Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 4, Issue. 6, June 2015, pg.1065 – 1070

RESEARCH ARTICLE

A Comparative Study of Various Computing Environments-Cluster, Grid and Cloud

Sukhdev Singh Ghuman
Dept. of Comp. Sci., SBDSM Khalsa College, Domeli (Kapurthala) Punjab, India
ghumanggg@gmail.com

Abstract— Cluster, Grid and Cloud computing are three main technologies for computing with each having its advantages and disadvantages. They have emerged during different periods of time as per needs of the time. Cluster computing is simply connection of computers using fast speed LAN to provide computing with efficiency and guaranteed availability. Grid computing is technology used mainly for number crunching like a supercomputer. It uses distributed environment of different networks or nodes. Cloud computing is latest of them. It uses grid computing as its backbone and provides everything as service which includes Infrastructure, Platform, Software and Data. Cloud computing eliminates the need of purchasing hardware and provides services billed as per usage. We can understand these technologies easily if we compare these three side by side taking each and every aspect into consideration.

Keywords— Computing, Platform, Service, Grid, Cloud

I. INTRODUCTION

To understand different technologies available for computing today we need to compare them vis-à-vis. Cluster computing uses computer systems in a network which are connected by LAN in a single room or a building. It is a centralized system which has many replications to perform the same task. Cluster is low cost computing to provide high performance. Cloud computing and Grid computing are two main technologies which are in use in the world for easy and portable computing. Although look similar from layman point of view but they are quite different from each other. Cloud computing provides platform for application software to be run without thinking about purchasing them. The services are delivered to us at our site as per our requirements and billed according to use. Grid computing is the collection of computer resources from multiple locations to reach a common goal. The grid can be imagined as a distributed system with non-interactive workloads that involve a large number of files. The workload in the grid environment is distributed for execution in the parallel infrastructure. It strives to provide higher throughput computing by taking advantage of networked computer. After introduction to the three different environments, in the second section cluster computing is explained in detail while section three and four explains the concepts about

cloud and grid computing. The fifth section is dedicated toward comparison of the three technologies. Last section concludes the paper.

II. CLUSTER COMPUTING

A computer cluster consists of a set of loosely or tightly connected computers that work together so as to work as single system. Computer clusters have each node set to perform the same task, controlled and scheduled by software [1]. Different computes or other devices can be connected to each other using Local Area Network (LAN) .Clusters help in improving performance and availability as compared to a single computer.

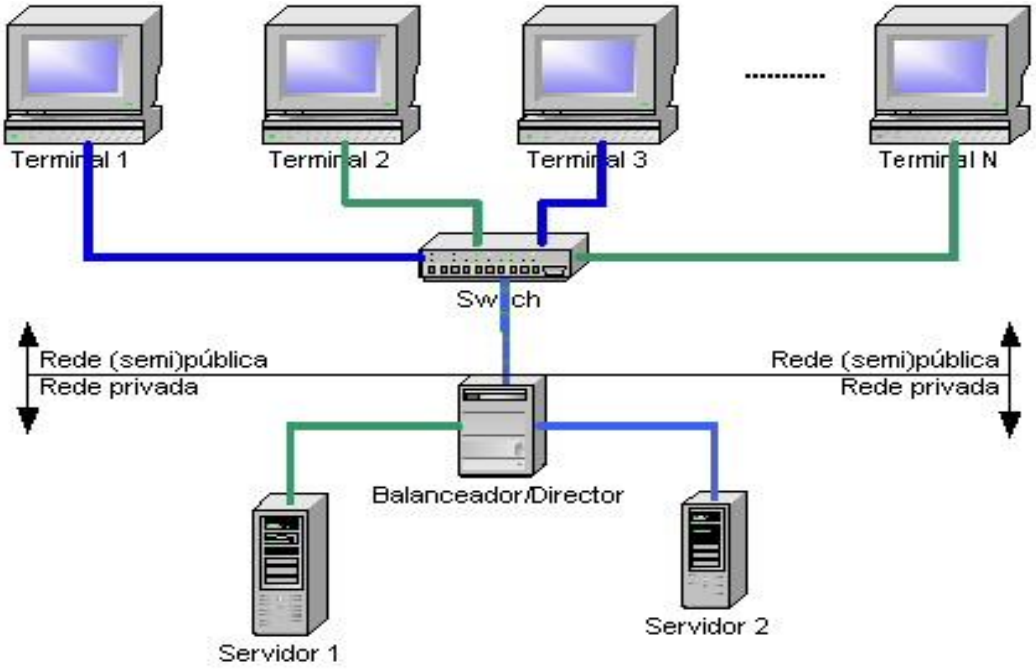

Figure 1: Cluster Computing [1]

A cluster may consist of just a few personal computers connected by a simple network. The cluster architecture may also be used to achieve very high levels of performance.

III. CLOUD COMPUTING

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [4]. Resources are pooled and offered on-demand with ubiquitous network access to rapidly configurable and elastic IT capabilities. The three types of services provided by cloud are Software as service, Platform as service and Infrastructure as service.

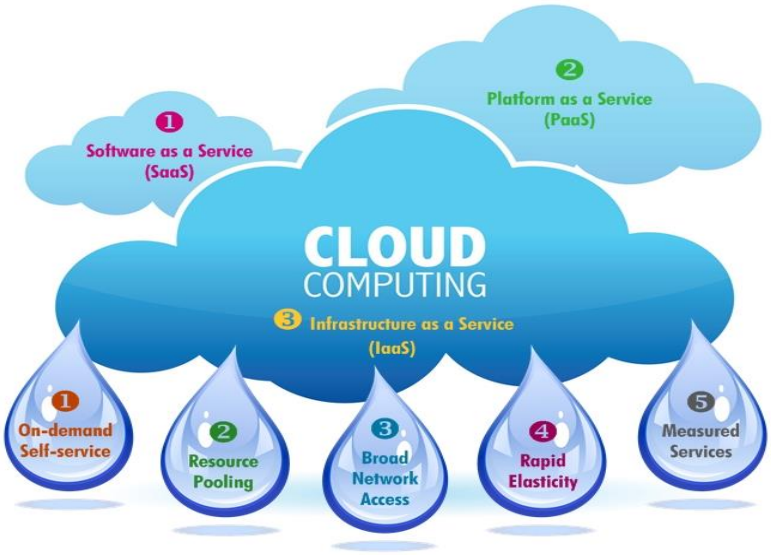

Figure 2: Cloud Computing [6]

The main properties of Grid Computing are [7]:-

- Cloud Computing came after Grid Computing came.
- Cloud Computing is where an application doesn't access resources directly but access it via Service.
- Application talks to service and then service maps to available resources and may talk to different types of devices and provides the service.
- Cloud Computing helps organizations to scale up without investing on new infrastructure etc.
- To get more power new nodes can be added.

IV. GRID COMPUTING

Grid computing can be defined as sharing information and power, which gives us access to another type of heterogeneous resources which are geographically separated [2]. The grid is based on IPs (Internet protocols) and on the principle of parallel and distributed computing. The grid computing provides the sharing of computational resources, storage devices, applications, equipment etc. in an efficient way.

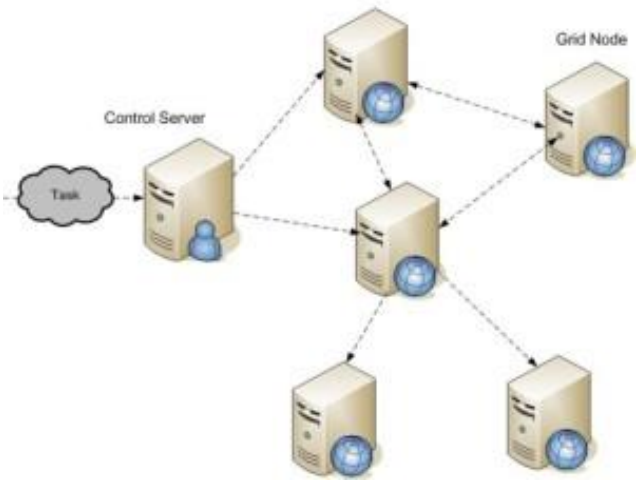

Figure 3: Grid Computing [7]

The main properties of Grid Computing are [7]:-

- Grid Computing is parent of Cloud Computing.
- Grid Computing involves more than one computer to solve the problem.
- Grid Computing is used mainly for CPU intensive calculations which can be divided into multiple tiny tasks and which can be executed in parallel on different nodes.
- Grid Computing helps organizations to scale up by increasing the grids but needs more upfront hardware cost to setup the nodes.
- If we need more power, service itself will try to allocate more resources to make the task run faster.

V. COMPARISON OF CLUSTER, GRID AND CLOUD COMPUTING TECHNOLOGIES [2][3][8]

Feature	Cluster Computing	Grid Computing	Cloud Computing
Goal	Improving performance and high availability	Collaborative Sharing of resources	Use of service
Principal	Does processing for specific applications	Needs processing from you	Does the processing for you
Level of abstraction	Low	Low	High
Degree of scalability	Low	Normal	High
Transparency	Low	Low	High
Time to run	Not Real Time	Not real time	Real time services
Security	High	Low	High
Ownership	Single	Multiple	Single
Resource sharing	Centralized	Collaborative	Assigned resources are not shared
Uses	Computing	As computing/storage platform	Offer services
High level services	Limited	Plenty	Not defined yet
Standardization	VIA based standards	Standardization and interoperability	Lack of standards for interoperability
Examples of real world	Google Search Engine, Petroleum Reservoir Simulation, Protein Explorer, Earthquake Simulation	SETI, BOINC, GIMPS	Google apps, Amazon Web Services (AWS)
Type of service	CPU	CPU, network, memory, bandwidth, device, storage	IaaS, PaaS, SaaS everything as a service
Resource management	Centralized	Distributed	Centralized /Distributed
Allocation/Scheduling	Centralized	Decentralized	Both centralized /decentralized
Dependency	Behaves like a single system	A grid is not necessarily a cloud or part of a cloud	A cloud would usually use a grid

Failure Management	Strong	Limited	Strong
Request type		Few but large allocation	Lots of small allocation
Operating System	Standard OS	Any standard OS	A hypervisor (VM) on which multiple OSs run
User friendly	Moderate	Low	High
Number of users	Few	Few	More
Response time	Real Time	Can't be serviced at a time and need to be scheduled	Real Time
Pricing of Service	Not open for market but has limited pricing	Dominated by public goods or privately assigned	Utility pricing, discounted for large customers
Data intensive storage	Suited for that	Suited for that	Not suited for that
Configuration	Easy	Difficult	Easy
Future	Grid Computing	Cloud computing	Next generation of internet
Heterogeneous/Homogenous	Homogenous	Heterogeneous	Either heterogeneous or homogenous
Coupling	Tightly coupled	Loosely coupled	Loosely or tightly coupled
Distribution	LAN	LAN or MAN	MAN
Job Processing	Centralized	Decentralized	Self managed

VI. CONCLUSIONS

In this paper the detailed comparison of the computing models cluster, grid and cloud computing has been presented. I think the close comparison like this help to understand the concept very easily and clearly. The cloud computing is based on grid computing. The cluster computing was invented to provide efficiency and reliability for computing tasks. I tried to differentiate all the three technologies by taking into consideration each and every point in side by side comparison. Cluster, Cloud and grid computing are promising model for future computing so there is great scope of future research in this area.

REFERENCES

[1] http://en.wikipedia.org/wiki/Cloud_computing

[2] Milan Kantial Vachhani,Kishore H.Atkotiya ,"similarities and contrast between Grid Computing and Cloud Computing." Indian Journal of applied research Vol.3,Issue.3 2013.

[3] Seyyed Mohsen Hashemi, Amid Khatibi Bardsiri," Cloud Vs. Grid computing" ARPN Journal of Systems and Software, VOL. 2, NO.5, MAY 2012

[4] NIST Cloud Computing Definition, NIST SP 800- 145.

[5] Ivona Brandic, Schahram Dustdar, Vienna University of Technology Cloud v/s Grid Computing Technology comparison Information Technology 53 (2011) Special Issue

[6] http://www.pinterest.com

[7] http://ww.differencebetween.co.in

[8] Ghuman SS, International Journal of Advanced Research in Computer Science and Software Engineering 5(5), May- 2015, pp. 555-557

