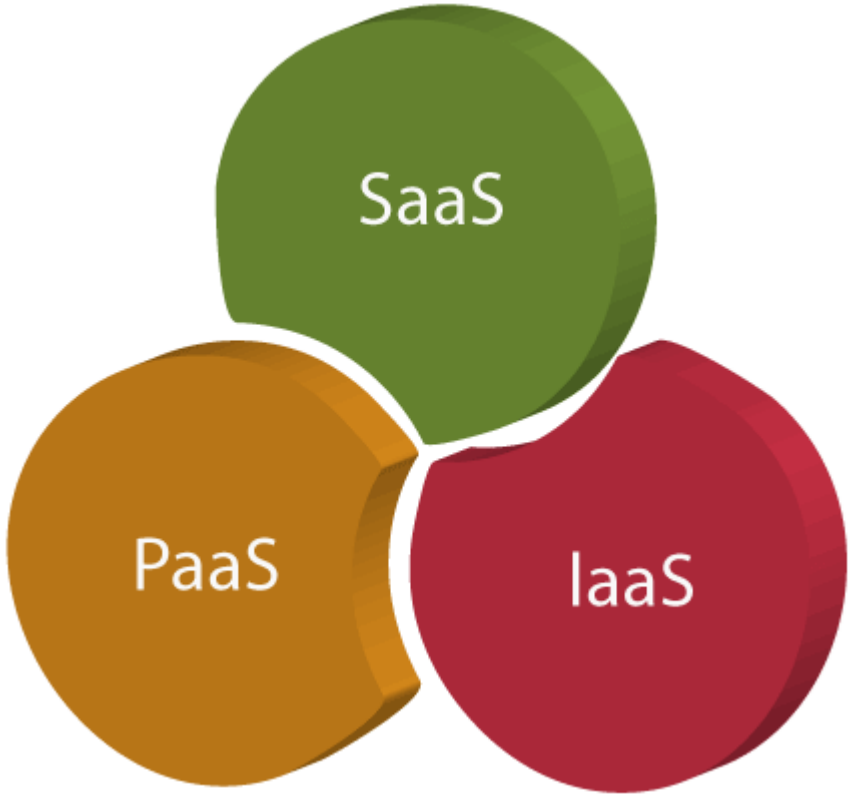
Introduction to Cloud Computing

Dr. Rastgoo

Cloud Service Models

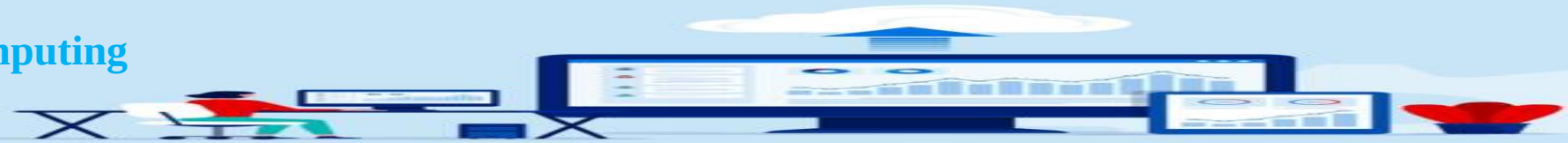
There are the following three types of cloud service models:

- Infrastructure as a Service (IaaS),
- Platform as a Service (PaaS),
- Software as a Service (SaaS).



Infrastructure as a Service (IaaS)

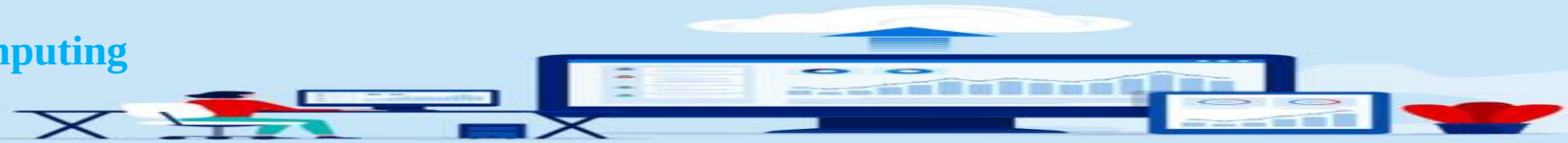
- IaaS is also known as Hardware as a Service (HaaS).
- It is a computing infrastructure managed over the internet.
- The main advantage of using IaaS is that it helps users to avoid the cost and complexity of purchasing and managing the physical servers.



Cloud Computing

Infrastructure as a Service (IaaS)

- It is one of the layers of the cloud computing platform.
- It allows customers to outsource their IT infrastructures, such as servers, networking, processing, storage, virtual machines, and other resources.
- Customers access these resources on the Internet using a pay-as-per use model.



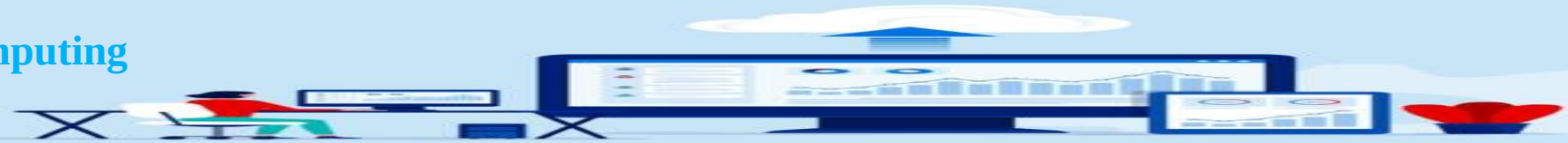
Cloud Computing

Infrastructure as a Service (IaaS)

- In traditional hosting services, IT infrastructure was rented out for a specific period of time, with pre-determined hardware configuration.

- The client paid for the configuration and time, regardless of the actual use.

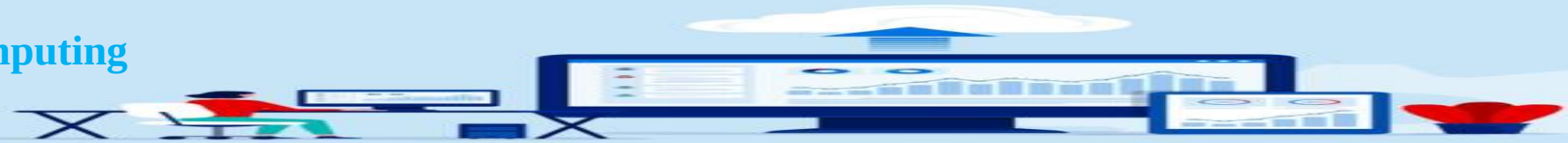
- With the help of the IaaS cloud computing platform layer, clients can dynamically scale the configuration to meet changing requirements and are billed only for the services actually used.



Infrastructure as a Service (IaaS)

- IaaS is offered in three models: public, private, and hybrid cloud.

- The private cloud implies that the infrastructure resides at the customer-premise. In the case of public cloud, it is located at the cloud computing platform vendor's data center, and the hybrid cloud is a combination of the two in which the customer selects the best of both public cloud or private cloud.



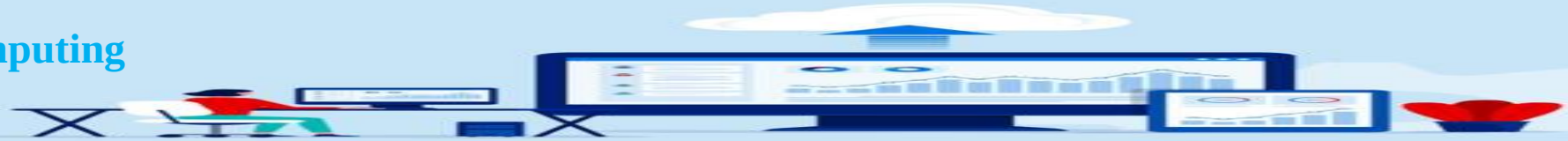
Cloud Computing

Infrastructure as a Service (IaaS)

- IaaS provider provides the following services:

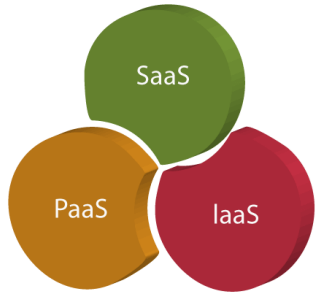
- **Compute**: Computing as a Service includes virtual central processing units and virtual main memory for the Vms that is provisioned to the end- users.

- **Storage**: IaaS provider provides back-end storage for storing files.



Cloud Computing

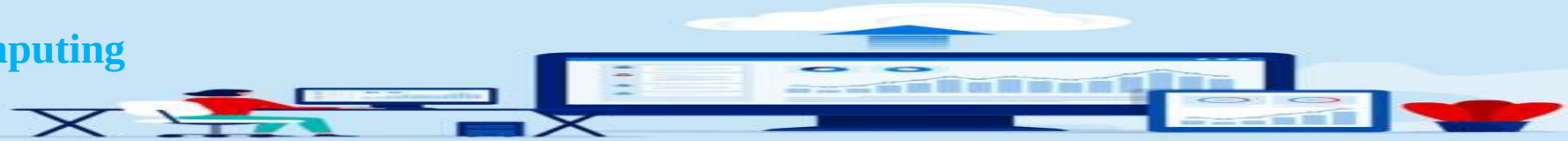
Infrastructure as a Service (IaaS)



- IaaS provider provides the following services -

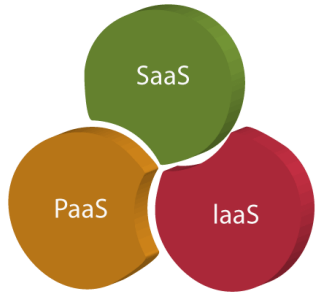
- **Network**: Network as a Service (NaaS) provides networking components such as routers, switches, and bridges for the Vms.

- **Load balancers**: It provides load balancing capability at the infrastructure layer.



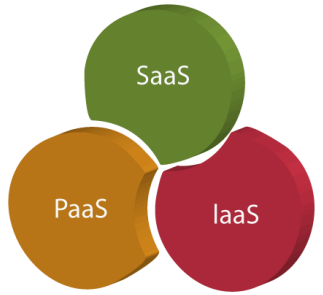
Cloud Computing

Advantages of IaaS cloud computing layer



- There are the following advantages of IaaS computing layer:
- **Shared infrastructure**: IaaS allows multiple users to share the same physical infrastructure.
- **Web access to the resources**: IaaS allows IT users to access resources over the internet.
- **Pay-as-per-use model**: IaaS providers provide services based on the pay-as-per-use basis. The users are required to pay for what they have used.

Advantages of IaaS cloud computing layer



- There are the following advantages of IaaS computing layer:
- **Focus on the core business**: IaaS providers focus on the organization's core business rather than on IT infrastructure.
- **On-demand scalability**: On-demand scalability is one of the biggest advantages of IaaS. Using IaaS, users do not worry about to upgrade software and troubleshoot the issues related to hardware components.

Disadvantages of IaaS cloud computing layer

- **Security**: Security is one of the biggest issues in IaaS. Most of the IaaS providers are not able to provide 100% security.

- **Maintenance & Upgrade**: Although IaaS service providers maintain the software, but they do not upgrade the software for some organizations.

- **Interoperability issues**: It is difficult to migrate VM from one IaaS provider to the other, so the customers might face problem related to vendor lock-in.

Some important point about IaaS cloud computing layer

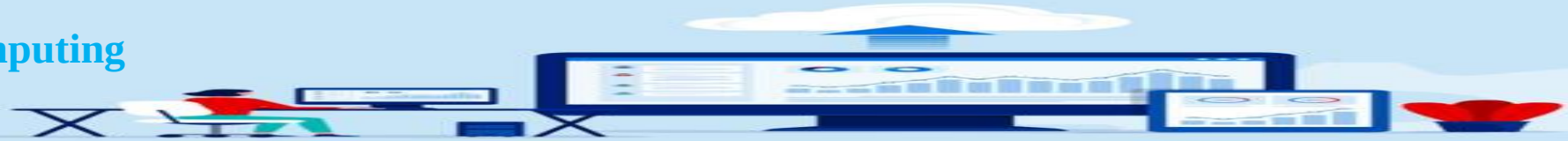
- IaaS cloud computing platform cannot replace the traditional hosting method, but it provides more than that, and each resource which are used are predictable as per the usage.

- IaaS cloud computing platform may not eliminate the need for an in-house IT department. It will be needed to monitor or control the IaaS setup.

Some important point about IaaS cloud computing layer

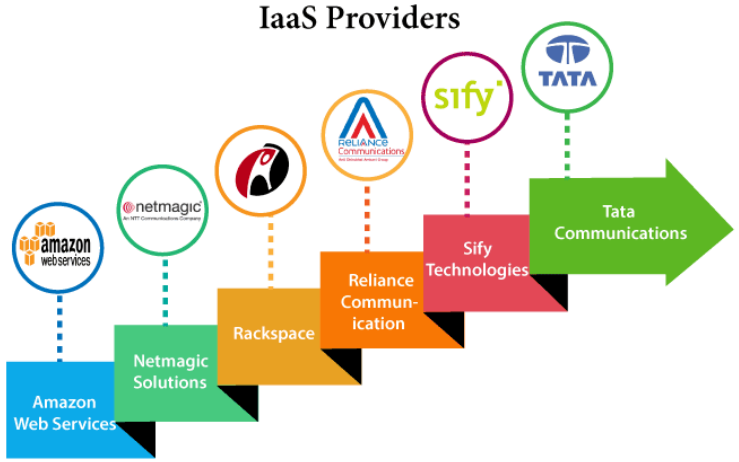
- Breakdowns at the IaaS cloud computing platform vendor's can bring your business to the halt stage. Assess the IaaS cloud computing platform vendor's stability and finances. Make sure that SLAs (i.e., Service Level Agreement) provide backups for data, hardware, network, and application failures.

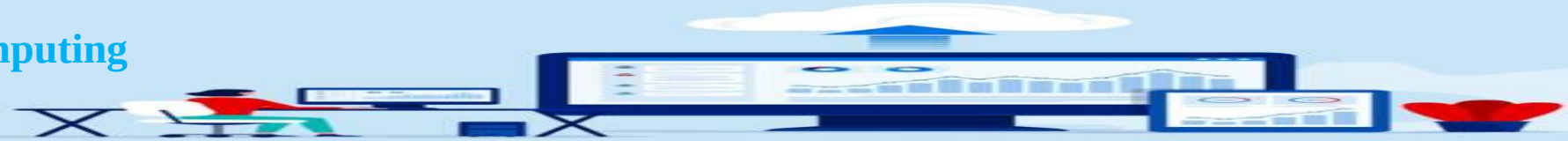
- The IaaS cloud computing platform vendor can get access to your sensitive data. So, engage with credible companies or organizations. Study their security policies and precautions.



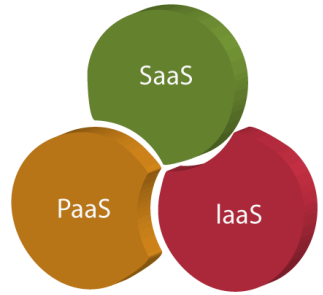
Top Iaas Providers who are providing IaaS cloud computing platform

IaaS Vendor	Iaas Solution	Details
Amazon Web Services	Elastic, Elastic Compute Cloud (EC2) MapReduce, Route 53, Virtual Private Cloud, etc.	The cloud computing platform pioneer, Amazon offers auto scaling, cloud monitoring, and load balancing features as part of its portfolio.
Netmagic Solutions	Netmagic IaaS Cloud	Netmagic runs from data centers in Mumbai, Chennai, and Bangalore, and a virtual data center in the United States. Plans are underway to extend services to West Asia.
Rackspace	Cloud servers, cloud files, cloud sites, etc.	The cloud computing platform vendor focuses primarily on enterprise-level hosting services.
Reliance Communications	Reliance Internet Data Center	RIDC supports both traditional hosting and cloud services, with data centers in Mumbai, Bangalore, Hyderabad, and Chennai. The cloud services offered by RIDC include IaaS and SaaS.

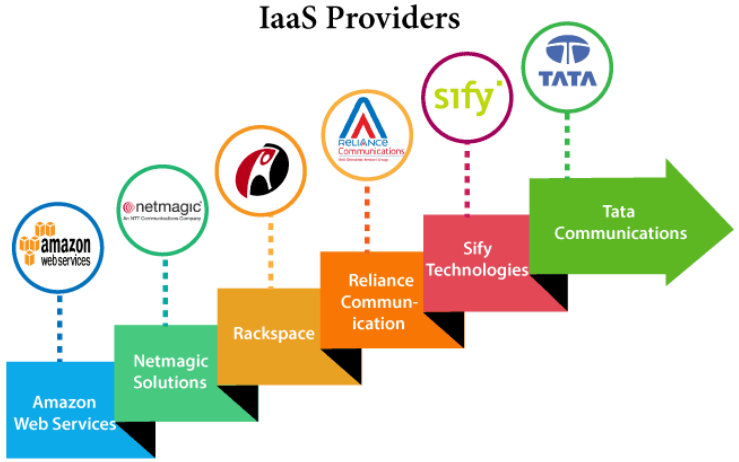


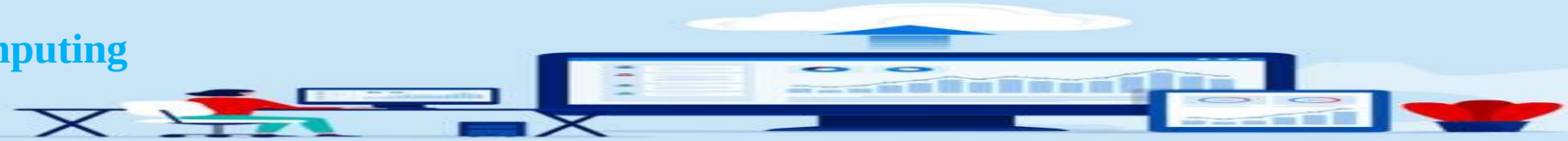


Top Iaas Providers who are providing IaaS cloud computing platform



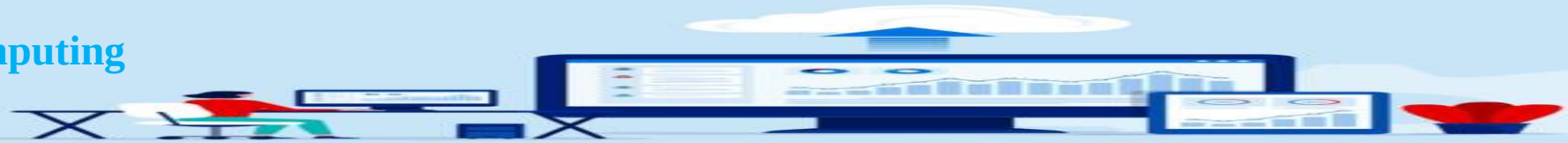
IaaS Vendor	Iaas Solution	Details
Sify Technologies	Sify IaaS	Sify's cloud computing platform is powered by HP's converged infrastructure. The vendor offers all three types of cloud services: IaaS, PaaS, and SaaS.
Tata Communications	InstaCompute	InstaCompute is Tata Communications' IaaS offering. InstaCompute data centers are located in Hyderabad and Singapore, with operations in both countries.





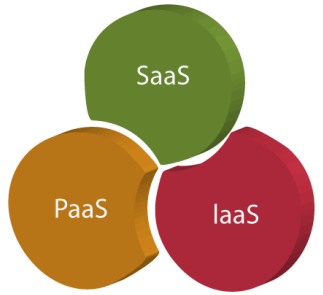
Characteristics of IaaS

- There are the following characteristics of IaaS -
- Resources are available as a service,
- Services are highly scalable,
- Dynamic and flexible,

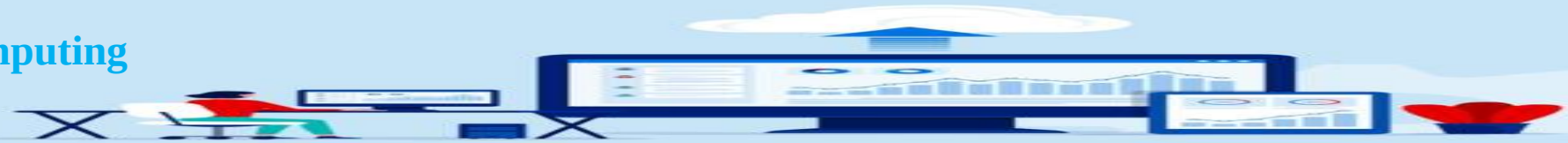


Cloud Computing

Characteristics of IaaS



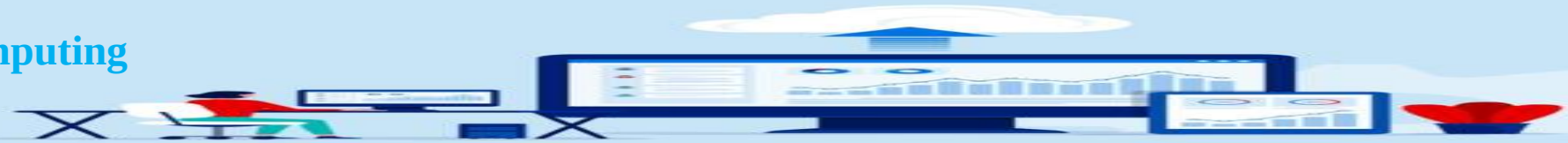
- There are the following characteristics of IaaS -
- GUI and API-based access,
- Automated administrative tasks,
- Example: DigitalOcean, Linode, Amazon Web Services (AWS), Microsoft Azure, Google Compute Engine (GCE), Rackspace, and Cisco Metacloud.



Cloud Computing

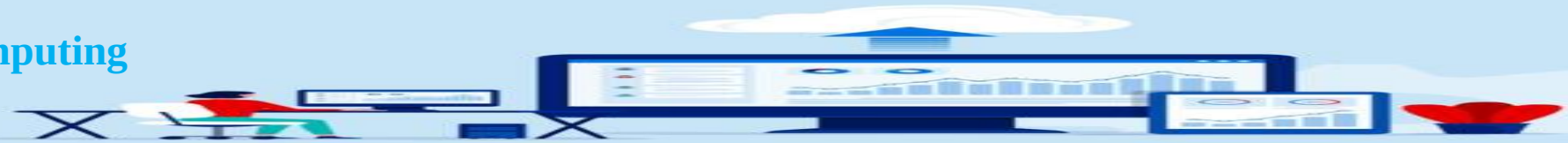
Platform as a Service (PaaS)

- PaaS cloud computing platform is created for the programmer to develop, test, run, and manage the applications.



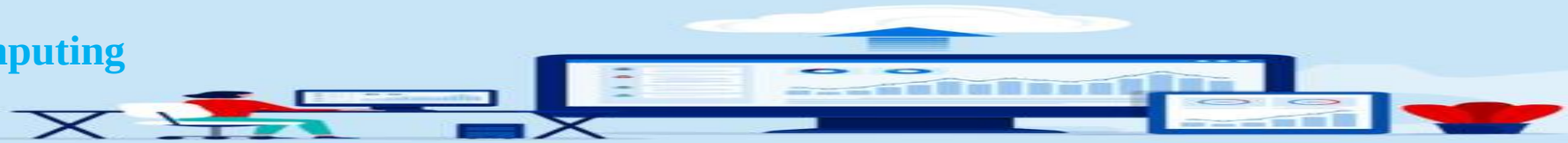
Characteristics of PaaS

- There are the following characteristics of PaaS:
- Accessible to various users via the same development application.
- Integrates with web services and databases.
- Builds on virtualization technology, so resources can easily be scaled up or down as per the organization's need.



Characteristics of PaaS

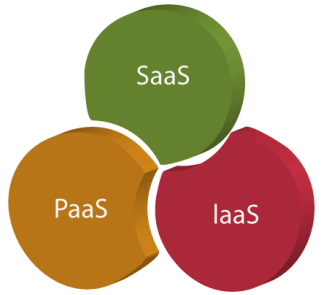
- There are the following characteristics of PaaS -
- Support multiple languages and frameworks.
- Provides an ability to "Auto-scale".
- Example: AWS Elastic Beanstalk, Windows Azure, Heroku, Force.com, Google App Engine, Apache Stratos, Magento Commerce Cloud, and OpenShift.



Software as a Service (SaaS)

- SaaS is also known as "On-Demand Software".
- It is a software distribution model in which services are hosted by a cloud service provider.
- These services are available to end-users over the internet so, the end-users do not need to install any software on their devices to access these services.

SaaS Services

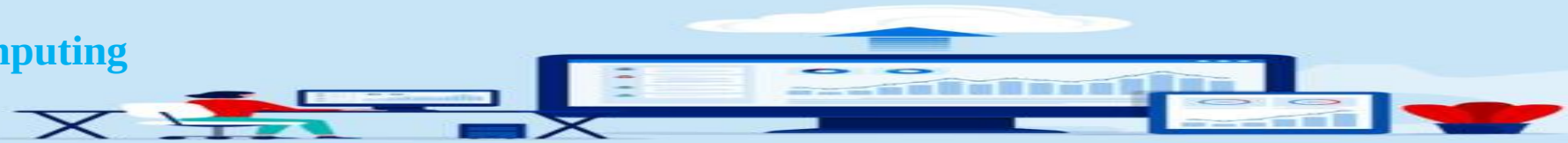


- There are the following services provided by SaaS providers:

- Business Services: SaaS Provider provides various business services to start-up the business. The SaaS business services include ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), billing, and sales.

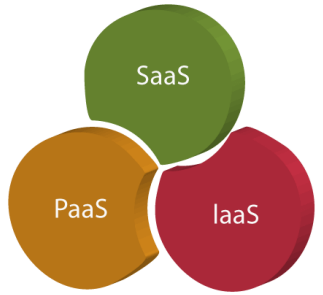
Enterprise resource planning is the integrated management of main business processes, often in real time and mediated by software and technology.

Customer relationship management is a process in which a business or other organization administers its interactions with customers, typically using data analysis to study large amounts of information.



Cloud Computing

SaaS Services



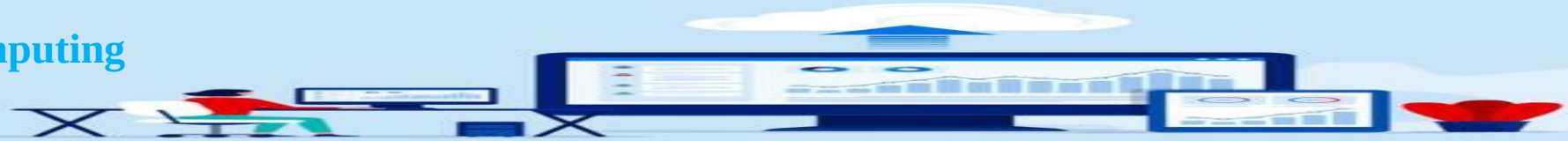
- There are the following services provided by SaaS providers:
- Document Management: SaaS document management is a software application offered by a third party (SaaS providers) to create, manage, and track electronic documents.
- Example: Slack, Samepage, Box, and Zoho Forms.

SaaS Services

- There are the following services provided by SaaS providers:

- Social Networks: As we all know, social networking sites are used by the general public, so social networking service providers use SaaS for their convenience and handle the general public's information.

- Mail Services: To handle the unpredictable number of users and load on e-mail services, many e-mail providers offering their services using SaaS.



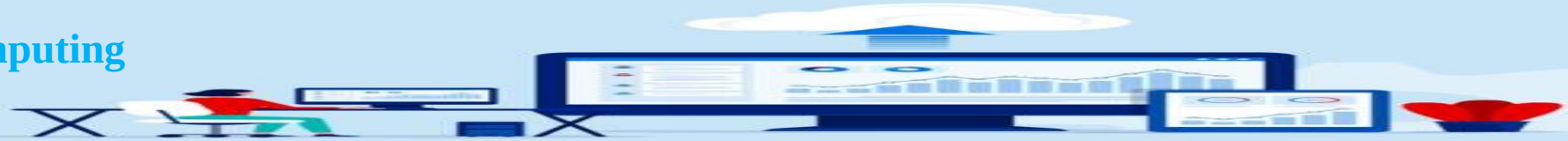
Cloud Computing

Advantages of SaaS cloud computing layer

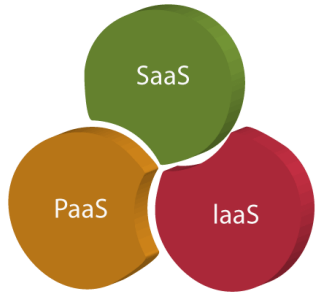
- 1) SaaS is easy to buy: SaaS pricing is based on a monthly fee or annual fee subscription, so it allows organizations to access business functionality at a low cost, which is less than licensed applications.

> Annual Subscription Fee means the annual amount payable by Members which may be subject to increases as determined from time to time in respect of any or all categories of Membership.

- Unlike traditional software, which is sold as a licensed based with an up-front cost (and often an optional ongoing support fee), SaaS providers are generally pricing the applications using a subscription fee, most commonly a monthly or annually fee.



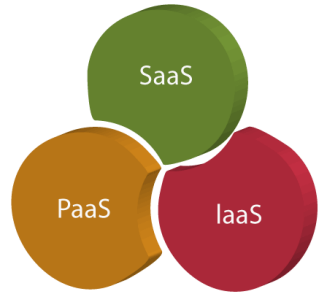
Advantages of SaaS cloud computing layer



- One to Many: SaaS services are offered as a one-to-many model means a single instance of the application is shared by multiple users.

- Less hardware required for SaaS: The software is hosted remotely, so organizations do not need to invest in additional hardware.

Advantages of SaaS cloud computing layer



- Low maintenance required for SaaS: Software as a service removes the need for installation, set-up, and daily maintenance for the organizations. The initial set-up cost for SaaS is typically less. SaaS vendors are pricing their applications based on some usage parameters, such as a number of users using the application. So SaaS does easy to monitor and automatic updates.

- No special software or hardware versions required: All users will have the same version of the software and typically access it through the web browser. SaaS reduces IT support costs by outsourcing hardware and software maintenance and support to the IaaS provider.

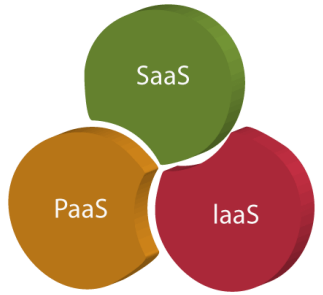
Advantages of SaaS cloud computing layer

- Multidevice support: SaaS services can be accessed from any device such as desktops, laptops, tablets, phones, and thin clients.

- API Integration: SaaS services easily integrate with other software or services through standard APIs.

- No client-side installation: SaaS services are accessed directly from the service provider using the internet connection, so do not need to require any software installation.

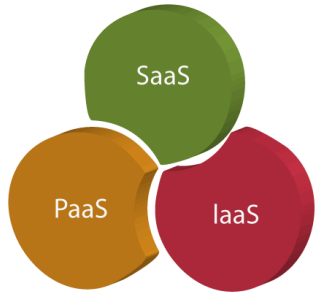
Disadvantages of SaaS cloud computing layer



- Security: Actually, data is stored in the cloud, so security may be an issue for some users. However, cloud computing is not more secure than in-house deployment.

- Latency issue: Since data and applications are stored in the cloud at a variable distance from the end-user, there is a possibility that there may be greater latency when interacting with the application compared to local deployment. Therefore, the SaaS model is not suitable for applications whose demand response time is in milliseconds.

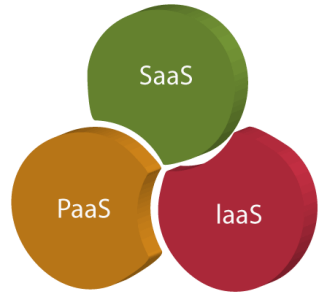
Disadvantages of SaaS cloud computing layer

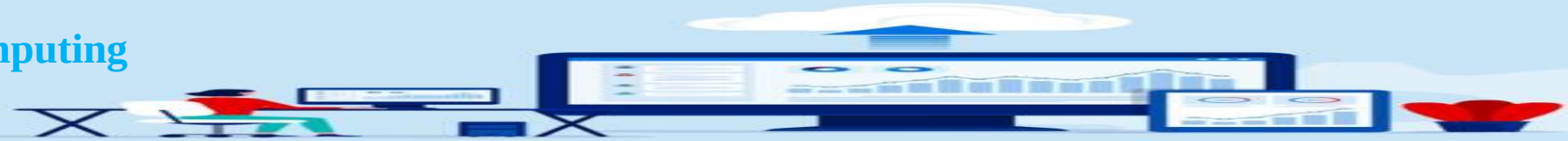


- Total Dependency on Internet: Without an internet connection, most SaaS applications are not usable.

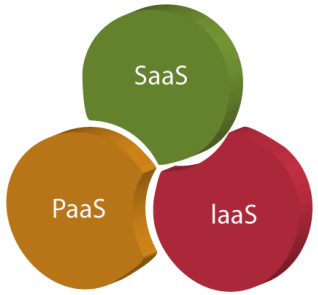
- Switching between SaaS vendors is difficult: Switching SaaS vendors involves the difficult and slow task of transferring the very large data files over the internet and then converting and importing them into another SaaS also.

Popular SaaS Providers

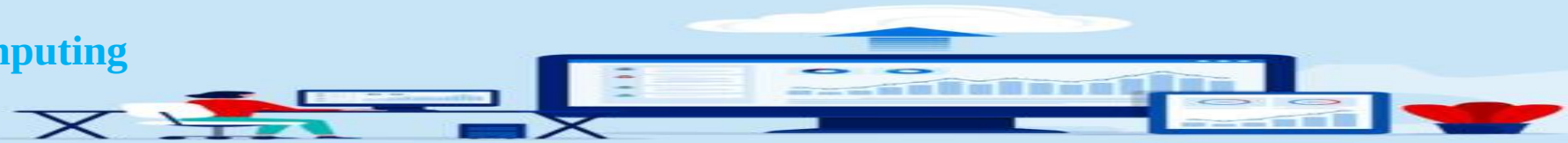




Popular SaaS Providers

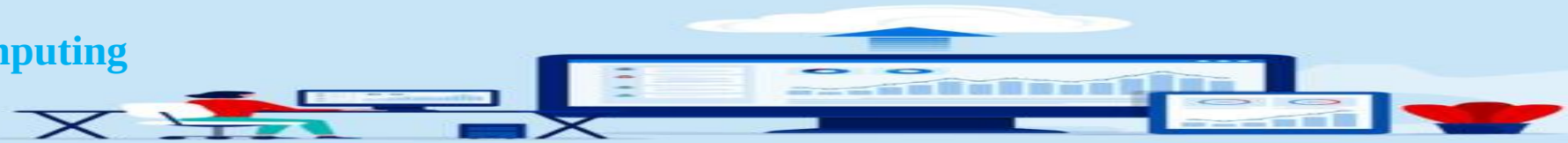


Provider	Services
Salseforce.com	On-demand CRM solutions
Microsoft Office 365	Online office suite
Google Apps	Gmail, Google Calendar, Docs, and sites
NetSuite	ERP, accounting, order management, CRM, Professionals Services Automation (PSA), and e-commerce applications.
GoToMeeting	Online meeting and video-conferencing software
Constant Contact	E-mail marketing, online survey, and event marketing
Oracle CRM	CRM applications
Workday, Inc	Human capital management, payroll, and financial management.

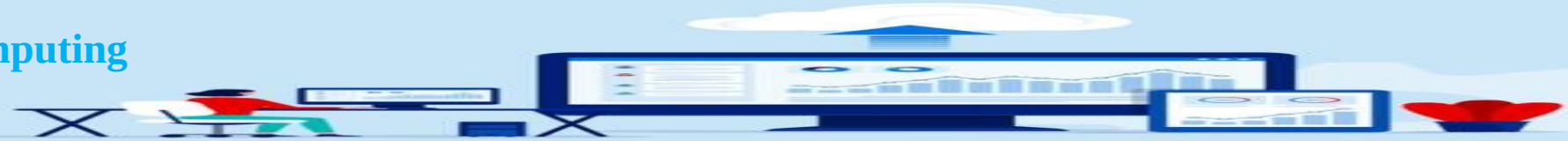


Comparison

IaaS	Paas	SaaS
It provides a virtual data center to store information and create platforms for app development, testing, and deployment.	It provides virtual platforms and tools to create, test, and deploy apps.	It provides web software and apps to complete business tasks.
It provides access to resources such as virtual machines, virtual storage, etc.	It provides runtime environments and deployment tools for applications.	It provides software as a service to the end-users.
It is used by network architects.	It is used by developers.	It is used by end users.
IaaS provides only Infrastructure.	PaaS provides Infrastructure+Platform.	SaaS provides Infrastructure+Platform +Software.



Cloud Computing



Cloud Computing