the storage area network. So the storage devices can be increased and decreased as required.
- The storage is removed from the purview of the system and moved and moved onto a separate network. This leads to a better performance overall as the data is not affected by local traffic or bottlenecks.
- The storage data is very secure on the storage area network and cannot be copied or stolen by anyone else.
- There can be a remote copy of the storage data kept separately using the storage area network. This can be useful if there is a primary data failure or natural disaster.

Disadvantages of Storage Area Networks

The different disadvantages of storage area networks are

- If there is a lot of traffic in the storage area network, then operations will be extremely slow. So it is better not to use storage area networks for data extensive applications.
- The storage area network operates in a shared environment. So there is a change that data may be leaked for sensitive operations.

Network-attached storage

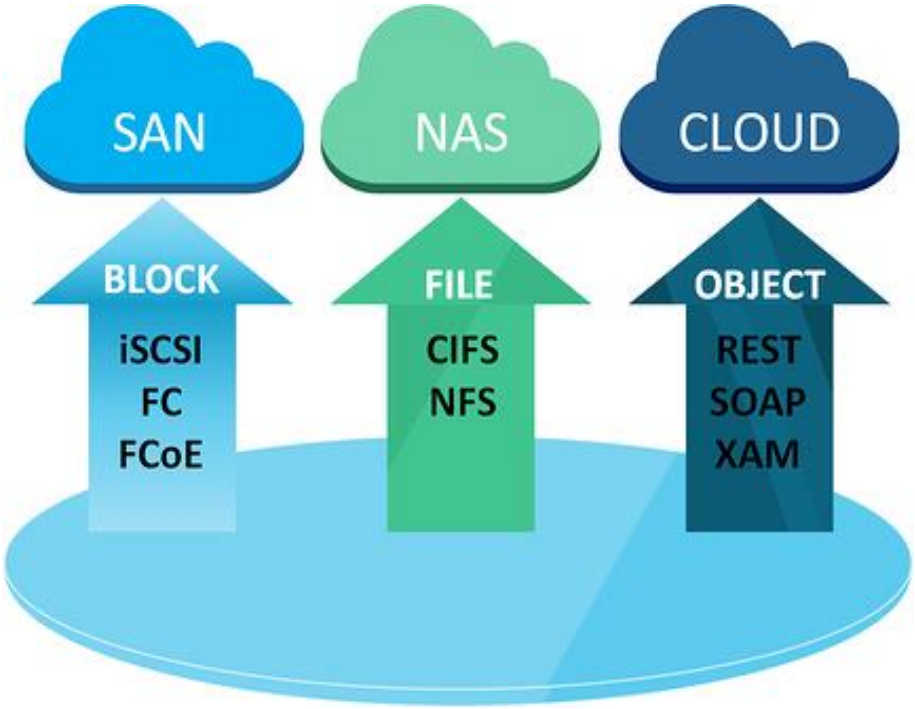
- Network-attached storage (NAS) is a file-level computer data storage server connected to a computer network providing data access to a heterogeneous group of clients. NAS is specialized for serving files either by its hardware, software, or configuration.
- NAS uses file-based protocols such as NFS or SMB/CIFS where it is clear that the storage is remote, and computers request a portion of an abstract file rather than a disk block. NAS is designed as an easy and self-contained solution for sharing files over the network.
- It works with standard Ethernet cards, cables and switches to handle Channel traffic at the data link layer, using Ethernet frames to encapsulate, route, and transport FC frames across an Ethernet network from one switch with Channel ports and attached devices to another, similarly equipped switch.

- When an end user or application sends a request, the operating system generates the appropriate SCSI commands and data request, which then go through encapsulation and, if necessary, encryption procedures. A packet header is added before the resulting IP packets are transmitted over an Ethernet connection. When a packet is received, it is decrypted, and disassembled, separating the SCSI commands and request.

The channel is more flexible; devices can be as far as ten kilometers (about six miles) apart if optical fiber is used as the physical medium. Optical fiber is not required for shorter distances, however, because the Channel also works using coaxial cable.

8.4.2 NAS Protocols

NAS Protocols are CIFS, NFS, iSCSI,FCoE



https://www.lookingpoint.com/blog/storage-protocol

https://www.rcannings.com/san-storage-fc-vs-fcoe-vs-iscsi/

- The two primary storage architectures in many companies today are a Storage Area Network (SAN) or a Network Attached Storage (NAS) solution. Traditionally a SAN provides Block storage while a NAS provides File level storage. It's also worth noting that internal server storage is making a comeback with the advent of software-defined storage (SDS). I'll save the software-defined storage (SDS), Hyper Converged Infrastructure (HCI) as well as Object storage such as Amazon Simple Storage Service (Amazon S3) for another article.

- The five predominate storage protocols I see today in the mid-market are Fibre Channel (**FC**), Internet Small Computer System Interface (**iSCSI**), Fibre Channel over Ethernet (**FCoE**), Network File System (**NFS**), and Common Internet File System (**CIFS**). Other storage communication standards such as InfiniBand (**IB**) are reserved more for the high-performance computer (**HPC**) environments that require very high throughput and a very low latency such as in supercomputers.

8.4.3 NAS interconnects

- Understanding interconnects like Fast Ethernet and Gigabit Ethernet, which are used to integrate NAS devices into networks, can help you make better decisions on NAS deployments.
- Storage managers use NAS interconnects are used to integrate NAS devices into their networks.

8.4.4 NAS Requirements

Cloud NAS (network attached **storage**) is remote **storage** that is accessed over the Internet as if it was local. The **storage** is usually hosted by a third-party service provider, who charges the customer a fee based on capacity and bandwidth.

8.4.5 High-Performance NAS

Network Attached Storage (NAS) allows enterprises of any size to consolidate distributed file servers into a smaller number of specialized storage systems. These systems provide access to files through several standard access protocols, such as NFS, SMB, FTP, etc. and have a centralized management console. Just a few years ago, NAS presented certain limitations: insufficient bandwidth, high latencies in data transfer channels, lower reliability and scalability. As a result, SAN networks were the top choice for business-critical tasks. These days, the new generation of high-performance NAS systems allows the user to surpass the previous restrictions and bring the features and benefits of SAN networks to file access.

8.4.6 Network Infrastructure

Network infrastructure is the hardware and software resources of an entire **network** that enable **network** connectivity, communication, operations and management of an enterprise **network**. It provides the communication path and services between users, processes, applications, services and external **networks**/the **internet**.

Difference between NAS and SAN and their storage architectures

- https://www.stellarinfo.co.in/blog/difference-between-nas-and-san-storage/

8.5 Cloud Server Virtualization

This section provides an overview of the architecture, features, and benefits of server virtualization solutions that provide a cost-effective VM solution for OS platforms. VMs help to run various OS concurrently on the single server. This helps to cater various scenarios such as consolidation, automation, test and development environments, migrating from x86 to non-x86 env, workload management (Fig. 8.5)

8.5.1 Datacenter Virtualization

The primary requirements of the datacenter with respect to datacenter virtualization are as follows:

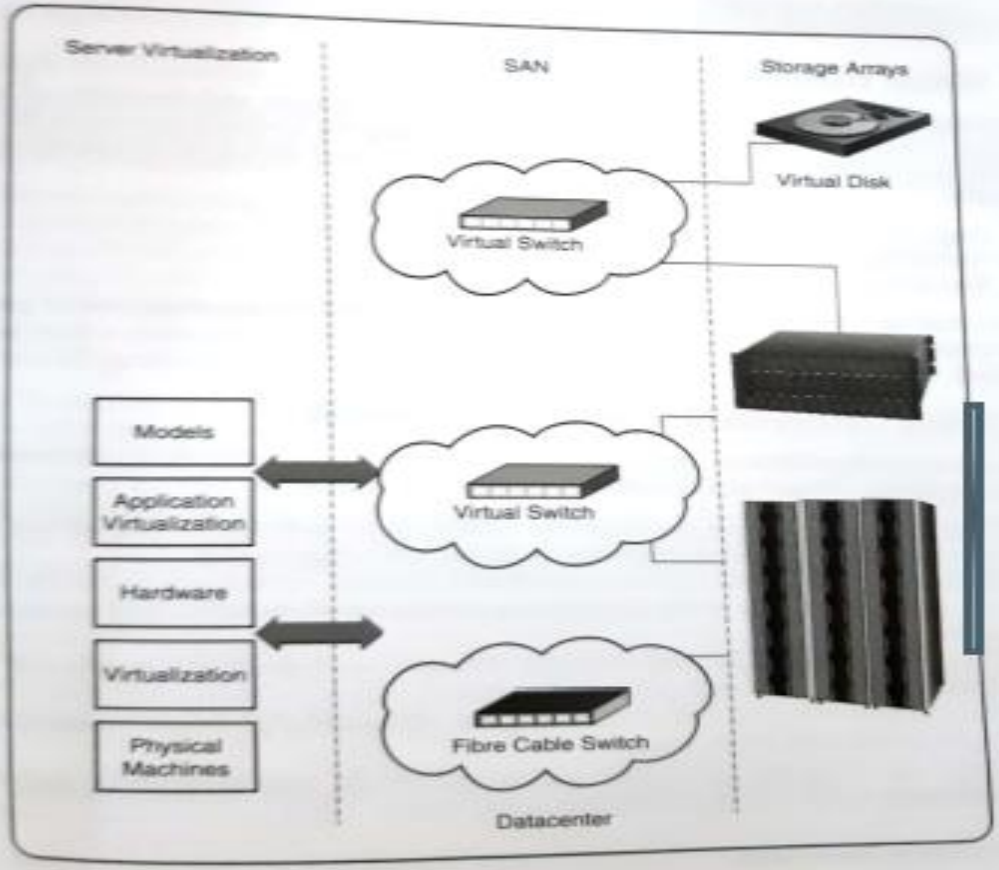


FIGURE 8.5 Server virtualization.

CLOUD SERVER VIRTUALIZATION

- The section provides an overview of the architecture, features, and benefits of server virtualization solutions that provide a cost-effective VM solution for OS platforms.
- VMs help to run various OS concurrently on the single server.
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DATACENTER VIRTUALIZATION

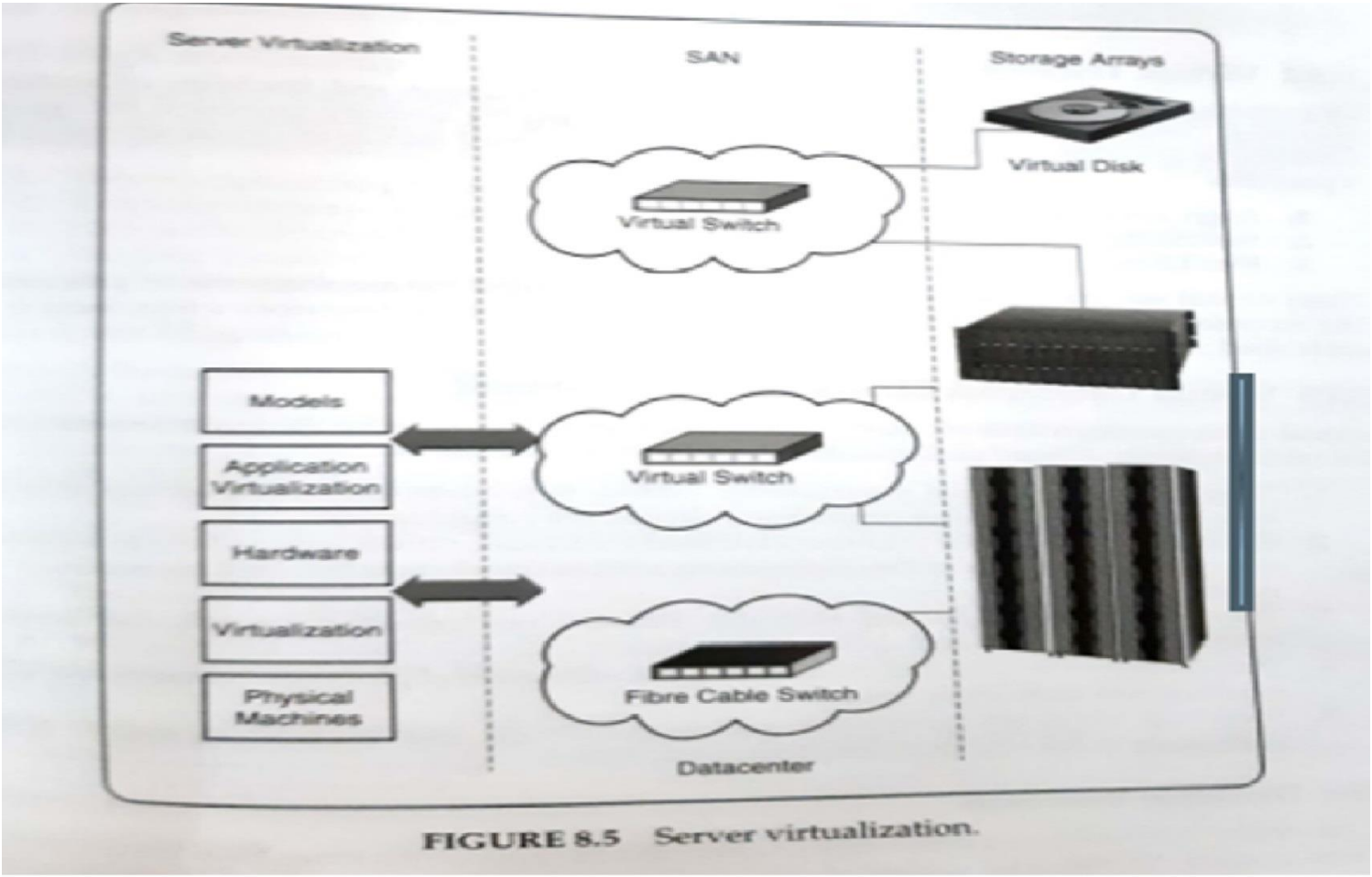


FIGURE 8.5 Server virtualization.

- The primary requirements of the datacenter with respect to datacenter virtualization are follows:

1. Virtual servers
2. Storage
3. Networking
4. Unmodified operating systems.

- These servers help to run independently the application on the VMs by sharing same pool of resources. They enable

1. Comprehensive virtualization
2. Management
3. Resource optimization.
4. Application availability
5. Operational automation capabilities.

- **VIRTUAL DATACENTER**
- Organizations are always in need of higher levels of utilization and flexibility of hardware resources.
- The most important feature of virtual servers is that it provides.

1. High level of performance
2. Scalability
3. Flexibility

- These virtual servers work like a complete server and fulfill the requirements of processors.
- **Virtual datacenter management and control:**
- Virtual datacenters provide all management and control functions of the environment under the umbrella
- These function offer the following benefits:

1. They use a way simple provisioning method to allocate the virtual servers with the easy –to-use interface and temple to deploy the virtual server.

2. Businesses need special attention at different intervals ; virtual servers help to automate the operational needs of the deployment and set the alerts when they are required the most.
3. They help to schedule and alert the different management control, and support functions with scheduled automated tasks.
4. They act as very good tool of metering the utilization of processor memory and IOPS requirements with scheduled automated tasks.
5. They help to set the customized roles based on the type of work as well as access permission to the resources using different tiers.

DYNAMIC RESOURCES

- In the virtual datacenter resource requirement are not same every time.
- They have different spikes to meet the dynamic nature of the environment.

1. Monitoring utilization,
2. Common resource pool maintenance
3. Matching the business needs and changing priorities,
4. Making additional capacity available,
5. Migrating live VMs,
6. Dynamically allocating IT resources.
7. Creating rules and policies to prioritize resource allocation,
8. Granting IT autonomy to business organization,
9. Providing dedicated IT infrastructure to business unity higher utilization achievement.
10. Having centralized IT control over hardware resources.

- Dynamic resources adhere to the requirement and allocate the computing Resources dynamically to meet business goals.

HIGH AVAILABILITY:

- A virtual datacenter requires the features of high availability to provide cost-effective failover options.
- The following features for high availability make a datacenter more robust and reliable:

1. Failover options to protect applications,
2. Consistent defense mechanism foe it infrastructure.
3. Live workload transfer in case of failover.
4. Alerting the administrator for stringent situation.
5. Zero down-time to meet SLAs.

- It should not be based on related operating system and virtualization technology.

- **LIVE MIGRATION:**
- Similar to the higher availability option we have already discussed, live migration helps the environments to run and gives unparalleled availability and flexibility to meet the requirement of the business goals.
- The main features/benefits it has are that it

1. Balances the workloads by transferring the under –performing servers.
2. Ensures live migration within no time and not even traced by the end-user.
3. Maintains , manages, and supports the resource pools automatically.
4. provides ease of hardware maintenance with failover alerts and scheduled maintenance.

NETWORKING ESSENTIAL TO THE CLOUD

- Network plays a vital role in infrastructure management to:

1. Reduce costs.
2. Improve service.
3. Manager risk.

- It is important to focus on infrastructure initiatives essential for reaping benefit such as:

1. server.
2. Storage hardware optimization.
3. Technology enhancements.
4. Service management improvement.
5. Security
6. Resiliency.
7. Optimization of the network(hardware, software management).

- Highly virtualized infrastructure based clouds meet the demanding network requirements that can restrict the growth of the infrastructure management activities.
- They is a need of the following features:

1. More stringent network performance.
2. Fast reliable access to virtualized resources.
3. Flexible and adaptable networks.
4. Application workload mobility.
5. Response to variable capacity requirements.
6. Security to support multi-tenancy.

Datacenter network

- To get the dynamic and self-service baser environments networking is very essential for initiatives such as datacenter consolidation and vitalization.

1. Expertise to assess, plan, design, and implement network with holistic consideration of servers, storage, application performance and manageability.
2. Different options of costs and different ranges of performance to match their needs.
3. Technological expertise to design and deploy security policies.
4. Simple operational software to lower the cost and to integrated the network and manager it.

Market opportunity

1. Cost control, high availability and performance, and robust security are business imperatives.
2. Datacenter networking technologies are changing fast and in-house staff does not always have adequate time and experience to take appropriate actions.

3. Datacenter consolidations as well as server and storage virtualization impact the network in terms of new requirements for flexibility performance and security.

- Most of the focus is on consolidating and virtualizing servers and storage without thinking long term about the supporting network.

Datacenter network services

- Network service help to model, design and architect solution for the organization to:

1. Develop the network infrastructure
2. Integrated service of infrastructure
3. Improve facility management
4. Prepare for new technologies
5. Provide greater freedom
6. Help reduce datacenter sprawl
7. Help build differentiating advantage through improved efficiency and business innovation.

Data and storage network convergence;

- At the same time, with a single physical infrastructure, deployment , upgrades, and managements will be simplified, contributing to lower total cost of ownership.
- The services include the following:

1. Developing the network design
2. selecting vendors and preparing a detailed design.
3. Creating a roadmap for migration.
4. Carrying procurement, logistics site preparation.
5. Deployment, testing the network.
6. Providing on –going maintenance support.

- The service product consists of the following components:

1. **Consolidation and virtualization**: there help to consolidate the datacenter by designing and deploying the virtualization IT environment.

2. **Private networking:** this helps in establishing the private network and design and deploy the connectivity between the resources of different datacenter.
3. **Security/firewalls:** this helps to design and deploy network firewall technology to support the security requirements to today's datacenter network.

Network infrastructure

- Network infrastructure engagements are assessments that look at the performance, availability resiliency, and cost of the network.
- **MAIN POINTS**:
- Rising costs and challenges in responding quickly to rapidly charging business opportunities.

Network infrastructure provide the following benefits:

- Identifying areas to cut costs through consolidation and virtualization.
- Planning a network that fully contributes to a responsive IT environments.
- Removing network as a bottleneck to meeting availability , security, and performance requirements.

Business impact:

- Increasing costs for a proliferation of hardware.
- Business constrained by IT infrastructure.
- Lost returns because of customer displeasure and reduced employee productivity.
- Inability to a achieve the right balance of business cost, and network benefits.

The technique provides a structured approach for deploying business applications integrated with IT capabilities.

Datacenter networking services enhancements:

- There are three service products under networking strategy and optimization services:

1. Organization network strategy planning
2. Network application optimization.
3. Network infrastructure.

- The following are four service components available under network integration services datacenter network:

1. Consolidation and virtualization
2. Data and storage network convergence
3. Private optical networking
4. Security and firewalls.

Network integration-consolidation and virtualization:

- The consolidation and virtualization component helps clients understands, plans for and meet.
- The new demands of virtualized servers and storage while also addressing consolidation and virtualization of the network itself to further reduce infrastructure costs.
- There are four type network integration;

1. **Legacy environment:** static, endpoint agnostic, strict, limited change windows, proliferation of special-purpose devices(firewalls, load balances IPS).
2. **Device virtualization:** physical consolidation and optimization, basic virtualization of servers, storage, and network simply network management.
3. **System virtualization:** connecting virtualized server and storage, support platform specific network requirements and multiple layers of network virtualization.

- **Cloud computing:** architect responsive secure network support automated provisioning of servers, storage and network increase operational savings.

Datacenter network thinking has to change:

- Static secure datacenter networks that meet their non-functional requirements through limited, controlled changes ae no longer adequate.
- Datacenter networks must become significantly more flexible and responsive, capable of dynamic change.
- The network must be integrated into the overall IT systems management environment to provide dynamic services in response to automated provisioning.

Chapter 9: Cloud and SOA

- 9.1 Introduction
  - -Enterprise Infrastructure and SOA
- 9.2 SOA Journey to Infrastructure
- 9.3 SOA and the Cloud

9.1 Introduction

- Service management is one of the similarities between the cloud infrastructure and Service Oriented Architecture (SOA) approaches.
- Developing an integrated service management approach for both application and infrastructure services will drive efficiency in IT operations by improving resource utilization and service levels.
- Such an integrated service management can move IT toward an end-to-end service-oriented environment.
- Such an environment enables business agility by aligning IT with the business in a better way.

Enterprise Infrastructure and SOA

- Design and provisioning of an enterprise infrastructure must be focused on the need of enterprise organisations.
- Through comprehensive capabilities of products, services, and integrated solutions, IT organizations are delivering increasingly complex solutions driven by SOA and related methodologies.
- To achieve their ambitious growth goals, leading IT organizations require continuing investments in IT and taking the advantage of emerging capabilities.
- A future technology platform will need to support agile business organizations through the simplification of information systems and reduce the complexity of the IT ecosystem through consolidation and rationalization.

- We need a governance model for the heterogeneous environment owned by many parties and providing an end-to-end IT infrastructure.
- This governance model will define the IT infrastructure service requirements in support of an integrated service offering for business systems.
- As the SOA projects are deployed, development of an effective design of the supporting infrastructure becomes critical.
- SOA introduces the requirements for availability, service continuity, monitoring, scalability, and geographic dispersion that are different than those of the past architectures.

- SOA converts IT applications into composite applications.
- Instead of traditional monolithic applications, composite applications are created, which are composed of many services often developed and deployed independently by separate development teams on different schedules.
- By adhering to common standards and interfaces, the development of new composite applications and the extension of existing applications are made easier through the reuse of existing services and the rapid integrations of new services.

9.2 SOA Journey to Infrastructure

- The path to transformation consists of a long journey with a staged approach , leading to the ultimate goal of a service-oriented enterprise.
- Multiple islands of disparate infrastructures in today's environment need to be consolidated to gain control, reduce costs, and become operationally efficient.
- The next is to introduce virtualized infrastructure to improve the utilization levels, allow dynamic flexibility to move resources, and the capacity to meet fluctuating workload demands.
- It is important to note how service orientation(SO) can be achieved by building capabilities on the top of virtualized and automated infrastructure.
- Service orientation is a state where the infrastructure is provided and utilized as a service rather than in piecemeal.
- Latest innovations, such as cloud computing, will help to further expand the service-oriented paradigm to meet the scaling demands of future state of business.

9.3 SOA and The Cloud

- SOA binds both the deliver and leverage cloud-based services.
- Cloud computing relies on service orientation to loosely couple the applications with the underlying infrastructure model for using Web services-such as service requestors, service registry, and service providers.
- Web services are required to compose the complex distributed legacy applications that can be customized later.
- This helps to integrate bespoke applications and provide the service for extensibility, encapsulations, and interoperability.
- SOA works as a foundation for the stepping stones to the cloud journey.
- It embraces all the characteristics of the cloud-such as self-service, shared and dynamic infrastructure, and virtualization.

SOA Model

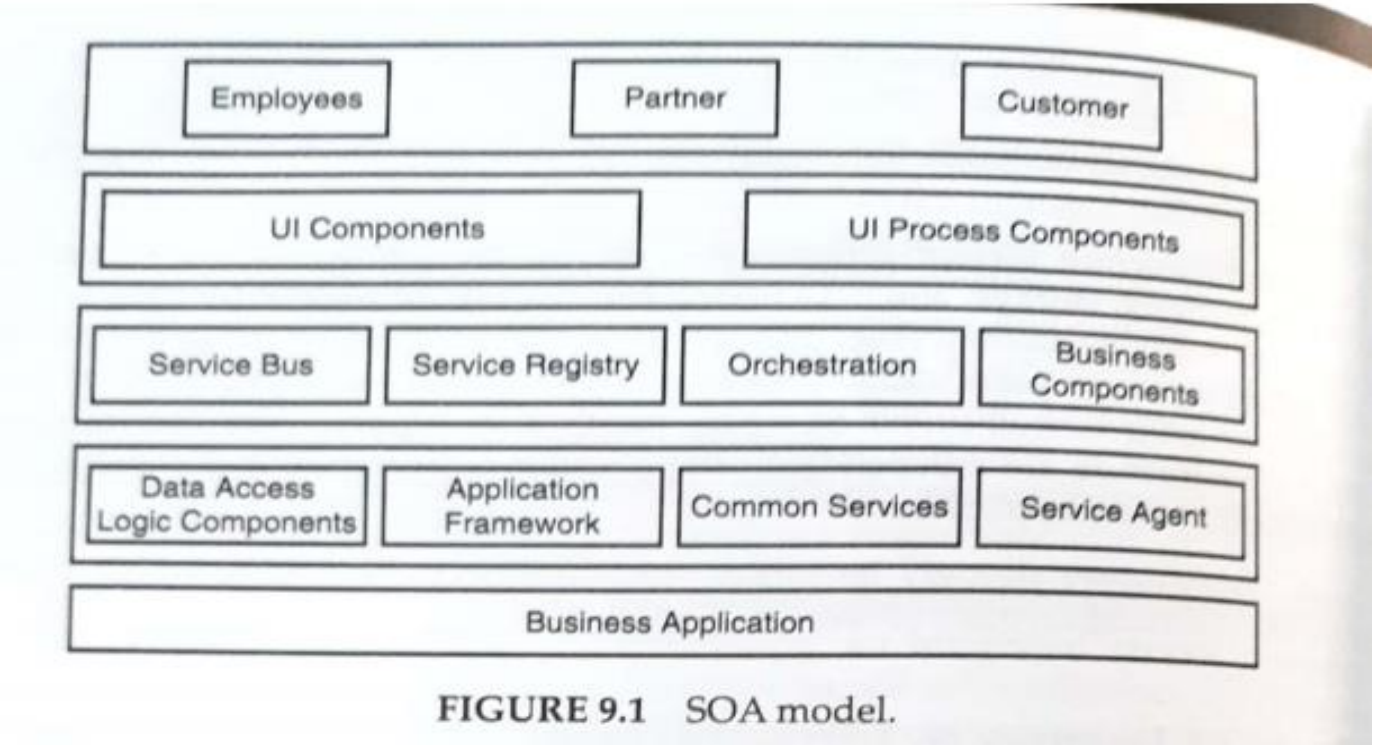


FIGURE 9.1 SOA model.

Infrastructure Technologies

- Cloud infrastructure is based on virtualization that is composed of dynamic systems that that enable the definition and delivery of resources on demand.
- Current server technology can deliver hundreds of virtual servers on small clusters of physical servers, enabling flexibility and high availability.
- In a virtual environment, workloads can be moved dynamically between components, allowing minimal unplanned downtime and no planned downtime.
- Each server contains a pool of processors, memory, and I/O resources that can be dynamically assigned and reassigned to meet needs.
- Surplus capacity cannot be pre-provisioned until activated.

9.4 SOA DEFINED

SOA is defined as a methodology for architecting the solution that looks for flexibility based on loose coupling and encapsulation. The functionalities of SOA are exposed as services, and there exists an instance for each service and its implementation. The deployment of these services requires less deployment time as they are built once and can be redeployed at multiple instances, and can be invoked at remote or onsite locations.

SOA is about an evolving living organism and not about building a house. This is an ongoing journey and not a project that finishes with a concrete result. Agility of the business is an important factor for business continuity as it helps to find faster solutions to changing business priorities and leverages the competitive effectiveness of business change requirements. SOA is defined by what a service is.

Services are defined by the following characteristics:

- Explicit, implementation-independent interfaces.
- Loosely bound.
- Invoked through communication protocols.
- Stress location transparency and interoperability.
- Summarized reusable business task and assets.

Conceptually, SOA can be visualized by the roles of individuals in any organization. The architects sees SOA from the perspective of the entire business and uses SOA implementation to bridge the gaps of the business.

SOA is very flexible; therefore, it facilities the different elements of business. The most important characteristics of SOA is the flexibility to treat the following elements of business:

- Business processes.
- Underlying the IT infrastructure.
- Secure standardized components(service).
- Changing business priorities.

So when we look at the SOA vision, we need to look at the following three aspects:

- The business view of a service- what is needed to support the business process?
- The architecture view of a service- how do we define and design these services?

- The implementation view of a service- how do we implement the service through the component deployed on the technical infrastructure?

  In order to run the business in a smooth manner, we should bundle the business requirements in a simplistic and standard way. This creates the service offerings and helps to get the right information from the right source, particularly the information about when the service is needed. This enables us to reuse and combine different other services being offered to answer the requirements of winning against competition.

SOA Lifecycle:

The SOA lifecycle is not so different from the traditional application lifecycles. It provides a new methodology. The lifecycle starts with the gathering of an organization's requirements, and information for designing the processes and architecture in the SOA model. After the optimization phase is over, SOA is implemented with the help of integrating new and existing services.

Once SOA is deployed, the end customers administrate and monitor the services from the business and IT perspective. The information gathered in the steady-state operations is fed back into the lifestyle to improvise the services. Assembling all the stages of the lifecycle gives governance and becomes the torch bearer for the guidance and supervision of the SOA project.

9.5 SOA and Infrastructure as a Service

Major industry analysts view cloud infrastructures as a key IT ingredient for business agility. Analysts recommend an IT infrastructure that is:

- Shared across customers, departments, and applications.
- Dynamically driven by business policies and service-level requirements.

Architecture

- Cloud infrastructure has many service components. However, they all need not be implemented concurrently. Services can be divided into four domains; application services, information services, common IT services, and infrastructure services. Within each domain, SOA can be measured and charted across a continuum of increasing dynamism and partner involvement.

Business Agility

This helps in defining the right time to launch or rapidly scale the deployment efforts needed to implement the new solutions.

Lower Cost of Operations

- This helps in utilizing the virtual pools efficiently which decreases the chance of procuring new systems.
- It helps in increasing the overall effectiveness while working in an automated environment.

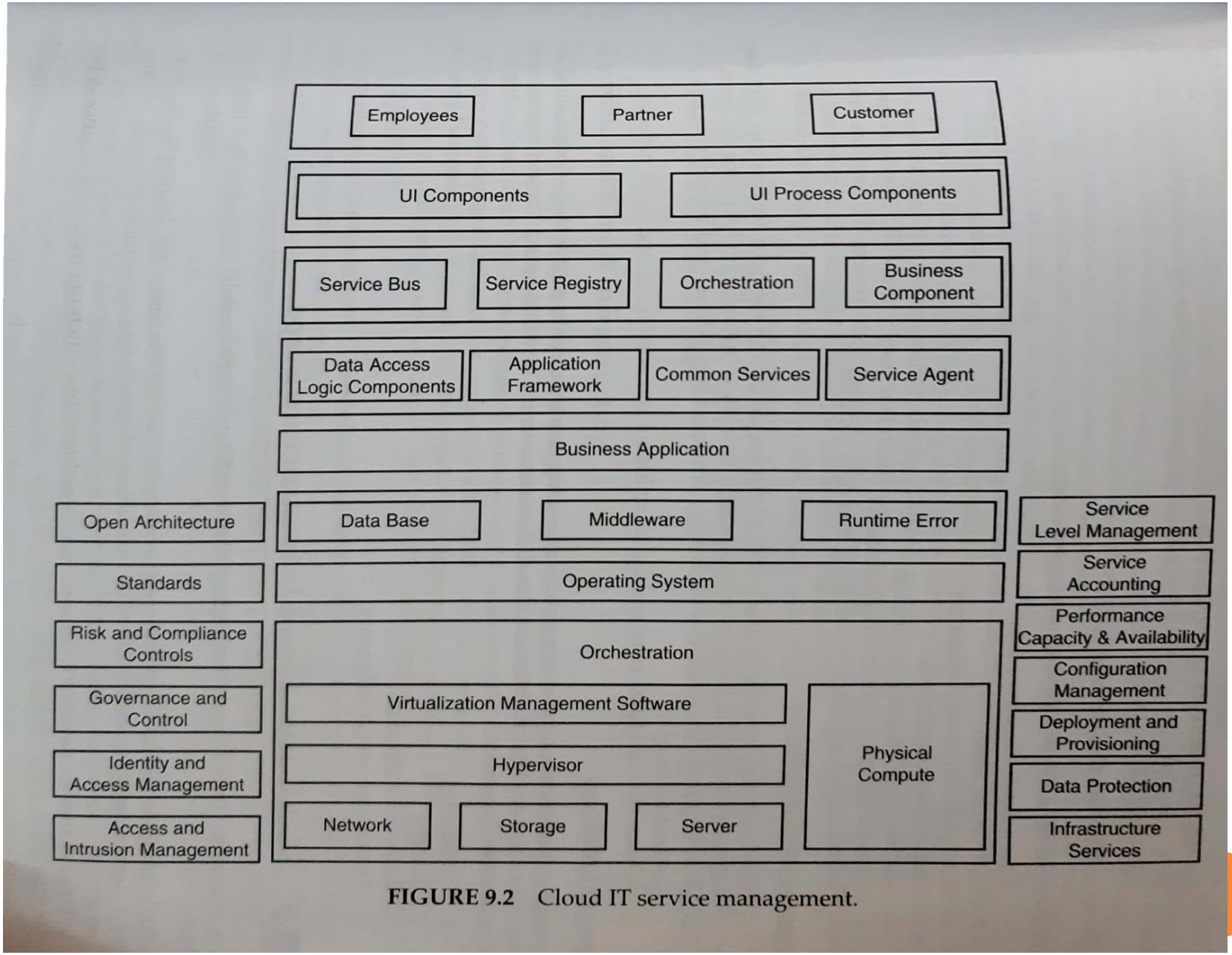


FIGURE 9.2 Cloud IT service management.

Improved Services Levels:

1. SOA-based infrastructure helps to adhere to the SLAs efficiently and helps in orchestrating the resources as per the rules and policies.
2. Business analytics helps to decide different predictive, proactive, alternative approaches when we follow SOA.

Efficient Information Management:

Efficient centralized virtual environment enables

- Information dissemination.
- Data replication.
- Business continuity protection.
- Regulatory compliance.
- Maximizing resource utilization.
- Rapid deployment of new applications.
- More timely response to changing business conditions.

Regulatory compliance:

- We need monitoring to track the performance of the services to confirm that they comply with the regulatory compliances. Workflow automation helps for the same .
- It is important to adhere with energy emission regulations and efficiencies to adopt greener solutions.
- If there is centralized data storage it facilitates and accelerates the audit process.

Energy efficiency:

energy requirements for the Datacenter are rising day to day. To match the requirements, we have the answer. The SOA-based cloud infrastructure. The SOA-based cloud infrastructure substantially improves

- Computing.
- Storage.
- Network utilization.
- Datacenter energy efficiency.

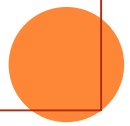
9.6 SOA-Based Cloud Infrastructure Steps

- Service-oriented architecture (SOA) is a style of software design where services are provided to the other components by application components, through a communication protocol over a network.

- Analysis and strategy
- Planning
- Implementation
- Value-driven

SOA and Cloud Infrastructure

- Cloud infrastructure refers to the hardware and software components -- such as servers, storage, a network and virtualization software -- that are needed to support the computing requirements of a cloud computing model.
- Cloud infrastructure also includes an abstraction layer that virtualizes resources and logically presents them to users through application program interfaces and API-enabled command-line or graphical interfaces



9.7 SOA Business and IT Services

- Business Process is a management authority that improves the performance of business and builds the operational solutions for SOA (service-oriented architecture).
- It implements and optimizes the business process.
- It is a powerful tool that keeps running operations optimally.
- It decreases the cost and increases the business agility (changing the services to meet customer requirements).
- Implementing the business process provides increased efficiency.
- It makes the process more effective when process becomes more efficient.
- It specifies the higher productivity and faster process times.