Welcome to:

Introduction to cloud computing

Unit Objectives

After completing this unit, you should be able to:

- Differentiate between virtualization and cloud
- Define cloud computing and explain its benefits
- Identify cloud architectures and cloud service models
- Understand the relationship between grid and cloud computing

Overview of SLA

- Think of an electric company and the services it delivers to customers. An electric company maintains its own electric power station and the infrastructure to deliver electricity to the customers.

- The electricity is delivered at a utility value, i.e. it comes with a description of the type of service that is being delivered to customers. i.e. 220V rating and a 50Hz frequency.

- Based on this service metaphor, we'll extend and define our definition of Cloud Computing. Like an electric power station, a cloud computing framework attempts to deliver Information Technology as a utility to business.

- Cloud provides a mechanism for delivering IT as a service to business with the following characteristics:
  - You do not need to own a data center to use hardware or software services.
  - You have an option to subscribe or unsubscribe to cloud services.
  - The cloud service provider will provide you an SLA for the services defined in the service catalog.
  - The cloud services could be accessed using a standard interface.
  - The cloud services are available on demand.

Operating system and virtualization

- Existing role of the operating system

- Virtualization

- Virtualization allows transformation of a server for multiple applications.

Figure: Operating system and virtualization

Virtual machines

- Virtual machines run on any hardware configuration.
- Virtual Machines Can Run on a Shared Infrastructure.

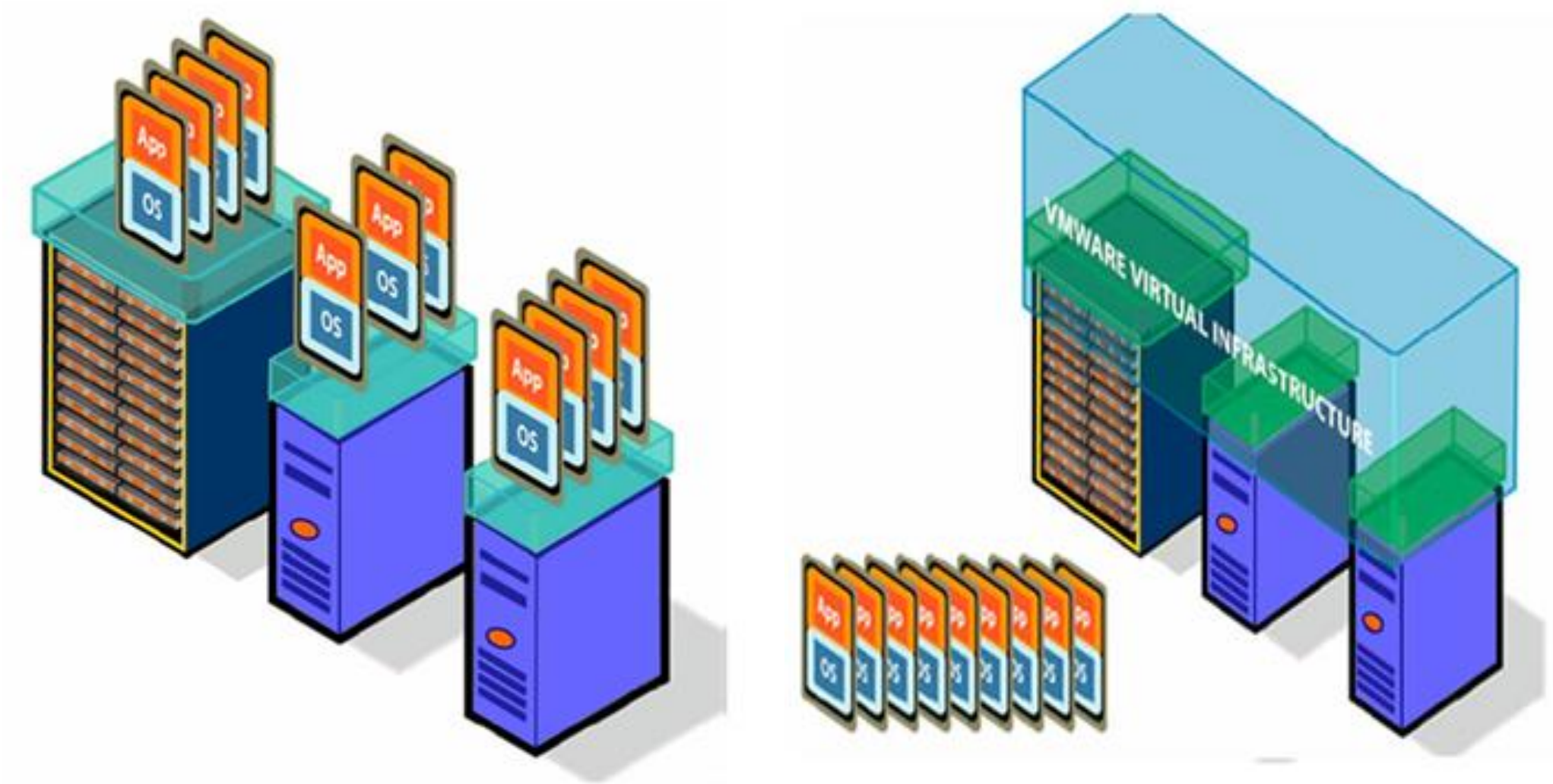
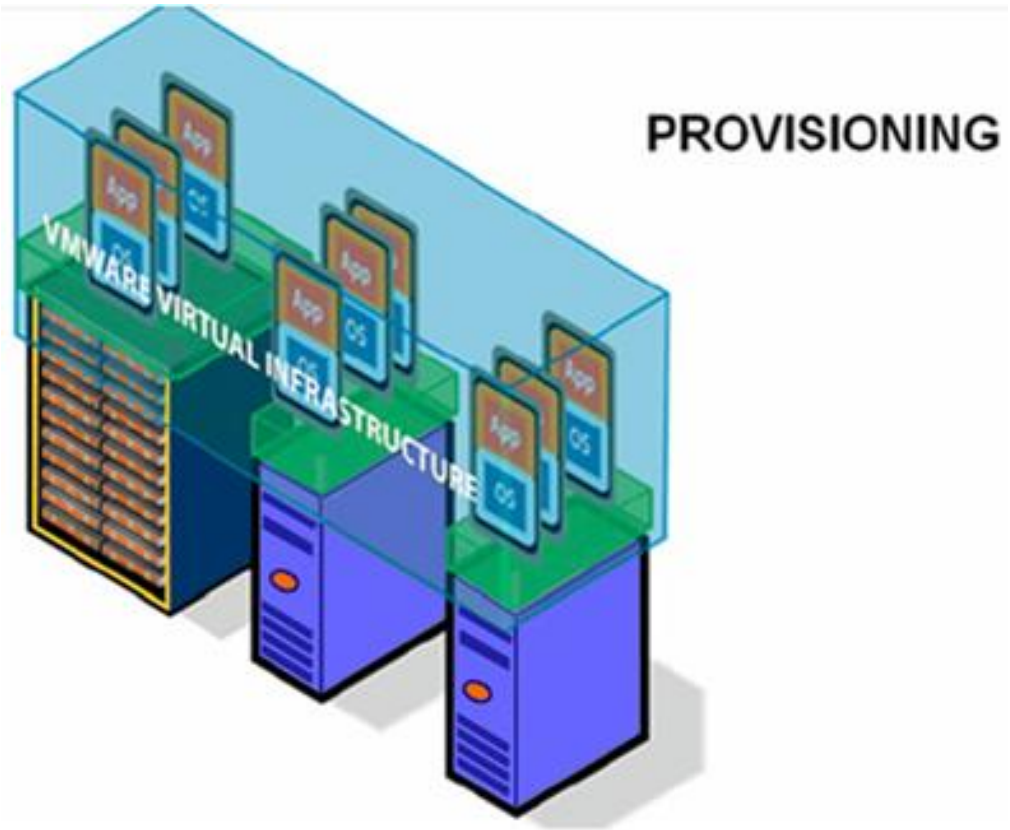
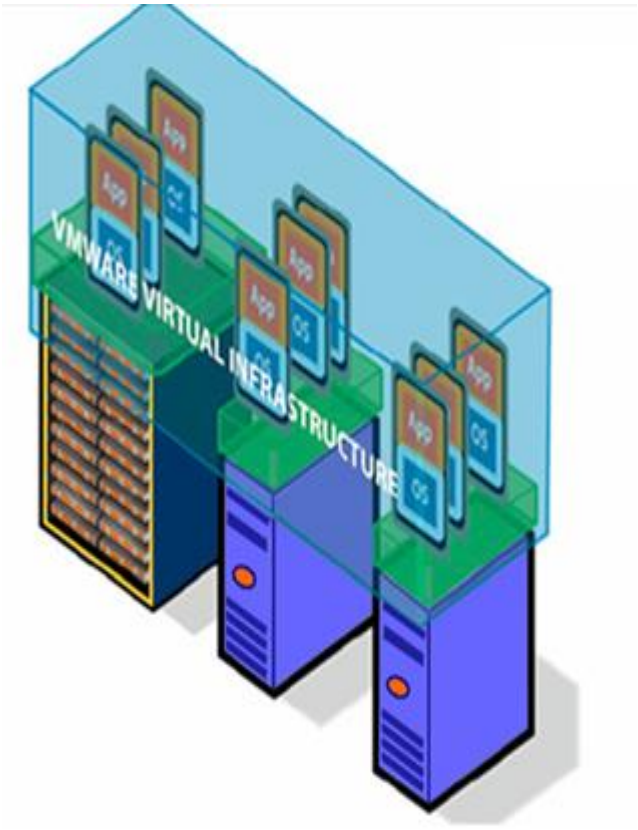


Figure: Virtual machines

Virtual infrastructure

- A single software can span different hardware components.
- Virtualization allows moving applications without service interruption.





- Figure: Virtual infrastructure 1
- Figure: Virtual infrastructure 2

Overview of Virtualization and Cloud

- Virtualization and Cloud are sometimes confused as one technology in certain scenarios.

- Virtualization and Cloud are two distinct technologies. However, in certain aspects, these are related to each other.

Virtualization technology

- Virtualization is a technology without no direct business benefits other than saving cost to the business. On the other hand, Cloud connects a business requirement to technology and can be used to map and fulfill a business requirement.

- A virtualized infrastructure has limited automation built-in. However, Cloud-based infrastructure is built around complete automation and orchestration.
  - The elasticity and the flexibility in the Cloud are built on the foundation of Virtualization.
  - It is recommended and an industry practice to first consolidate a physical infrastructure using Virtualization before moving in for a Cloud Transformation.
  - Virtualization and Cloud both bring saving to the business due to consolidation and the flexibility and increased manageability.

Areas and relative savings

Parameter	Virtualization	Cloud
Utilization	Typically 60-70%	Typically 60-70%. However, it is possible to share resources across pools (physical hosts) and maintain the utilization levels. Spare capacity available on demand
Provisioning	Manual, 1 day	Automatic, On-demand within minutes or few hours
Monitoring	Comparative ease in monitoring using automated tools. However, need manual intervention to take care of any failures	Typically automated. No manual intervention required due to advanced orchestration capabilities built into the cloud
Sizing	Easier to resize. However, manual intervention required to resize for new requirements	On-demand automatic rescaling of the resources
Staff for Administration	Reduced number of Full Time employees	Typical reduction in number of employees required to manage the infrastructure. On an average, FTE reduction is generally in the range of 1 administrator for 400 cloud instances
Cost	Initial hardware cost reduced due to sharing of hardware assets and due to increased utilization	In most cases, the initial hardware cost is almost negligible. There'll be running cost on a monthly basis.
Optimization	Easy to share resources and re-balance loads on the virtual machines on the same host. However, re-balancing across physical hosts require advanced features and planned downtime	Easy to share resources and re-balance loads across resource pools. No manual intervention required to move resources or resize resources for an application.

Figure: Areas and relative savings

What is cloud computing?

- Cloud “is an emerging consumption and delivery model form any IT-based services, in which the user sees only the service and has no need to know anything about the technology or implementation”.

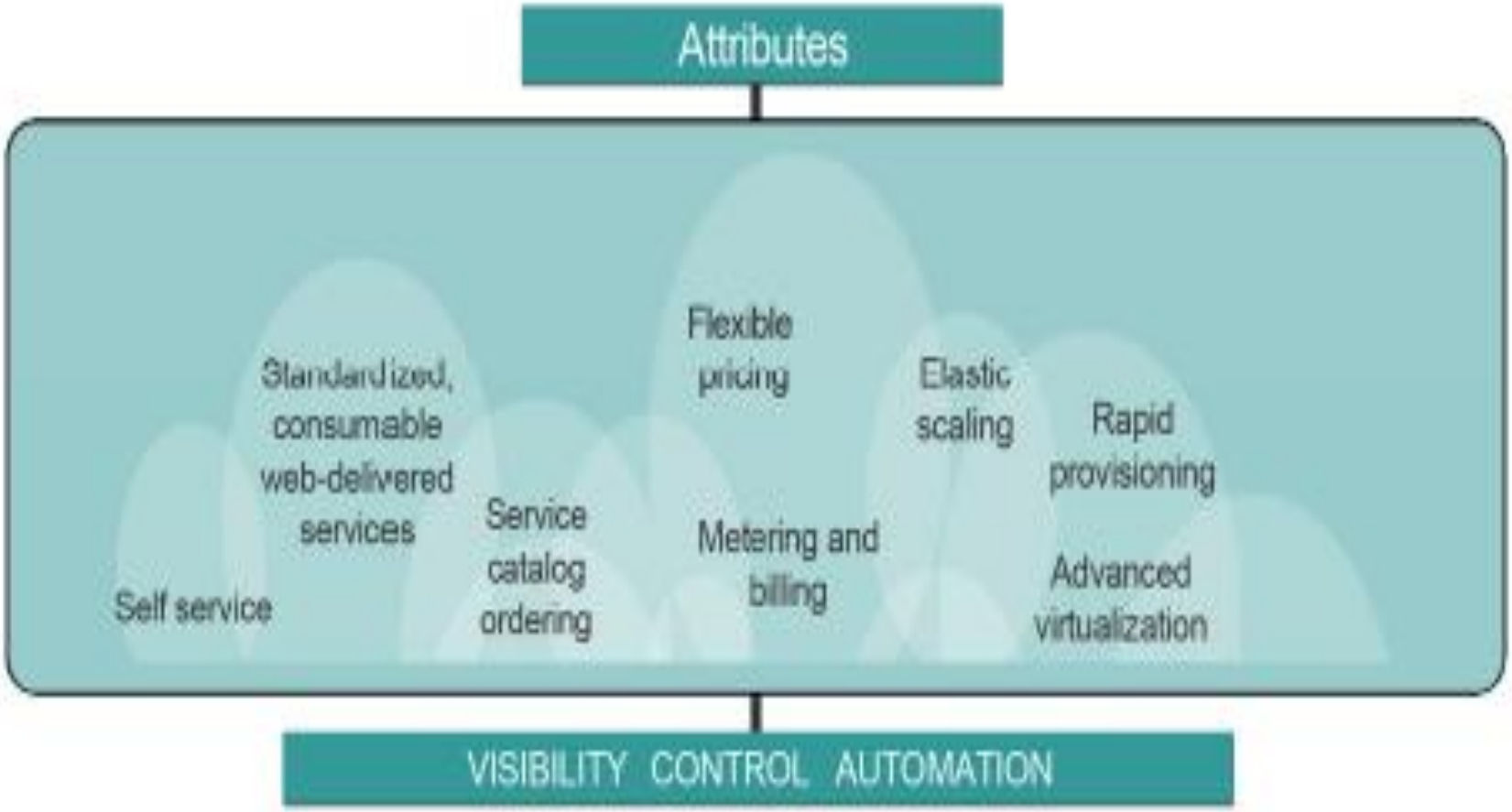


Figure: What is cloud computing?

Cloud computing and end user

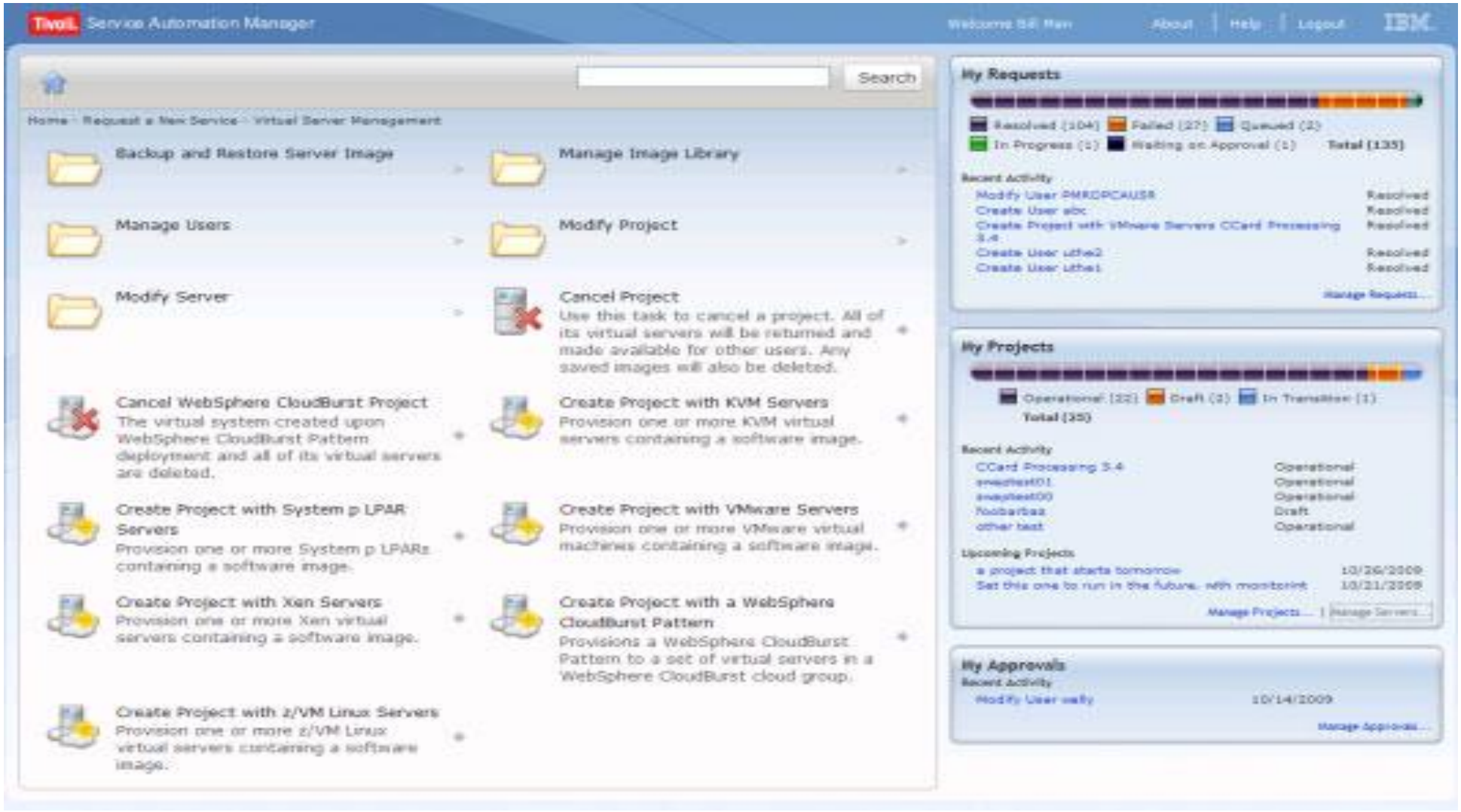
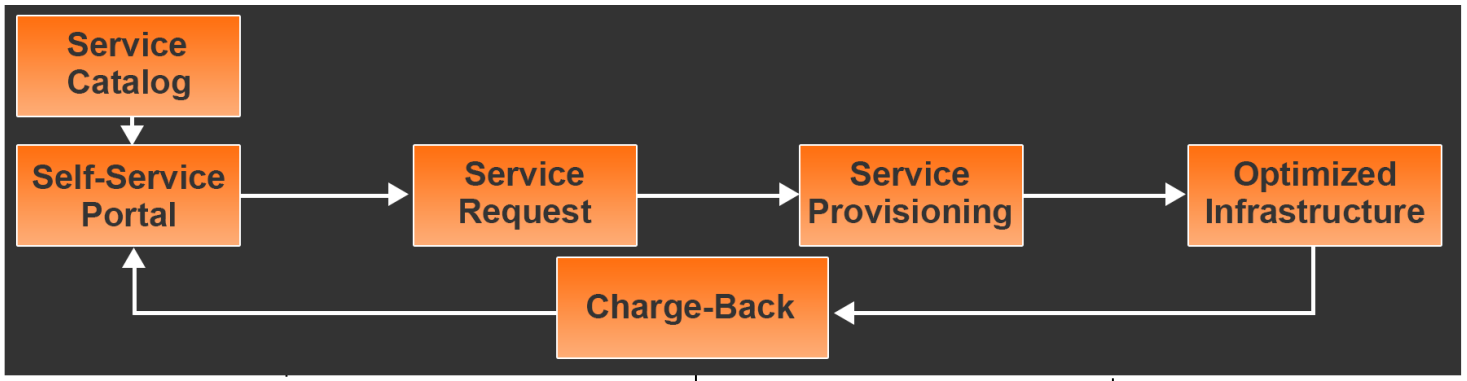


Figure: Cloud computing and end user

Cloud computing solution components

- A cloud computing solution is the end-to-end integration of components, each bringing a specific value to the whole



User/IT self service
Improving customer satisfaction and responsiveness

Standardized delivery models
Utilize service catalog of standard components.

Capacity management
Reservation with connection to platform configuration

Controlled anticipation
Validated change requests with automated approval workflow process

Low or no touch deployment
Drive down operational costs and manage thru full life-cycle

Deploy new systems faster
Shorter leads times, quicker to market, agility, competitive advantage

Improve server and power utilization
Cost avoidance on new hardware, energy and cooling costs

Consistency of configuration
Driving compliance, easier support and auditing, consistent security.

Figure: Cloud computing solution components

What is different about cloud computing?

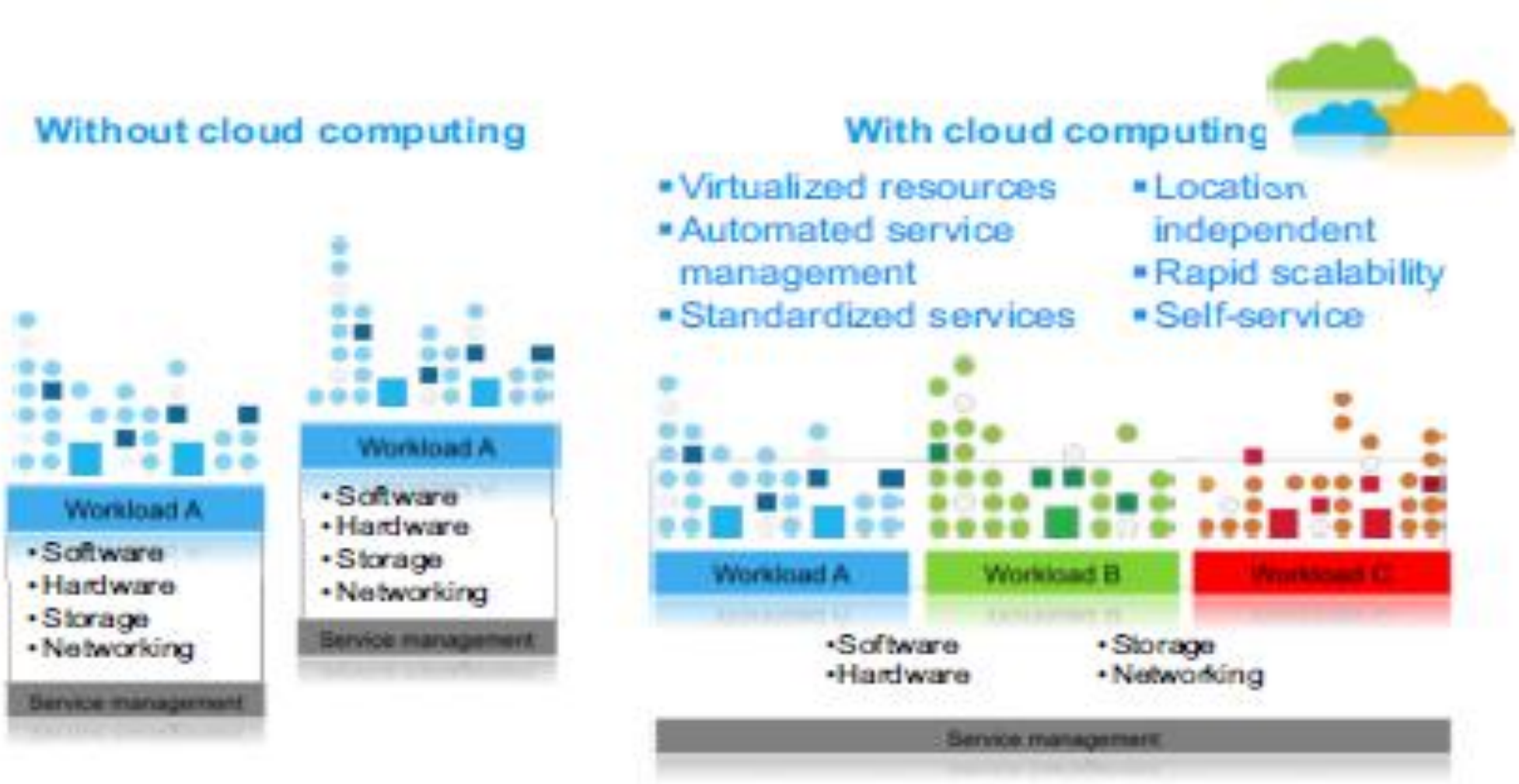


Figure: What is different about cloud computing?

Cloud delivery and deployment models

Deployment Models:

- Private cloud
- Public cloud
- Hybrid cloud

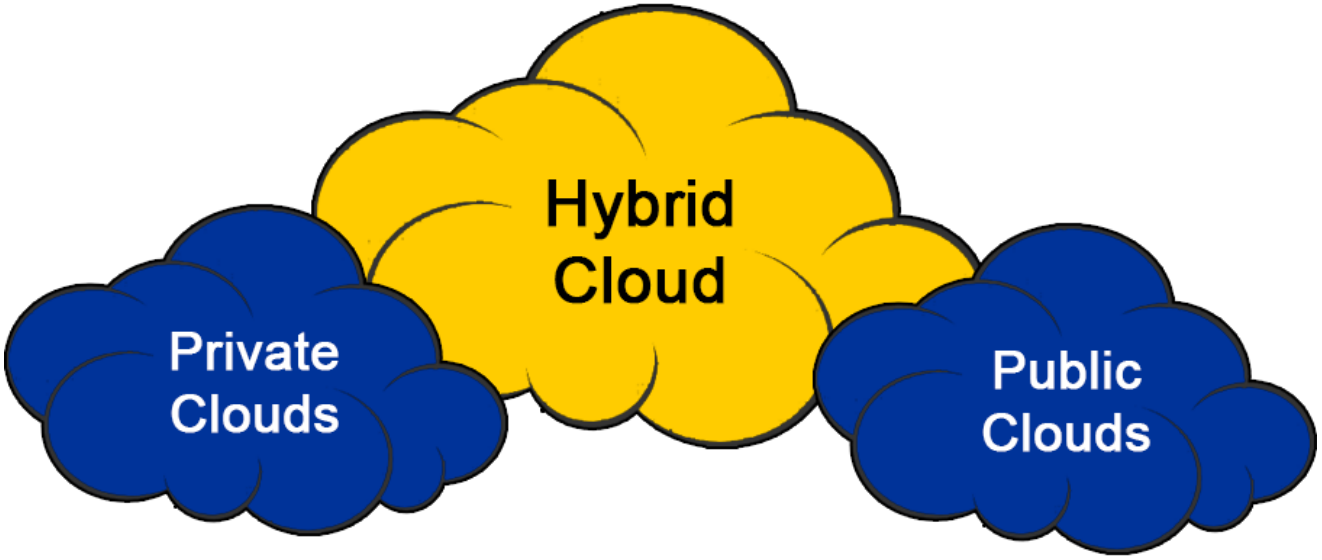


Figure: Cloud delivery and deployment models

Delivery models

- IaaS (Infrastructure as a Service).
- PaaS (Platform as a Service).
- SaaS (Software as a Service).
- BPaaS (Business Process as a Service).

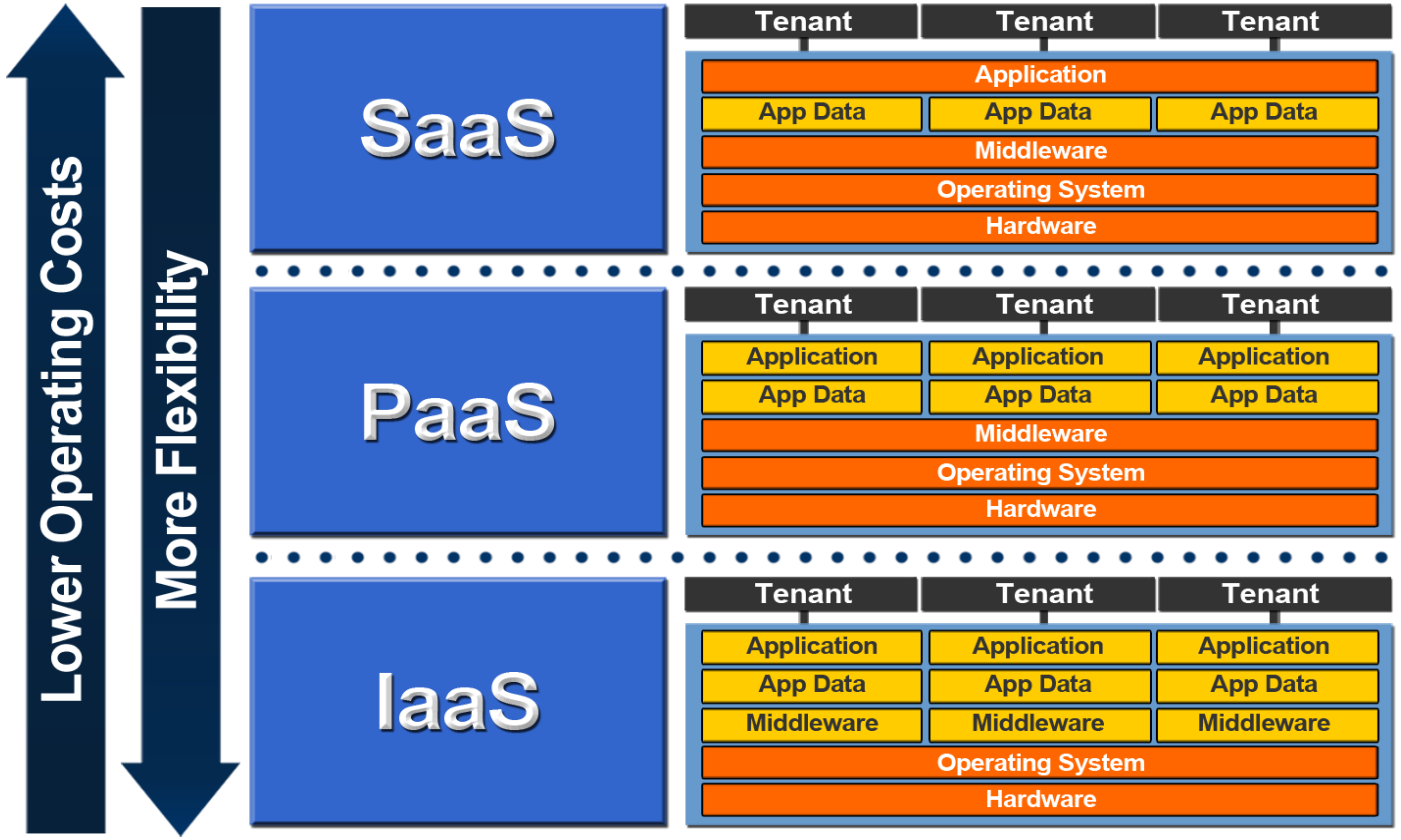
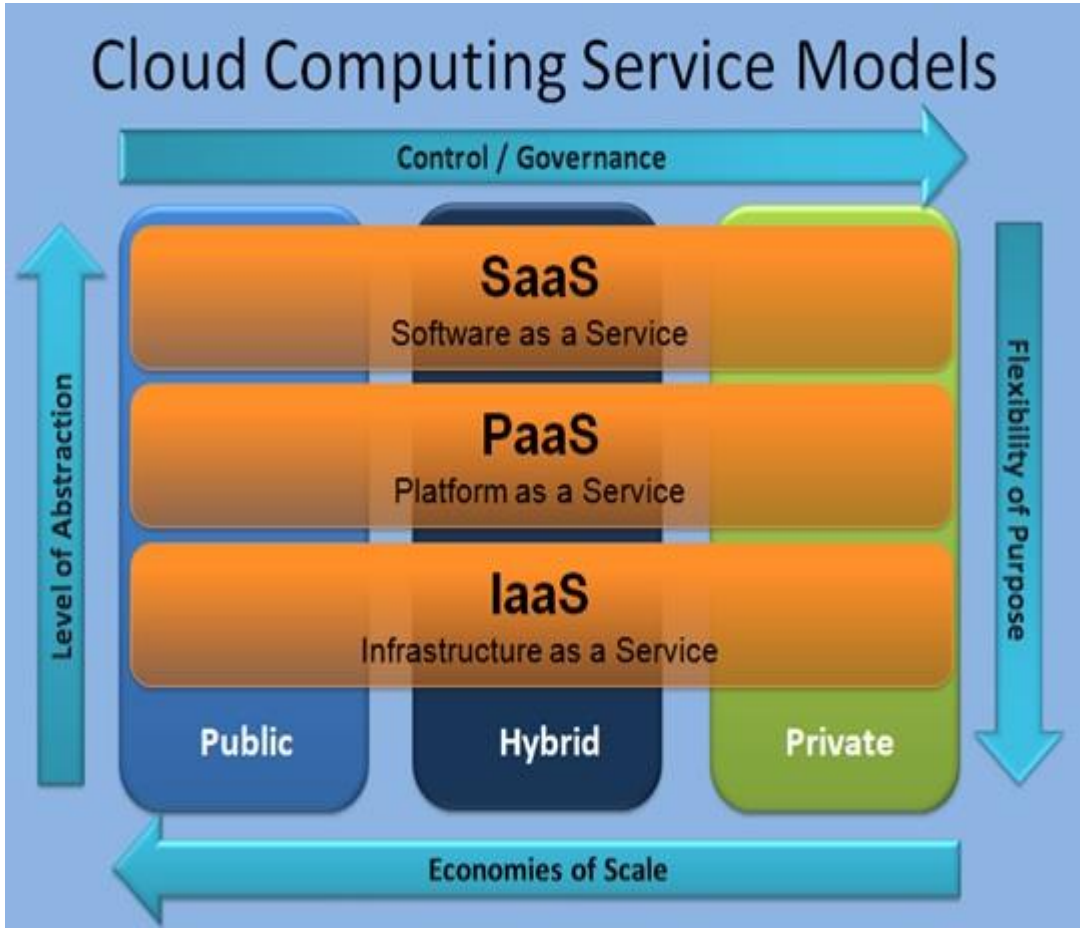


Figure: Delivery models

Cloud service models

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



- Figure: Cloud service models

Cloud transformation roadmap

Figure: Cloud transformation roadmap

History of cloud computing

Figure: History of cloud computing

Client-server model: Evolution

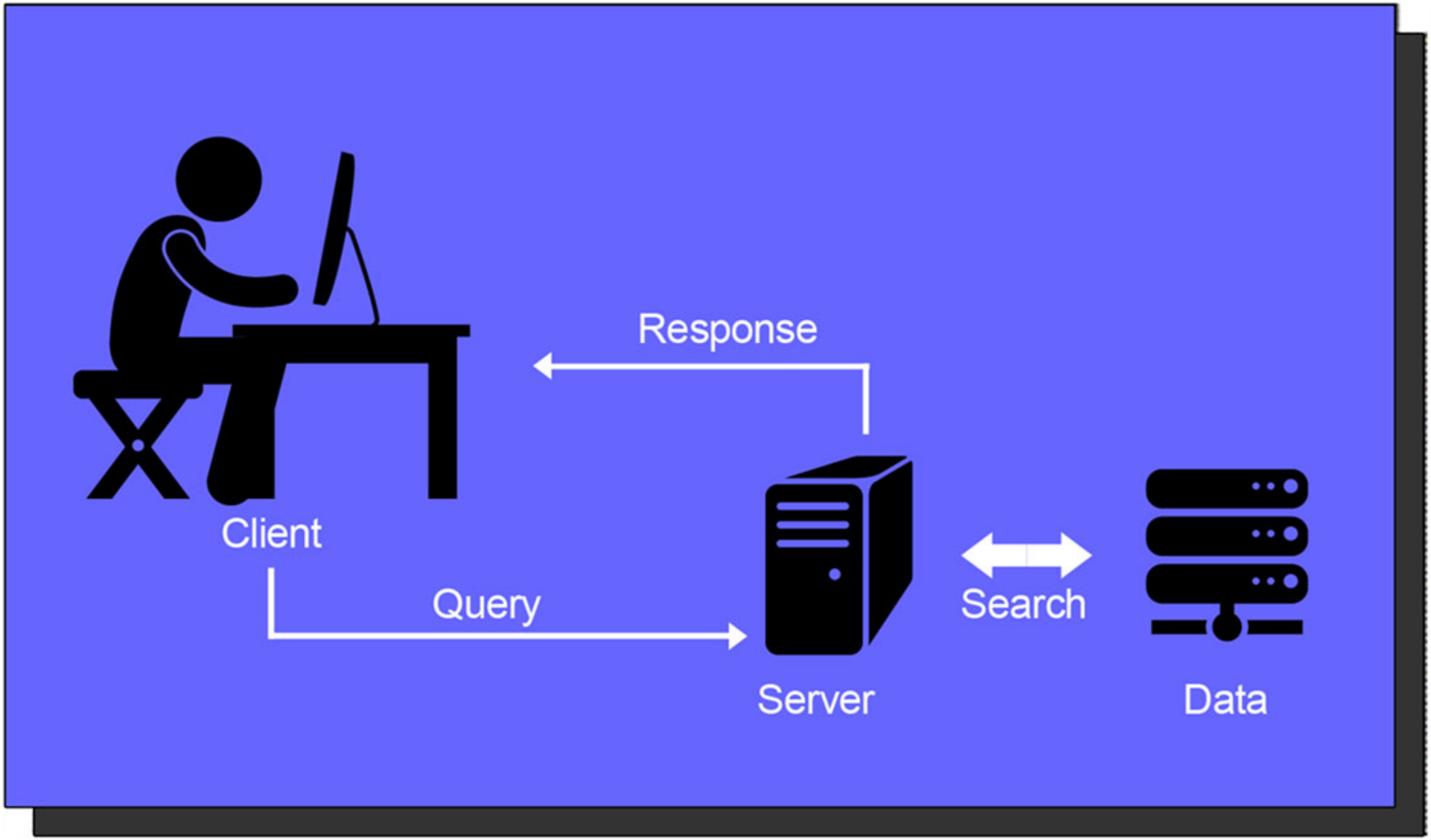


Figure: Client-server model - evolution

Grid computing

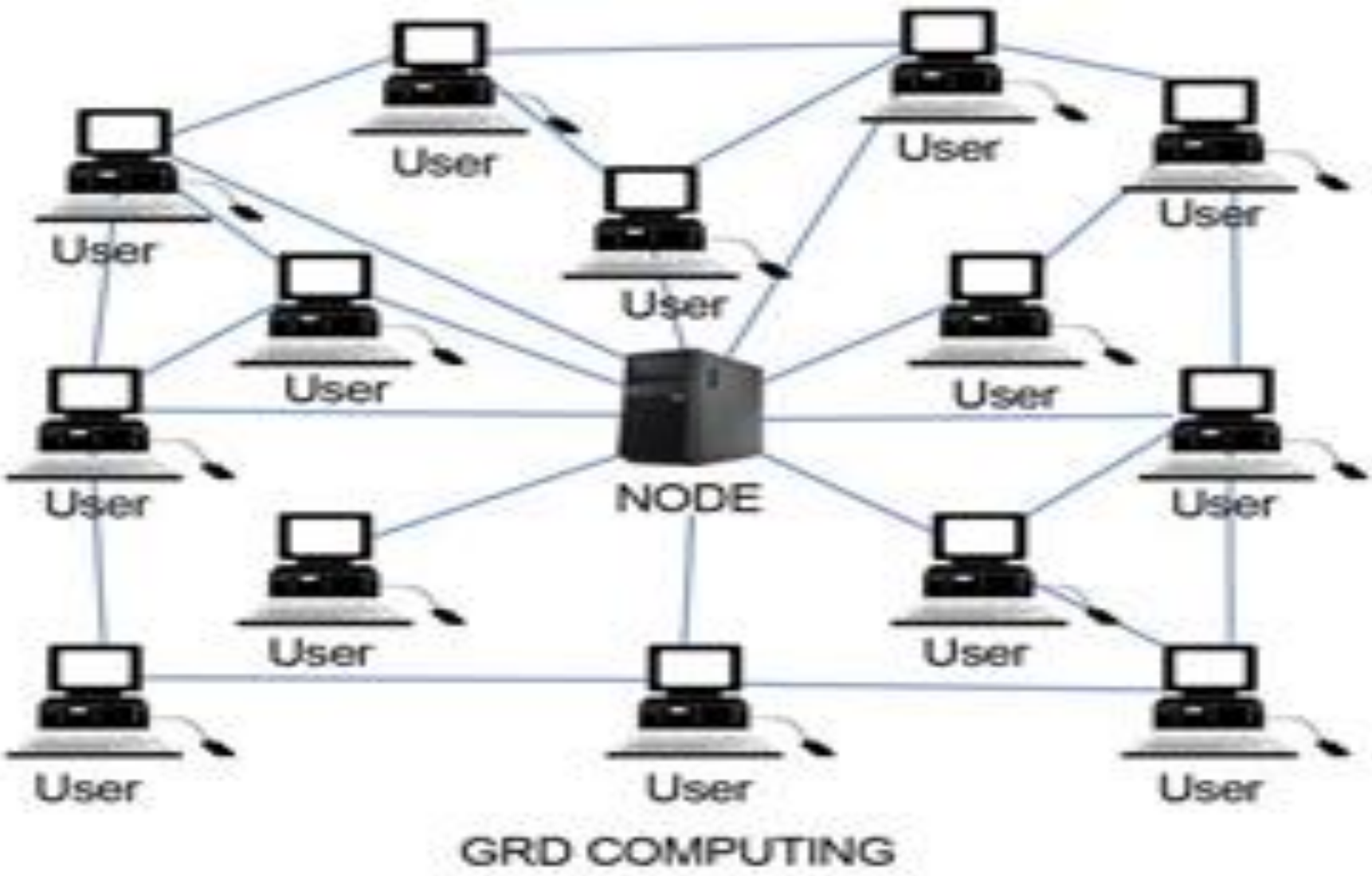
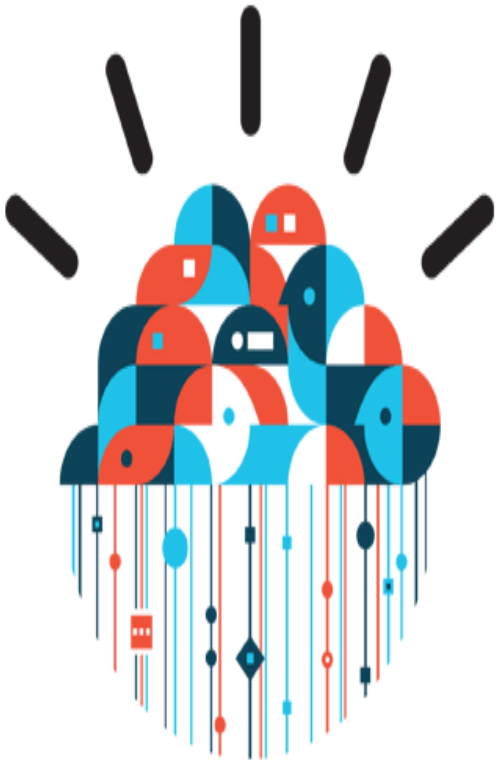


Figure: Grid computing

Cloud vs grid computing



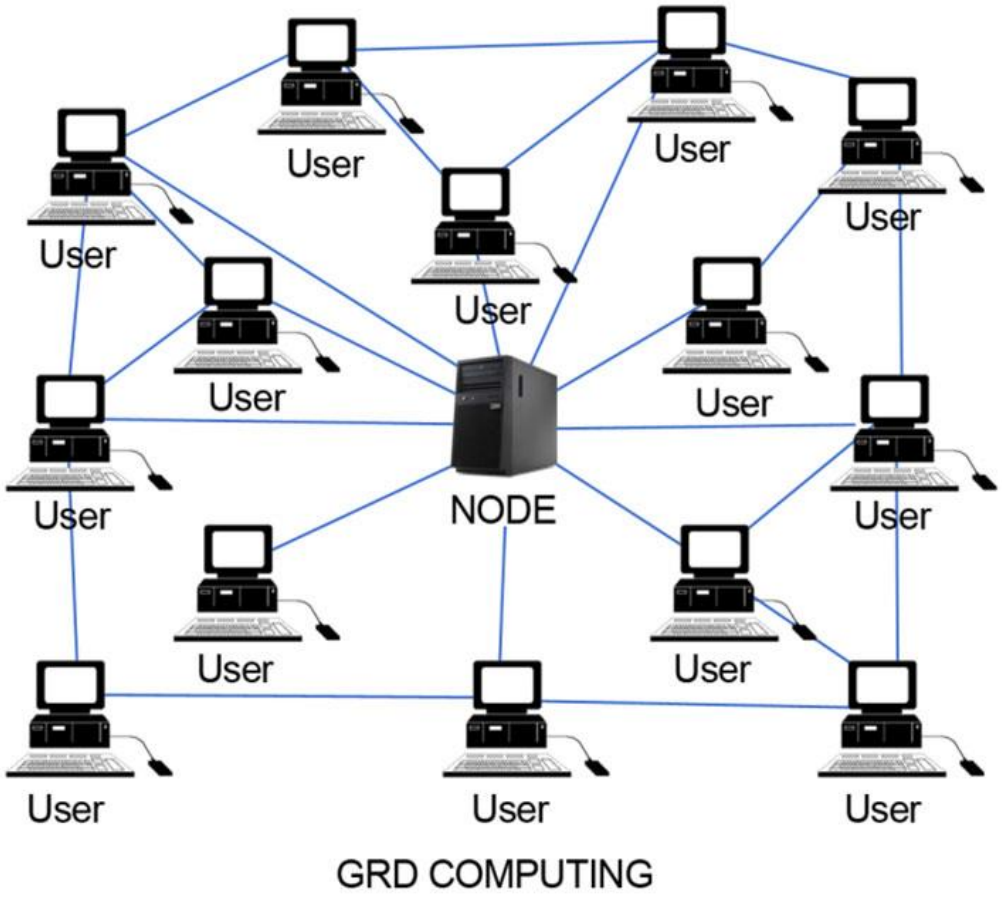


Figure: Cloud vs grid computing

Clusters and clouds

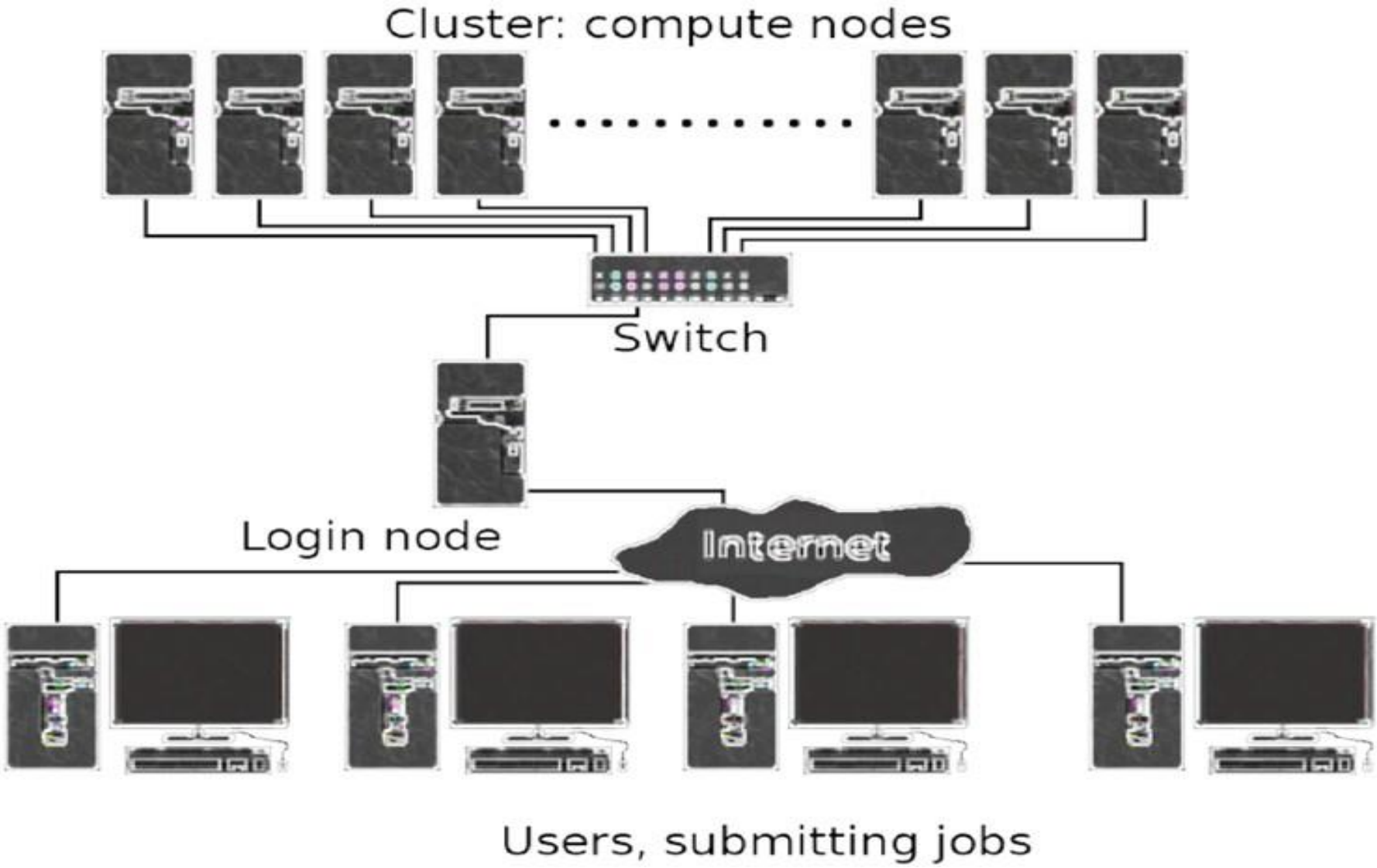


Figure: Clusters and clouds

Utility computing

- Utility computing is a model of service provision where a service provider provides the client with computational resources and infrastructure management as needed and loads them for a specific use instead of a lump sum. Like other types of on-demand computing (for example, grid computing), utility models seek to maximize the efficient use of resources and / or minimize associated costs.

- The utility is the packaging of the resources of the computer, such as Calculation, storage and services, as a measured service.

- This model has the advantage of a minimum or no initial cost to acquire computer resources. In contrast, computer resources are essentially rented.

Evolution of cloud computing and milestones

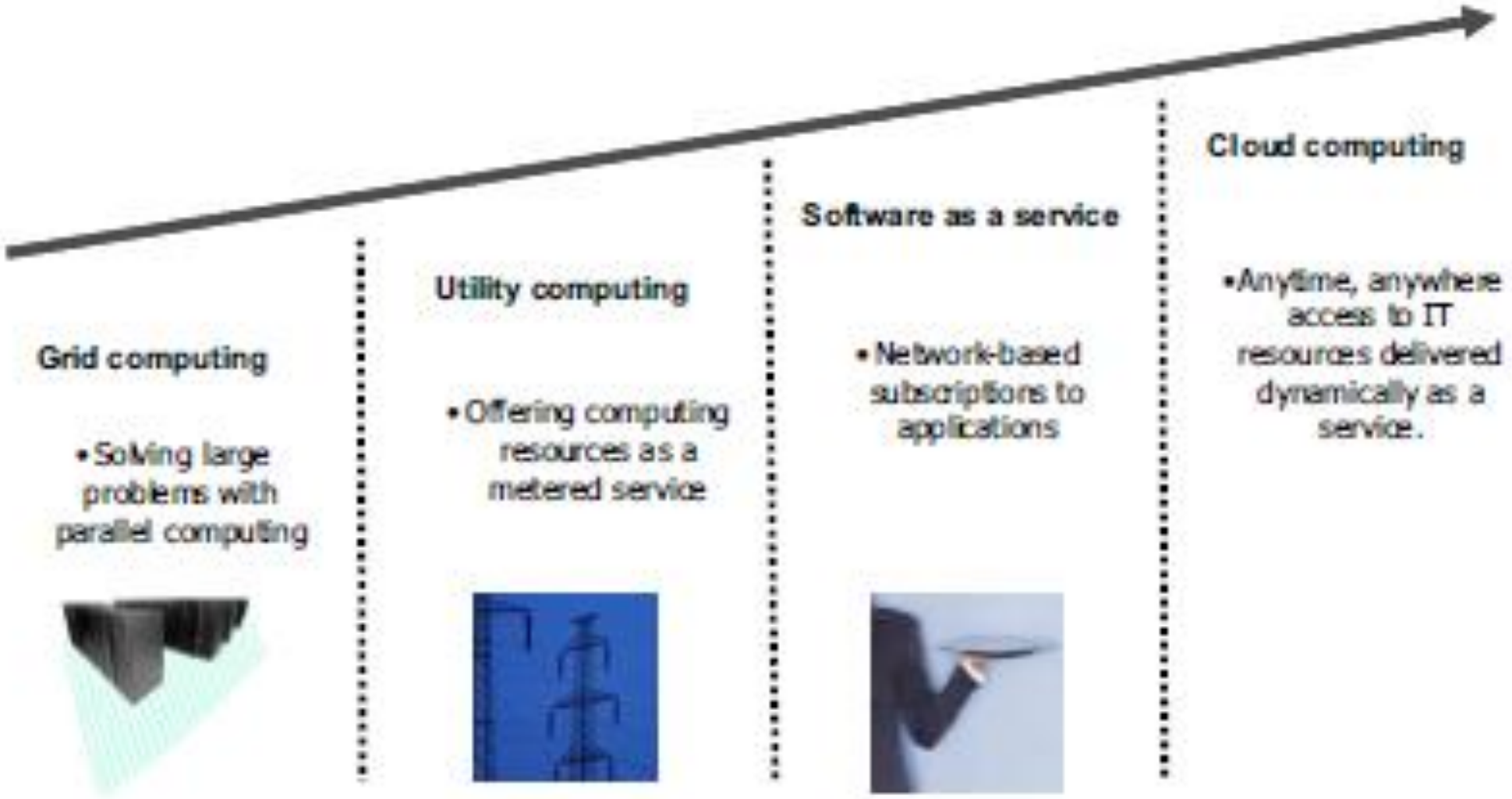


Figure: Evolution of cloud computing and milestones

Checkpoint (1 of 2)

Multiple choice questions:

1. Which of the following is a cloud deployment model ? (i) Private Cloud (ii) Public Cloud (iii) Hybrid (iv) IaaS
   a) (i), (ii) & (iii) are true
   b) Only (iii) is true
   c) All true
   d) None of these

2. Which component module in Cloud describe services offered by the provider
   a) CMDB
   b) Service Catalog
   c) Service Desk
   d) ITSM

3. Which of these should a company consider before implementing cloud computing technology?
   a) Employee satisfaction
   b) Potential cost reduction
   c) Information sensitivity
   d) All of the above

Checkpoint solutions (1 of 2)

Multiple choice questions:

1. Which of the following is a cloud deployment model ? (i) Private Cloud (ii) Public Cloud (iii) Hybrid (iv) IaaS
   - **a) (i), (ii) & (iii) are true**
   - b) Only (iii) is true
   - c) All true
   - d) None of these

2. Which component module in Cloud describe services offered by the provider
   - a) CMDB
   - **b) Service Catalog**
   - c) Service Desk
   - d) ITSM

3. Which of these should a company consider before implementing cloud computing technology?
   - a) Employee satisfaction
   - b) Potential cost reduction
   - c) Information sensitivity
   - **d) All of the above**

Checkpoint (2 of 2)

Fill in the blanks:

1. _____ is composed of eight major components.
2. _____ is a central configuration repository wherein all the meta-data and configuration of different modules, resources is kept and updated on a real-time basis
3. _____ defines what kind of services the cloud can provide and at what cost to the end-user.
4. The elasticity and the flexibility in the Cloud are built on the foundation of _____ .

True/False:

1. Cloud deployment models are IaaS, PaaS and SaaS. True/False
2. The utility is the packaging of the resources of the computer. True/False
3. Virtualization is a group of computers is a group of connected computers that work together to make a single computer. True/False

Checkpoint Solution (2 of 2)

Fill in the blanks:

1. **Cloud** is composed of eight major components.
2. **Configuration Management Database** is a central configuration repository wherein all the meta-data and configuration of different modules, resources is kept and updated on a real-time basis.
3. **Service catalog** defines what kind of services the cloud can provide and at what cost to the end-user.
4. The elasticity and the flexibility in the Cloud are built on the foundation of **Virtualization** .

True/False:

1. Cloud deployment models are IaaS, PaaS and SaaS. **False**.
2. The utility is the packaging of the resources of the computer. True.
3. Virtualization is a group of computers is a group of connected computers that work together to make a single computer. **False**.

Question bank

Two-mark questions:

1. Define Virtualization.
2. Define Cloud.
3. Mention Cloud service models.
4. Mention cloud delivery and deployment models.

Four-mark questions:

1. Explain in brief Virtualization infrastructure.
2. Explain in brief Virtualization and Cloud.
3. Explain in brief cloud transformation roadmap.
4. Explain in brief the benefits of cloud

Eight-mark questions:

1. Explain in detail grid computing.
2. Explain in detail Evolution of cloud computing & milestones.

Unit summary

Having completed this unit, you should be able to:

- Differentiate between virtualization and cloud
- Define cloud computing and explain its benefits
- Identify cloud architectures and cloud service models
- Understand the relationship between grid and cloud computing