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CLUSTER, GRID AND CLOUD COMPUTING: A REVIEW AND COMPARISON

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Abstract: - Cloud computing is largely growing computing technology these days. It is an interesting topic among various information technology based industries, business intelligence and the users. Various computer resources like hardware and software are collected into resource pool that can be assessed by the users through internet. However, its functioning is based on models of cluster, distributed and grid computing. In this paper author presents a direct comparison between Cluster Computing, Grid Computing and Cloud Computing including various aspects related to these computing. Cluster includes computers connected over a LAN on the other hand cloud and grids are geographically distributed on a larger scale.

Keywords: Cloud Computing, Cluster Computing, Grid Computing, Computing Model, SaaS, PaaS, IaaS



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I. INTRODUCTION

A tremendous change is observed in computing over the years. During the early years, operating of large computer was thought that only professional person can operate it accurately. Then a new concept name cluster computing came that works on homogeneous network and connect two or more than two computer in such a way that they work in a combination as one computing unit. Then another concept named grid computing came that allows the users for computing on demand as per their needs [1]. It work on heterogeneous network and also helps in building small scale architecture in low cost. Then finally we came to know of cloud computing in which a large pool of dynamically scalable and virtual resources provide services to user on demand. This can be happened with the help of internet.

II. CLUSTER COMPUTING

A cluster computing is a single logical unit consisting of multiple nodes or computers that are linked together [2]. This linkage of nodes may be possible through high speed LAN [3]. There are only two reasons while deploying cluster rather than to use single computer are fault tolerance and high performance. During running of a system if in any case fault comes in any part of cluster it only effect's its power but not effect's its availability. So, user always has components to work with and doesn't effect from any fault of component. As far as high performance is concerned, by employing parallel programming cluster computing provides high computation and many processors run simultaneously for many processes or a single one.

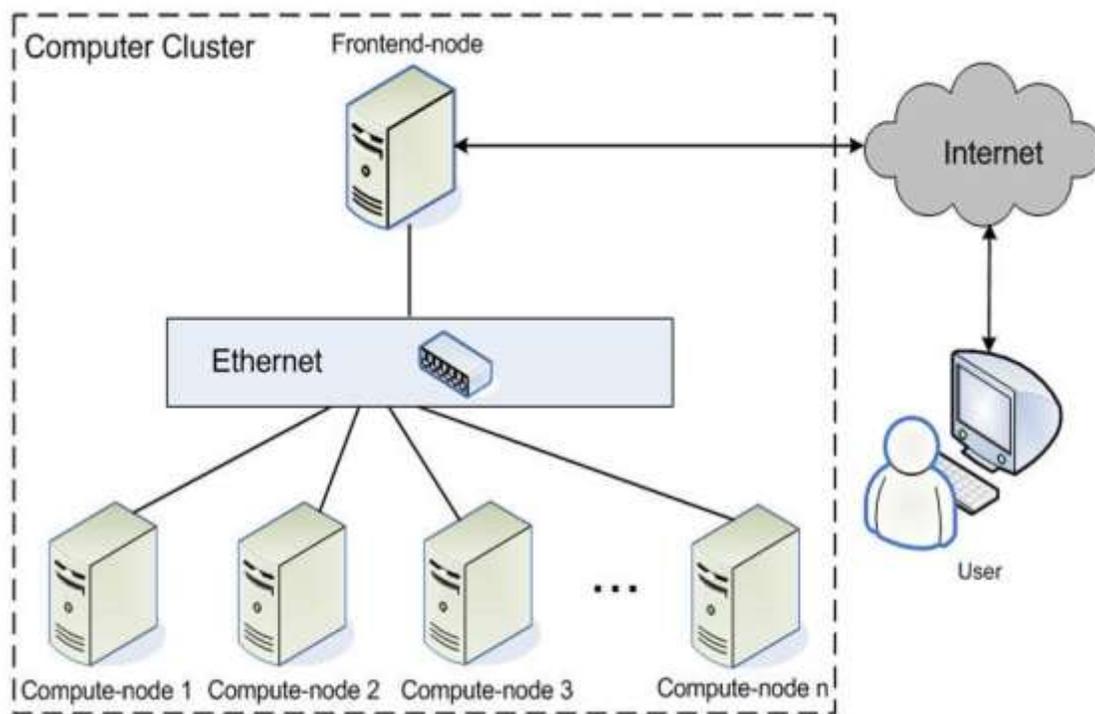
**FIG. 1.**

Fig. 1 shows the basic concept of cluster computing in which several nodes merge together and for any user it works as a single node.

Advantages of Cluster Computing

- 1) Easily Manage: It is very difficult to manage large number of different components but with cluster computing these components are combined and work as single unit. So that it is easily manage.
- 2) Availability of components: In cluster computing all components are copy of each other so if in any case one component goes down then the other component take its place and user's work get not effected.
- 3) Image of Single System: In cluster computing, user feels like he/she working with a single system but in actual they are working with huge number of components.

Disadvantages of Cluster Computing

- 1) Troubleshoot Issue: As user deal with single entity image, it is very hard to deal with problem related to individual component.
- 2) Programmability Issue: This is the case when the different components are different from one another in term of software. Then there may be issue when combining these to each other for single image.
- 3) Difficult for Non-Technical person: As cluster is combination of same or different component together so it may be difficult for any non-technical person to deal and maintain this type of arrangement.

III. GRID COMPUTING

Grid computing combines the various computer resources from different domains to reach a main task. In other words in grid computing computers that are on the network can work on a task together. It works with the use of multiple clusters that are loosely coupled, heterogeneous and also geographically dispersed [4]. Here individual user gets access to the resources, like processors, storage etc., on demand basis with little or zero knowledge of the fact that the actual location of the resources. For explaining the working of grid computing, take an example of electricity supply that comes in our home. User just uses the electricity with the help of sockets without much concerned about the fact that from where that electricity is coming and how it is being generated [5]. It is more commonly known as a collection of servers that are bound together to solve a single problem [6]. Grid computing is more concerned about collecting, sharing and providing services to various consumers. Here Fig. 2 shows the general concept of grid computing.

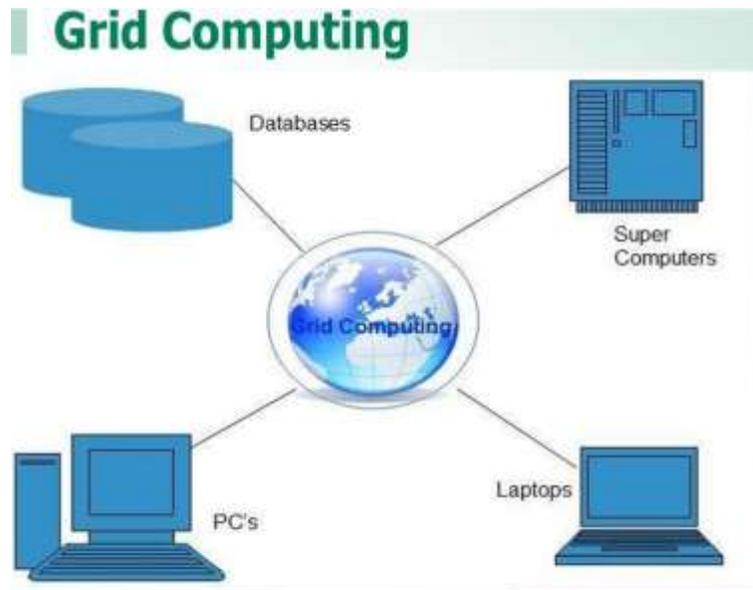


FIG. 2

Advantages of Grid Computing

- 1) Balancing of resources: Applications which are facilitated with grid performs the resource balancing by scheduling grid jobs on machines that are showing less utilization.
- 2) Reduce failure point: Grid environments are much more modular so that it reducing the points of failure.
- 3) Grid software: The grid policies in the grid can be easily accomplished by the grid software.

Disadvantages of Grid Computing

- 1) Low Stability: Grid software and the standards are not stable in comparison to other various computing. Its standards are still growing [7].
- 2) Requirement of High speed internet: For collecting different resources from dispersed location, grid require high speed internet that again increase the cost of computing.

IV. CLOUD COMPUTING

Cloud Computing is focuses on sharing the data over a scalable network of nodes. ``A Cloud is a type of distributed and parallel system that consists of a collaboration of inter-connected and computers which further are dynamically presented as one or more combined computing resource(s) based on service-level agreements (SLA's) established through the negotiation between the consumers and the cloud service provider [8].''

Fig. 3 shows that how users can connect to the cloud services that are provided by cloud service provider over the internet. Cloud infrastructure includes scalable resources in network, compute and storage.



Cloud computing provides following three kinds of service:

- a) Software as a Service (SaaS):- Software as a Service (SaaS) is a software model in which various applications are hosted by a service provider and made available to customers over the Internet.

- b) Platform as a Service (PaaS):- Platform as a Service (PaaS) is a way in which the hardware, operating systems and storage on the lease over Internet.
- c) Infrastructure as a Service (IaaS):- Infrastructure as a Service is a model in which an organization outsources the various resources that are used to maintain operations and various networking components.

Advantages of Cloud Computing

- 1) Worldwide Access- Cloud computing increase the mobility, as anyone can access their documents from any device and from any part of the world.
- 2) Large storage space - Cloud computing provides larger storage space, so anyone won't have to worry about the space on the hard drive.
- 3) Inexpensive- Cloud computing is often inexpensive. The software is already installed online, so that the user won't need to install it their machines.

Disadvantages of Cloud Computing

- 1) Security Issue- When using a cloud computing service generally the users are handing over the whole data to the other party. So the security issue arises at this point.
- 2) Privacy Issue- In cloud computing the risk of unauthorized access of data of some users is also a major concern.

V. COMPARISION

As far as comparison is concern between cluster, grid and cloud computing the following table successfully shows the comparison.

	Cluster Computing	Grid Computing	Cloud Computing
Allocation	Centralized	Decentralized	Both
Reliability	No	Half	Full
Service Agreement Level	Limited	Yes	Yes

User Friendly	No	Half	Full
Interoperability	Yes	Yes	Half
Loosely Coupled	No	Both	Yes
Business Model	No	No	Yes
Scalable	No	Half	Yes

From the above table we easily conclude the comparison between these three computing systems.

VI. CONCLUSION

Cloud computing is a recent technology that provides web services at less cost comparing to other techniques. It also contributes to improve the services in various areas. Presently, the security in clouds is less than the model in grid environment. But continuous research is going on for improving it.

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