A Detailed Survey on High Performance Computing

Aditi Shelke
Dept. of Computer Engineering
Pimpri Chinchwad College of
Engineering, Pune

Prateeksha Bisure
Dept. of Computer Engineering
Pimpri Chinchwad College of
Engineering, Pune

Atharva Unde
Dept. of Computer Engineering
Pimpri Chinchwad College of
Engineering, Pune

Pritee Bokefode
Dept. of Computer Engineering
Pimpri Chinchwad College of Engineering, Pune

Deepika Kanade
Dept. of Computer Engineering
Pimpri Chinchwad College of Engineering, Pune

Abstract:- This paper surveys on various techniques used in High Performance Computing domain which is used to gain powers like supercomputing. As the cost of energy is increasing day by day, it is becoming necessary to have power efficient computing environment that can provide high performance with consumption of less power. HPC is widely used when it comes to research and development. Cluster Computing, Cloud Computing are some of the examples of the types of HPC which makes computing more affordable and accessible to everyone.

Keywords:- Cluster Computing, Cloud Computing, Grid Computing, Parallel Computing, Processing Speed.

I. INTRODUCTION

Now a days, HPC has become a must have tool for every researcher. Computational *Simulation plays an important* role when it comes to simulation of various problems. Due to lack of knowledge in low-level-computer science, researchers tend to look at computers *as an extension* of their body and brain instead of an autonomous system. As the working pattern of computers is different than that of us, the result is Low Level Computing instead of High Level Computing.

II. OVERVIEW

High-performance computing (HPC) is that the ability to method information and perform complicated calculations at high speeds. To place it into perspective, a portable computer or desktop with a three gigahertz processor will perform around three billion calculations per second. whereas that's a lot of quicker than any human are able to do, it pales as compared to HPC solutions that may perform quadrillions of calculations per second.

III. CLOUD COMPUTING

Cloud computing is a modern computing technology which eliminates the need of local servers and physical devices as the system is based on sharing of computational service. It is an internet based High Performance Computing system which uses internet to provide services like servers, storage services as well as virtual servers for use. It is mainly used to provide facilities like supercomputing, reliable storage services to the customers. Cloud computing is considered as economical as it uses the general-purpose computer hardware or servers connected to each other with special interface connections over large network connection.

Cloud computing creates a shared IT infrastructure containing a very big group of linked systems and virtualization to improve its performance. End users can connect to the cloud services via local interface or via the browser interface and then the cloud will take the care of the rest of things. Users are the front-end of the cloud and cloud is the back-end of the service. Front end is made of the user's computer, computer network and software required to access the cloud. Various computers, servers and data storage system build the rear finish that is indeed the cloud of computing services, any package runs on the traditional laptop is run on the cloud infrastructure with ease. Typically, the cloud instance run on the system that's consisting of hypervisor thus every application is technically having its own dedicated application server. There's a centralized server that's wont to maintain all servers, monitor network on assign the resources centrally. Middle ware of the business API's is wont to implement the association between front-end and backed. Cloud computing comes in 3 forms: public clouds, non-public clouds, and hybrids clouds. A public cloud is one during which the services and infrastructure area unit provided off-site over the web. These clouds provide the best level of potency in shared resources. A non-public cloud is one during which the services and infrastructure area unit maintained on a non-public network. A Hybrid cloud could be a cloud computing surroundings that uses a combination of on-premises, non-public cloud and third-party, public cloud services with orchestration between the 2 platforms. shopper needs to purchase the service used from the cloud.

A cloud provides three types of services. They are: Software as a Service (SaaS), Platform as a Service (Paas) and Infrastructure as a Service (IaaS).

A. Software as a Service (SaaS)
SaaS stands for code as a service wherever the cloud supplier provides code with the assistance of net. it's scalable and provides a profit that the system directors will

transfer the applications to every of their own servers. the purchasers mistreatment SaaS also can access the applying while not putting in the code.

B. Infrastructure as a Service (IaaS)
Identify applicable funding agency here. If none, delete this text box.

IaaS stands for Infrastructure as a service. this suggests that taking the physical hardware and providing the virtual services. In this, there square measure businesses that pay the fee to run virtual servers, network, and storage from the cloud. This infrastructure maintains by the rear finish.

C. Platform as a Service (PaaS)
PaaS stands for Platform as a service during this the third-party supplier delivers hardware and code tools. This primarily advantages those that are want of application development. The host providing this service provides the hardware and code on its own. This advantages the user by not putting in the code at their premises.

IV. GRID COMPUTING

Grid computing could be a methodology wont to share pc power and knowledge storage through the net, that currently a days makes a giant contribution to analysis by creating out there, analyses and storing the massive quantity of information all round the world. A grid is usually connected by parallel nodes that type a pc cluster, that runs on associate software package, UNIX system or free software system. The dimensions of the grid will vary from alittle work station to many networks. Grid computing

technology is employed in an exceedingly wide selection of applications, like mathematical, scientific or academic tasks through many computing resources. It's usually utilized in structural analysis, internet services like ATM banking, back-office infrastructures, and scientific or market research.

The idea of grid computing was initial introduced within the early Nineteen Nineties by Carl Kesselman, Ian Foster and Steve Tuecke. They developed the Globus Toolkit customary, including grids for knowledge storage management, processing and intensive computation management. Grid computing could be a cluster of networked computers that work along as a virtual mainframe to perform massive tasks, like analyzing vast sets of information or weather modeling. Through the cloud, you'll be able to assemble and use huge pc grids for specific time periods and functions, paying, if necessary, just for what you employ to save lots of each the time and expense of buying and deploying the required resources yourself. additionally by rending tasks over multiple machines, interval is considerably reduced to extend potency and minimize wasted resources.

Unlike with parallel computing, grid computing comes area unit time freelance. They use computers that area unit a part of the grid only idle and operators will perform tasks unrelated to the grid at any time. Security should be thought-about once victimisation pc grids as controls on member nodes area unit sometimes terribly loose. Redundancy ought to even be in-built as several computers might disconnect or fail throughout process.
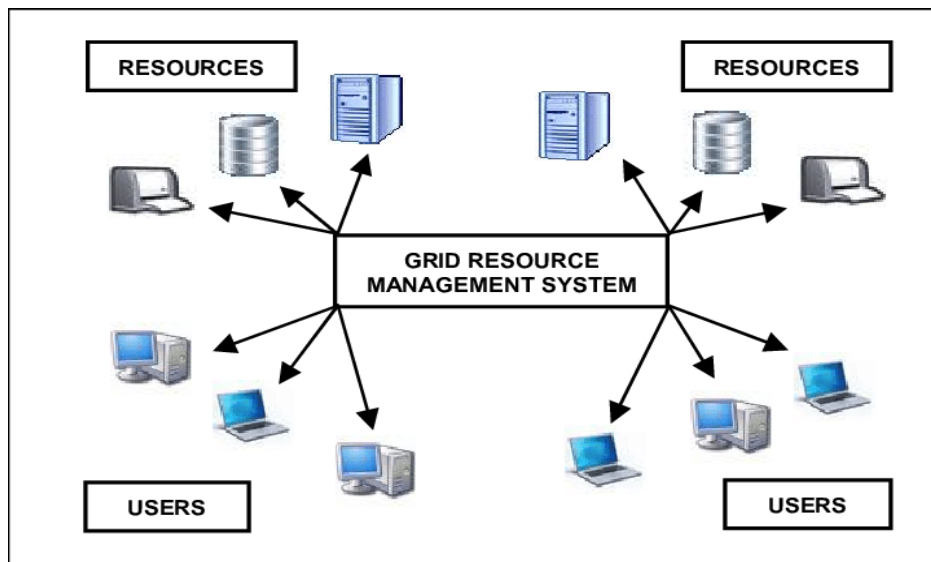

Fig 1

V. CLUSTER COMPUTING

A kind of computing during which nodes area unit connected through a local {area network|LAN|computer network} (local area network) and that they behave sort of a single machine is termed as Cluster computing. A pc

cluster has a capability to unravel complicated operations a lot of expeditiously with quicker process speed. Cluster Computing may be enlarged simply by adding the extra desktop digital computer to the system. If any node fails during a pc cluster, another node at intervals the cluster still offer uninterrupted process.

A pc cluster outlined because the addition of processes for delivering large-scale process to scale back period of time and bigger storage capability as compared to a different desktop {workstation|digital pc} or computer.

Google computer programme, crude Reservoir Simulation, Earthquake Simulation, prediction area unit applications of Cluster computing.
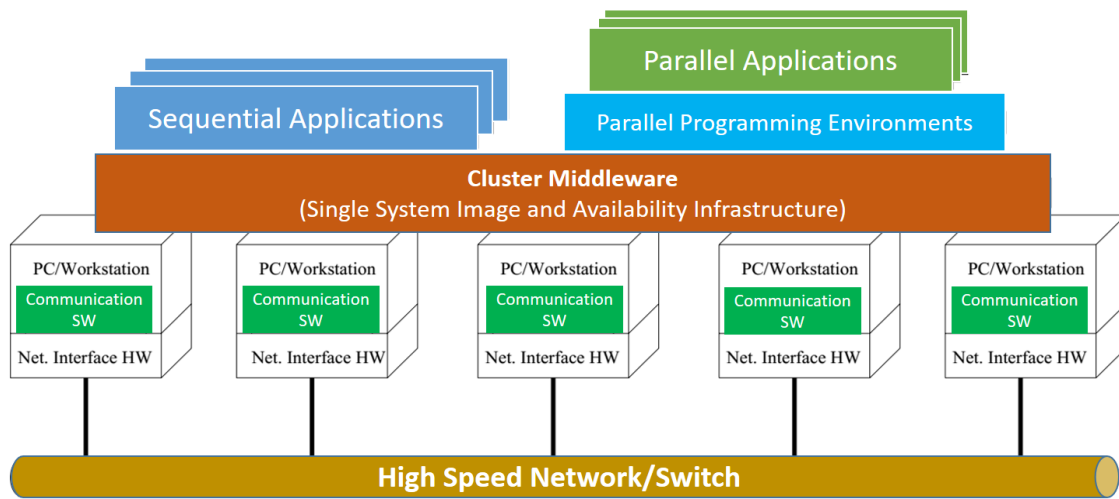
Computer Cluster Architecture

Fig 2

In cluster computing group of computers which are linked together act like a single entity. Clusters are classified into two types open clusters and closed clusters. In open cluster all nodes are visible to outside world and they are highly flexible. In closed clusters nodes are hide behind the gateway node hence provide more security.

VI. LIMITATIONS

High Performance Computers (HPC) clusters (supercomputers). Instrumentality is extremely high-priced and can be superannuated in an exceedingly few years. Code developed for one HPC cluster might not be moveable to different HPC clusters. Cooling and electricity to stay HPC clusters running is additionally terribly high-priced. Maintaining associate degree HPC cluster over time additionally becomes high-priced as a result of with a better magnitude of elements for a cluster additional elements can fail inflicting additional nodes failures. It becomes more durable to stay all nodes running 100% over time.

VII. ADVANTAGES

Speed: With more process cores, usually with higher performance specs, than a typical laptop computer or desktop, HPC systems can give vital speed up.

Volume: several HPC systems have each the process memory (RAM) and disk storage to handle terribly massive amounts of information. Terabytes of RAM and petabytes of storage area unit out there for analysis comes.

Efficiency: several HPC systems operate a pool of resources that area unit drawn on by a several users. In

most cases once the pool is massive and numerous enough the resources on the system area unit used virtually perpetually.

Cost: Bulk getting and government funding mean that the price to the analysis community for victimisation these systems in considerably less that it'd be otherwise.

Convenience: perhaps your calculations simply take a protracted time to run or area unit otherwise inconvenient to run on your pc. There's no have to be compelled to hold up your own laptop for hours once you will use somebody else's instead.

VIII. CONCLUSION

In this paper we have surveyed various papers related to HPC written by number of authors. Various methodologies like cloud, grid, cluster computing is surveyed in this paper. Each methodology is having its application in its own specific area with some advantages as well as some disadvantages.

We can conclude our survey with a statement that all methodologies discussed above are going to change the technology in near future.

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