

CE644 Cloud Computing and Applications

Cloud Types- IaaS, PaaS, SaaS

- IaaS: Compute, Network and Storage
 - **Cloud provider is Exempted** from maintaining data center or infrastructure.
 - **End user are responsible** for managing applications that are running on top of the service provider cloud.
 - End user access IaaS using CLI or API
 - Examples: AWS, Google Compute Engine, OpenStack and Eucalyptus.

laaS – Infrastructure as a Service

- In traditional data centers, the **computing power** is consumed by having **physical access** to the infrastructure.
- laaS changes the computing from a physical infrastructure to a virtual infrastructure.
- laaS provides **virtual computing, storage, and network resources** by abstracting the physical resources.
- Technology ***virtualization*** is used to provide the virtual resources.
- All the virtual resources are given to the virtual machines (VMs) that are configured by the service provider.

- The targeted audience of IaaS is the **IT architect**. The IT architect can **design virtual infrastructure, network, load balancers, etc.**, based on their needs.

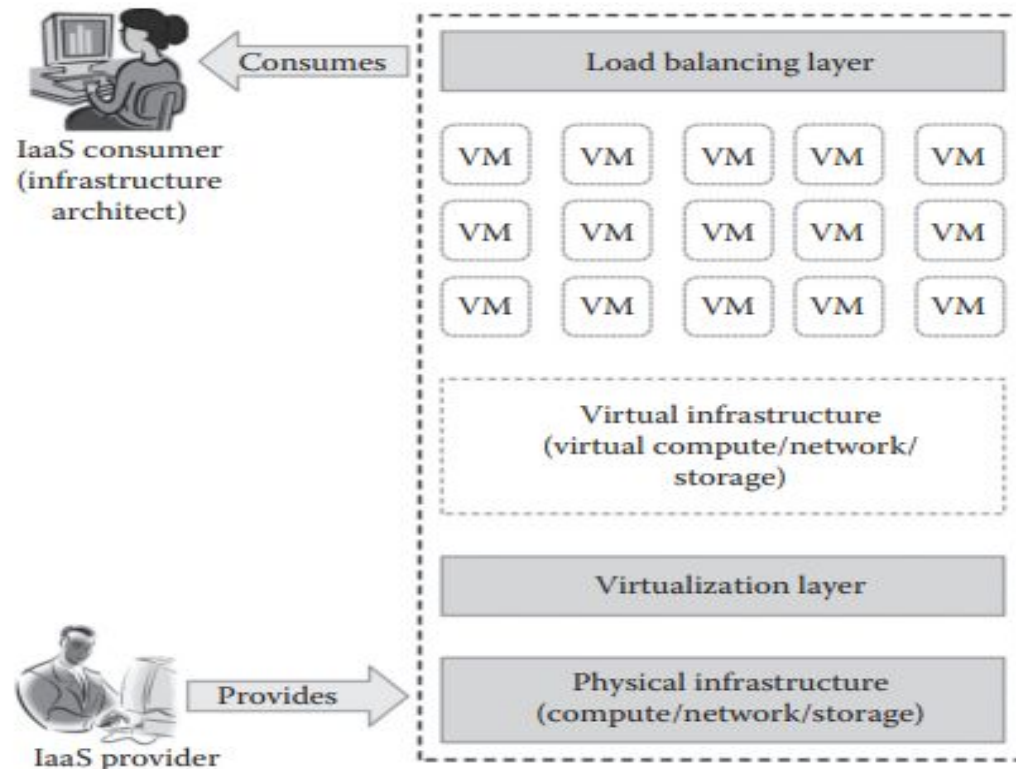
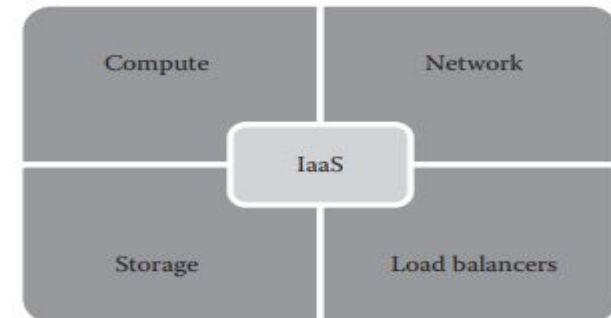


FIGURE 5.4
Overview of IaaS.

IaaS Provides Services such as:

- Compute: Computing as a Service includes **virtual central processing units (CPUs)** and **virtual main memory** for the VMs that are provisioned to the end users.
- Storage: **STaaS** provides **back-end** storage for the VM images. Some of the IaaS providers also provide the back end for storing files.
- Network: Network as a Service (NaaS) provides virtual networking components such as **virtual router, switch, and bridge for the VMs**.
- Load balancers: Load Balancing as a Service may provide **load balancing capability** at the infrastructure layer.



Characteristics of IaaS

1. Web access to the resources: The IaaS model enables the IT users to access infrastructure resources over the **Internet**.
2. Centralized management: Even though the physical resources are distributed, the management will be from a **single place**.
3. Elasticity and dynamic scaling: IaaS provides elastic services where the **usage of resources** can be increased or decreased according to the requirements. The **load** on any application is dynamic and IaaS services are capable of providing the required services dynamically.

4. Shared infrastructure: IaaS follows a **one-to-many delivery model** and allows multiple IT users to share the same physical infrastructure. The different IT users will be given **different VMs**. IaaS ensures high resource utilization.

5. Preconfigured VMs: IaaS providers offer **preconfigured VMs with operating systems (OSs), network configuration, etc.**

6. Metered services: IaaS allows the IT users to **rent** the computing resources instead of buying it.

Suitability of IaaS

1. Unpredictable spikes in usage: When there is a **significant spike in usage of computing resources**, IaaS is the best option for IT industries. If there is an **unpredictable demand of infrastructure**, then it is recommended to use IaaS services.
2. Limited capital investment: IaaS is the suitable option for start-up companies with **less capital investment on hardware**.
3. Infrastructure on demand: IaaS best suits the organizations that look for infrastructure on demand or for a **short time period**.

ROI Calculation Example

Example 1



The diagram illustrates the ROI calculation. It shows a profit of \$500 from the sale of an investment, divided by the initial investment of \$1000, multiplied by 100 to get a 50% ROI. The profit is represented by a hand holding a coin with a dollar sign, and the investment is represented by a hand holding a coin with a dollar sign. The result is shown as a hand holding a coin with a percentage sign.

$$\frac{\$500 \text{ Profit from Sale}}{\$1000 \text{ Investment in Stocks}} \times 100 = 50\%$$

Return on investment formula

$$= \frac{\text{Net investment gain}}{\text{Cost of investment}}$$



More images

Return on investment



Return on investment or return on costs is a ratio between net income and investment. A high ROI means the investment's gains compare favourably to its cost. As a performance measure, ROI is used to evaluate the efficiency of an investment or to compare the efficiencies of several different investments.

Non-Suitability of IaaS

1. When regulatory compliance does not allow off-premise hosting: For some companies, its regulation may not allow the application and data to be **hosted on third-party off-premise infrastructure**.
2. When usage is minimal: When the **usage is minimal** and the **available on-premise infrastructure itself is capable** of satisfying their needs.
3. When better performance is required: Since the IaaS services are **accessed through the Internet**, sometimes the **performance** might be not as expected **due to network latency**.
4. When there is a need for more control on physical infrastructure: Some organizations might require **physical control over the underlying infrastructure**. As the IaaS services are abstracted as virtual resources, it is not possible to have more control on underlying physical infrastructure.

Pros and Cons of IaaS:

Pros/Advantages:

1. Pay-as-you-use model: The IaaS services are provided to the customers on a **pay-per-use** basis.
2. Reduced TCO: The IT users can **rent** the IT infrastructure rather than **buy it** by spending large amount. IaaS reduces the need for buying hardware resources and thus **reduces the TCO**.
3. Elastic resources: IaaS provides resources based on the current needs. IT users can **scale up or scale down the resources whenever they want**. This **dynamic scaling** is done automatically using some **load balancers**. This load balancer transfers the additional resource request to the new server and improves application efficiency.

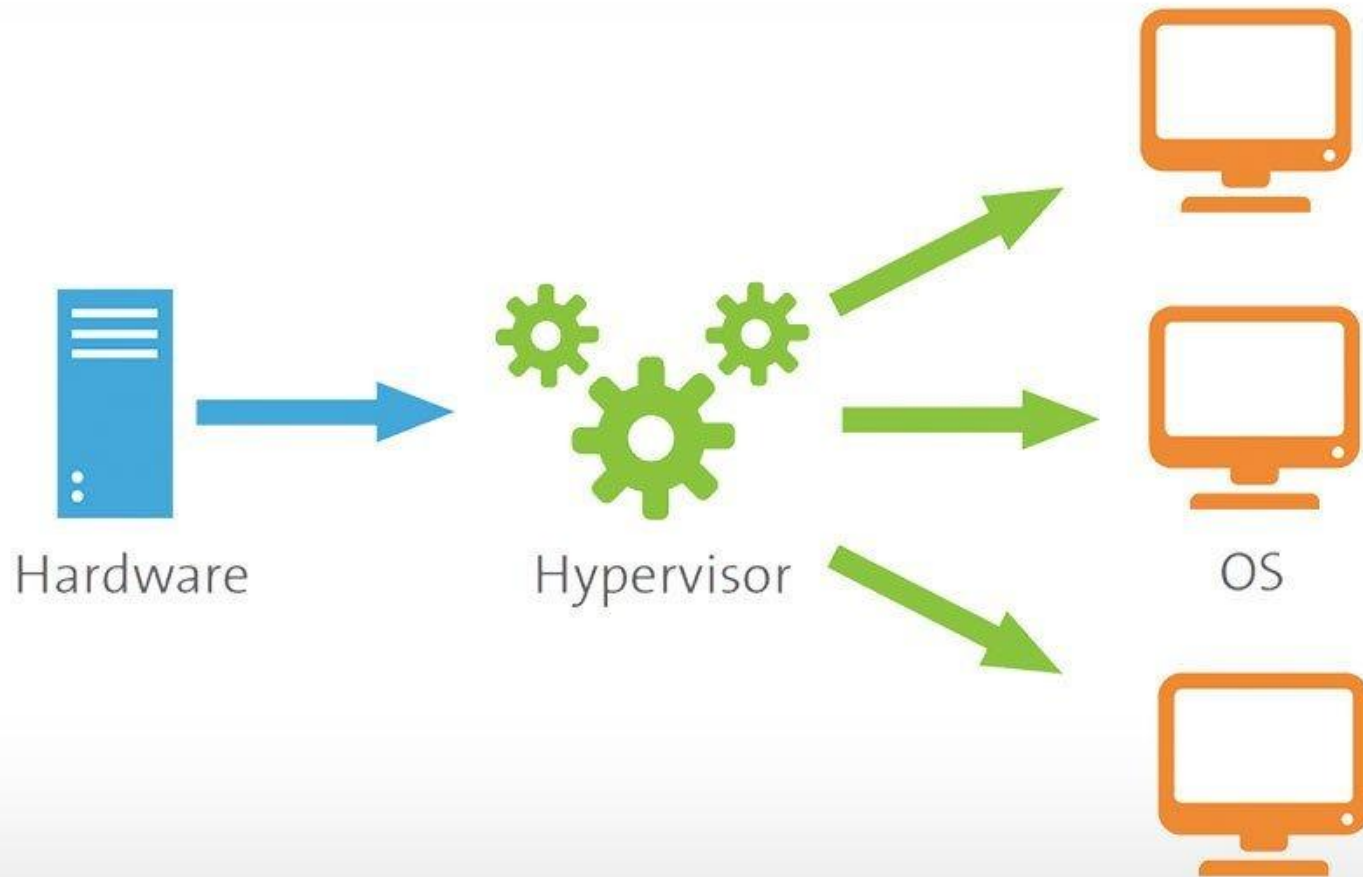
4. Better resource utilization: Resource utilization is the most important criteria to succeed in the IT business. IaaS ensures **better resource utilization** and provides **high ROI** for IaaS providers.

5. Supports Green IT: In IaaS, the **need of buying dedicated servers is eliminated** as single infrastructure is shared between multiple customers, thus reducing the number of servers to be purchased and hence the **power consumption that results in Green IT**.

Cons/dis-advantages:

1. Security issues: Since IaaS uses **virtualization** as the enabling technology, **hypervisors** play an important role. There are **many attacks that target the hypervisors** to compromise it. If hypervisors get compromised, then any VMs can be attacked easily. Most of the IaaS providers are not able to provide 100% security to the VMs and the data stored on the VMs.
2. Interoperability issues: There are **no common standards followed** among the different IaaS providers. It is very **difficult to migrate any VM from one IaaS provider to the other**. Sometimes, the customers might face the vendor lock-in problem.
3. Performance issues: IaaS is nothing but the consolidation of available resources from the distributed cloud servers. Here, **all the distributed servers are connected over the network**. **Latency** of the network plays an important role in deciding the performance. Because of latency issues, sometimes the VM contains issues with its performance.

A hypervisor is a kind of emulator; it is computer software, firmware or hardware that creates and runs virtual machines



Thank you

Q) Requirements for starting a data center. –
Internet, AC, Power, Fire suppression system, Staff.

Q) Can we rely on a single data center? Is it feasible to do it?

Q) Improving performance through load balancing.

Q) System and storage redundancy

Q) Utilizing cloud based NAS devices.

Q) Server types within an IaaS solution.