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Snoopy Cache and Shared Memory Model for Commodity Computing using Cloud Management System

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Abstract

Now a day's famous buzzword trolling around globe is cloud computing. Cloud computing solves lot challenges related to businesses. It is successful used in various businesses like amazon, Microsoft, google, IBM and so on with successful stories. Cloud is suitable for small scale to larger scale business. This type of system obviously requires more computers or PCs for working purposes. This group of systems are located geographically somewhere corner in the globe and they are spelled as commodity computers and they are used for computing purpose. Group of people working on one different commodity computers and zones want to work commonly, they require common memory for that purpose. Common memory or temporary memory which is allocated to group of computers is shared memory. Shared memory can be part of resource pool and after completing the task they can be released for better cloud management system. By using Shared memory and cache, performance can be increased. SCSM model for Cloud Management System is introduced with snoopy cache and shared memory for commodity Computing. SCSM model purpose is to increase the performance between the commodity systems.

Keywords: Commodity systems, shared memory, cache, cloud management systems, business*;*

Introduction

Scaling strategies in cloud

Cloud Computing is empowered by its dynamic scaling capability. In the dynamic scaling approach, a system can be resized during its execution restarting or interrupting any service. This critical task of dynamic capacity can be done in two ways:

1. Manually
2. Automatically

1. Manually: when a system can be scaled while running by executing appropriate through the application interface.

2. Automatically: when this type of scaling of the system can be implemented through programs that can automatically adjust system capacity by observing the actual demand.

The ability of manual capacity adjustment of the system during its operation in a huge task for any computing environment. But passing beyond this, the real power of cloud scaling life in automatic scaling ability. Here, no human intervention is required. The system can adjust or resize itself on its own. The dynamic auto-scaling is generally referred as auto-scaling which is also known as cloud scaling.

Auto-scaling can be implemented in two different ways:

* scaling based on predefined schedule known as proactive scaling

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* scaling based on current demand known as reactive scaling

Proactive scaling

Application demand generally varies with time. Suppose, an e-commerce site is really exist in the early morning or Enterprise application gets the majority of hits during the last two hours of the day. In such cases, where the expected increase or decrease of demand is known as a pre-programmed plan is placed to automatically alter the resource capacity. Such a scaling strategy that does not wait for workload to change, rather Alters capacity in advance based on a predefined schedule known as proactive scaling.

The proactive scaling schedules are implemented in different ways as

1. Proactive cyclic scaling: this type of proactive scaling event takes place at fixed at regular intervals and by predefined times of the day, week, month and year. For example enterprise application may need to scale every business day into 11AM to 3PM which is their peak business hours.

2. Proactive even-based scaling: major variations in traffic load may occur due to some scheduled business events like campaigns or new product launch and else. For those cases, event-based proactive scaling is the best way out.

Reactive scaling

In this strategy, the system reacts immediately changing demand of resources adding or removing capacity on its own. Here, the decision is taken resource utilization. When utilization of processor or memory or some other resource reaches a certain threshold, more of that resource can be added into the environment by the system itself with not any external intervention. Under this scaling technique, depending on the situation where the suitable parameters are identified at first to activate the auto scaling process. System scales in response to the changing conditions of those parameters. This eliminates the need for any pre-scheduled action to handle scaling as it always remains unknown when those conditions may change. Scalable system should deal with varying workloads through proactive scaling approach as much as possible. Reactive scaling approach should be seen as a safeguard for absolutely unavoidable scenario. Too much dependency on the reactive scaling strategy, without performing appropriate capacity planning to facilitate proactive scaling of a system may turn suicidal.

Auto-scaling implementation requires mixture of both reactive and proactive scaling approaches. Auto-scaling is also called as cloud scaling mechanism, the system itself can increase the required resource capacity, automatically (and dynamically), when the demand of workload goes up. The mechanism can also release and return resources to the free pool when they are no more required. Auto-scaling facility maximizes resource utilization by automatically during the work of scaling. The working of the auto scaling mechanism in cloud has been briefly in below figure. Auto-scaling allows scaling of computing resources both in the predictable and unpredictable circumstances.

- Scaling in these two situations happens in the following fashion
- unpredictability based on specified condition
- predictability according to defined schedule

Literature Survey

[1] SunandaNalajalaet. al, author focuses on lightweight Secure data like files, audio clips, data sharing among the light weight is very difficult task in cloud computing. For security

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purpose cipher attribute based encryption (CP-ABE) is used.
[2] Senthil Kumar AvinashiMalleswaranet. al, author focuses on FF-CSA means Fire fly crow search algorithm which is used to solve non-deterministic polynomial task scheduling. Crow search algorithm is combined with cloud system to enhance the global optimisation higher performance purpose.
[3] Dr. V Krishna Reddy et. al, author focuses on attacks over encryption data in cloud, LH-SPHF is used to encrypt the data for data integrity purpose in cloud.
[4] B Tirapthi Reddy et. al, author focuses on security key for sharing data in cloud computing. When we speak about cloud that means more number of users and they want to share the data between them with data security. SBIBD model is used for the secure data. The security key contains a square structure and no focus on internal execution of the jobs.
[5] P Raja Sekhar Reddy et. al, author focuses on privacy techniques on secured data in cloud. Mainly paper focuses on merits and demerits of secure data integrity. Paper evolution is based on numerical outcome and no focus on internal job execution in cloud management system.
[6] H Anandakumaret. al, author focuses on cloud based simulation methods and Optimisation algorithms for better performance.
[7] DorababuSudarsaet. al, author focuses on preserving and retrieval of data from multiple clouds. There is no fixed agenda data of one cloud is permitted to only to that cloud. Data in one cloud evaluated with another cloud. The professionals may be located geographically around the corners and they need execute data from one cloud with another cloud. STRE and ABE techniques are used for encryption of the data and no focus on internal execution of the jobs.
[8] N Gowtham Kumar et. al, author focuses on Markle Hellman Knapsack Crypto-System (MHKCS) algorithm that calculates evaluation matrix like encryption time, decryption time, key generation time communication cost to 10% then existing methods RSA, MRSA and MRSAC. MHKCS algorithm discusses privacy preserving in cloud storage which gives more performance and no focuson internal execution of the jobs.
[9] D Radhikaet. al, author focuses on Big Data Analytics, cloud computing and internet of things that make Smart home, City, business and country, no focus on internal execution of jobs. Paper focuses on application areas and challenges of IoT.
[10] V Murali Mohan et. al, author focuses on resource planning location in distributed cloud networks using voids in scheduled intervals (RPA-DCN) technique. The main theme of the paper is discussed on prerequisite of resources, current scheduling methods, methods and materials supplies source scheduling and significance over other standard methods and work is done simulation outcomes.

Existing System

Cloud computing process is not new domain; it is exist from long years. Initially cloud are meant for storage purposes. That means user can be geographically located at different places and they storage data about their task in the cloud and shared to other user by using authentication. Gradually the cloud taking its shape by adding nodes, node means a computer, later on added with processors and more storage. They made processors, main memory, databases and networks to resources pool. A may have numbers resources pools attached to it. If we utilize these resources properly, we can hike the performance.

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Proposed System

Scalability is ability to handle a growing amount of work in a capable manner. Scalability is related to hardware and software as shown in below figure 1.

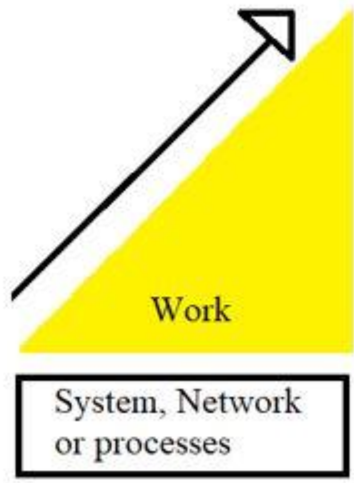

Fig 1 Scalability

Here we see about hardware, scalability is achieved using two methods horizontal scaling and vertical scaling anything should happen as shown in figure 2 and 3. Vertical scaling or scaling up means to add more resources to existing computer or it is called as scaling up. Any computer can be powerful in sense of processors with huge memory, but in vertical scaling has a limit, we cannot make computer powerful because of limit. This is where big data fails.

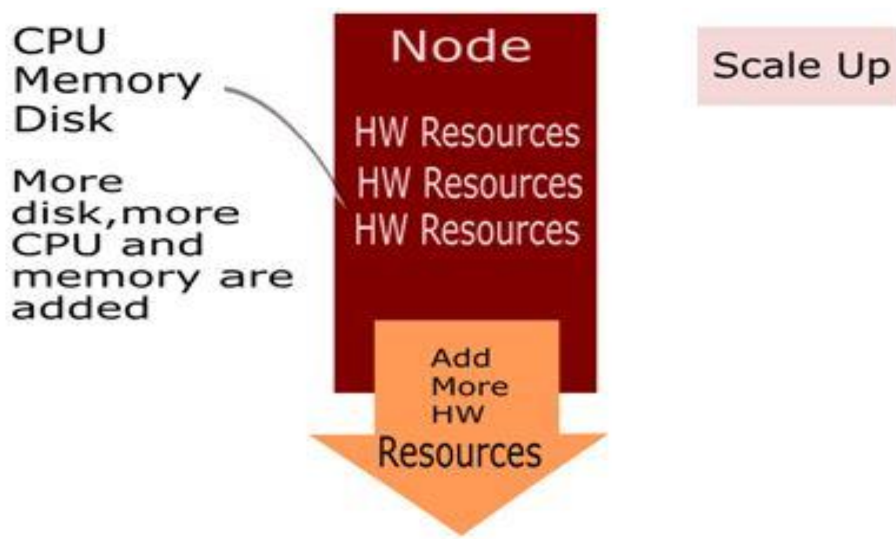

Fig 2 Vertical Scaling

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Vertical scaling is used in visualization. Horizontal scaling is adding nodes to node as you need more power. Scaling out is used for horizontal scaling.

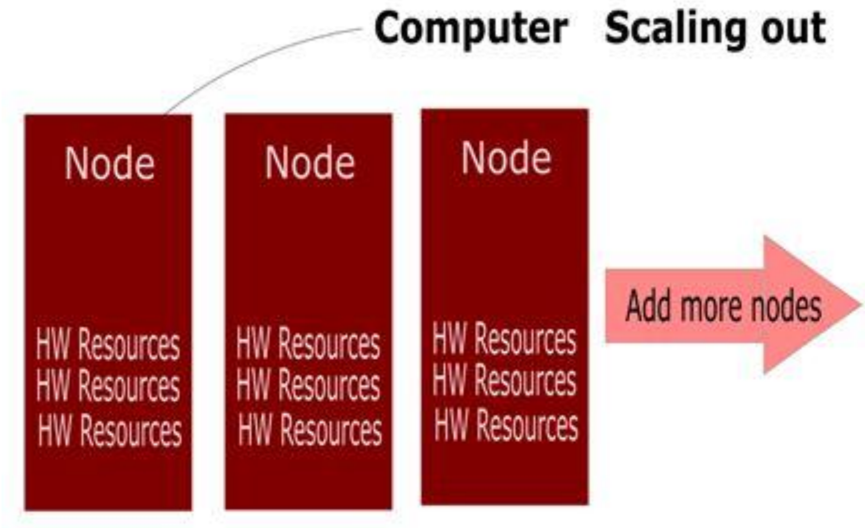

Fig 3 Horizontal Scaling

Scaling out is for horizontal scaling, is a linear correlation between the number of computers and promise, you can process x and data in certain time in order to process to x, so you need to double your computer, shown in below figure 4.

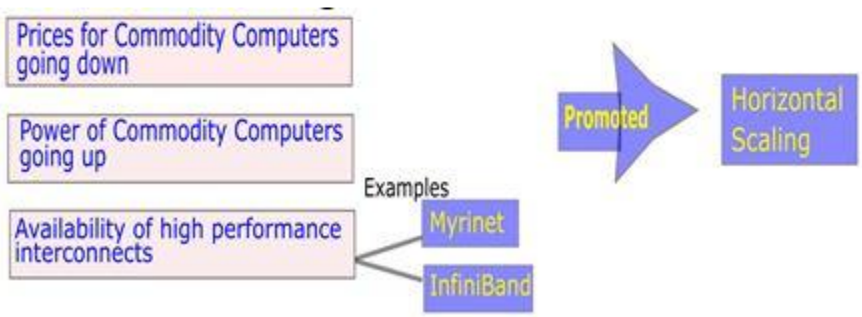

Fig 4 Factors Promoting Horizontal Scaling Model

Computers we are using in scaling or normal computers, where they are affordable in price and power and they are increased according to the time. Word commodity computer is used to represent a computer which is an affordable in price and easily everybody can get from the market. We can connect hundreds of these computers to achieve very high performance computing systems. When commodity computers are correlated together in a distributed system, all these computers then they have a better performance than a scientific computer with RISC processor in it. RISC is a small and with best set of instructions and is compared with commodity computer as shown in below figure 5.

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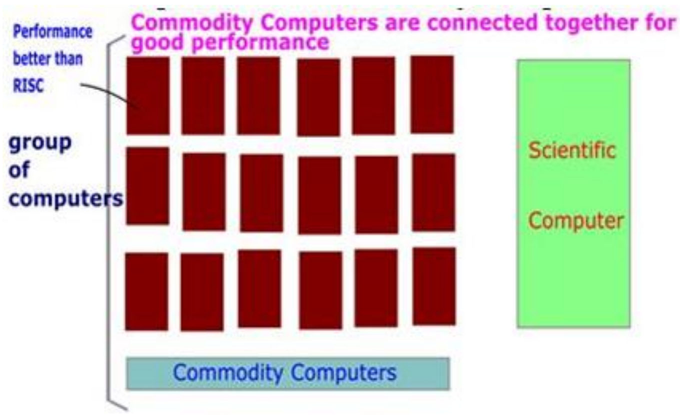

Fig 5 Commodity Computers

Horizontal scaling works on distributed systems meaning multiple computers are connected together to take an advantage of horizontal scaling, we need specialized programs that take advantage of distributed systems that process the data that is stored on the multiple computers, programs are being developed to take advantage of horizontal scaling on hadoop and MongoDB and soon are designed to work on the distributed systems and they are designed to work on the distributed systems and they are designed to address the issues of big data as shown in below figure 6.

Fig 6 Special Programs

Commodity computers topic related to Cloud Computing concept, commodity means good used for commerce that is interchangeable other services are shown in figure 7. A commodity computer is a normal PC that is available around the globe. Commodity computers have various characteristics like base instruction set, all software's that are available, compatibility with common peripherals, out-of-the-box functionality, architecture that supports all similar type of models and parts interchangeable among similar models. Commodity computing is referred to low budget cluster computing which is the use of multiple computers, multiple storage devices and redundant interconnection to compose the user equivalent of a single highly available system. A working principle of commodity computing is a preference for inexpensive modestly performing hardware components working in parallel. Virtualization refers to building/creating simulation version of something including virtual computer hardware platforms storage devices and network sources. Virtualization in cloud computing is preparing simulation of a virtual platform of server operating system and storage devices. Types of virtualization in cloud computing are operating system virtualization, hardware virtualization, server virtualization and storage virtualization. In OS virtualization in cloud computing, the virtual machine software installs in the operating system rather than directly on the hardware system. The most important use of operating system virtualization is for testing the application on different platforms or operating system. Here, the software is present in the hardware, which allows different applications to run. Network virtualization is the process of combining work

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resources and network functionality into a single, software based administrative entity called as virtual network. There are two common forms of network virtualization which is given as follows: virtual device based virtual network and protocol based virtual network. Storage virtualization is important aspect in entire cloud computing concept. In traditional computing system, the storages have been directly linked with the physical server. With virtualization-based storage, has been changed. Now virtualized storage systems are linked with servers and actual (physical) storage systems remain hidden. Like other computing resources, virtualization of storage also happens through layer of software which creates logical abstraction of the pooling of physical storage devices having linked together by network. Data stored in logical (virtualized) storage devices ultimately get stored in some physical storage disks. The advent of Storage Area Networks (SAN) has made the pooling (and hence the virtualization as well) of physical storage systems easier. There are many commercial virtualized cloud storage systems available in the market Google Cloud Storage, Microsoft's Azure Storage, Simple Storage System (S3) and Elastic Block Storage (EBS) of Amazon are few to name among them. Desktop virtualization does not fall under the core category of computing infrastructure virtualization-based concept. But it is the key to business as it can lower the cost of ownership and enhances security of system, application and data. Desktop virtualization is different from Remote Desktop Access. Through desktop virtualization Technology, any computer's applications can be separated from its desktop and user can get the look and feel of some other environment while using those applications.

Advantages of virtualization

the advantages of virtualization provide many benefits to consumers in term of financial: Better utilization of existing resources, reduction in hardware cost, reduction in computing infrastructure costs.

Visualization and cloud computing

Resource pooling is one important feature of cloud computing, but users are not given Direct Access to that pool. Pools of resources are created at data centers and a layer of abstraction is created over the pools of various types of physical resources using virtualization. Consumers of cloud services can only access the virtual computing resources from the data center. The attributes of cloud that are used for virtualization are given follows: shared service, elasticity, service orientation and metered usage. Resource sharing capability among multiple users has been redefined with the introduction of virtualization. Users remain unaware about the actual physical resources and cannot occupy any specific resource unit while not doing any productive work. Thus Cloud Computing delivers shared service among consumers using resource virtualization.

Commodization of the data center

In computing, commodity hardware is a device component that is widely available, relativelyinexpensive and more or less inter-changeable with other hardware of similar type. Cloud Computing service promises high performance computing (HPC) facility. Technologists have been succeeded to produce this high computing performance by combining the powers of multiple commodity computing components. This has opened up new avenues of advancement. Wide scale and planned utilization of commodity hardware has enabled the cloud service providers to achieve their operational efficiency of scale. Commoditization of resource pools at data centers has been and attracting feature of cloud computing, especially for data center owners. Specialized components are not required and commodity components are used to build the pools of (high-performance) servers, processors, storage disks and else. As

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commodity components are cheaper than specialized components, the commoditization of data centers is an important factor towards building of widely acceptable Cloud Computing facilities. Unlike commodity computing components, the specialized components may not be easily available everywhere and anytime. The commoditization of data centers are also inspired by the diverse physical location of data centers on which clouds operate. It is not always possible to keep the whole data center at one part of the globe for many reasons. Apart from location wise benefits for disaster recovery issues, it is also a fact that many governments regulate the placement of physical storage of data within the jurisdiction of the business. When commodity hardware components are used to build such data center, it becomes easier for computing vendors to maintain the resource pools while it requires replacing and procuring further.

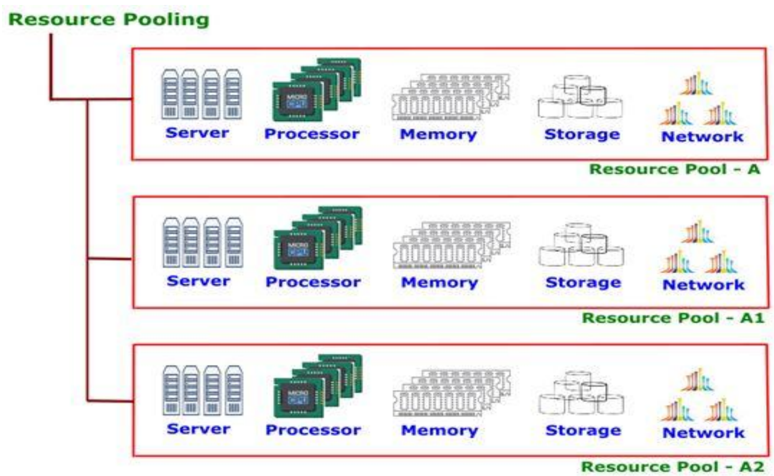
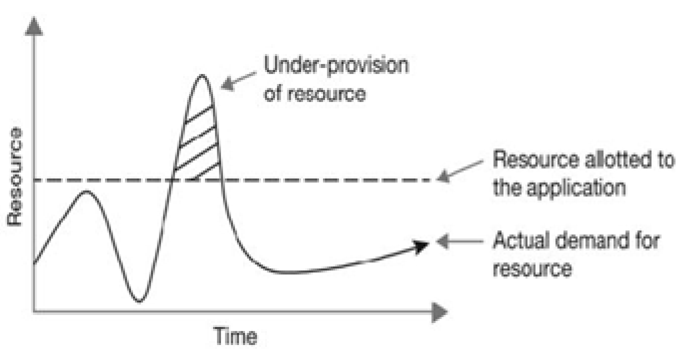


Fig 7 Resource Pooling

Assuming cloud means there will be lot of resources and those resources are shared among various devices and they should be well utilize among themselves. A provision problem results when beneficiaries are faced with the problem of maintaining or developing a resource and preventing it from destruction. According to the below figure 8, the resources are not managed or used properly among the system.



Resources under-provisioning problem in traditional system

Fig 8 Resources management graph

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Snoopy cache and shared memory model (SCSM Model) for Cloud Management System is given in the below figure 9. Cloud computing may contain different cloud(s) that are located geographically at different places with horizontal scaling commodity computers. Horizontal scaling commodity computers are similar to normal computer and more computers can be added to the existing commodity computers. The cloud can be divided into different sub-clouds as per figure C1, C2, C3 and C4. Each cloud can be having separate private or internal data can be only accessed by the thread owns it. Commodity computers can be scalable based on the requirement of the professional or teams. Application wing can be like that the team members may be located geographically in different clouds and team can work more than one complex project. If the work is not private than can work on public slot called shared memory. Shared memory can have cache memory in built for each cloud, whenever there is shared data then that information is shared in common memory, if any cloud updates the data than it is immediately replaced by new data values in shared memory. Likewise different groups of cloud teams will be working on different software applications from different geographical areas. The shared memory space is reserved for the process of work and free to the resource pools for next coming software applications. Intelligent maintenance of the resources is important to increase the fastness.

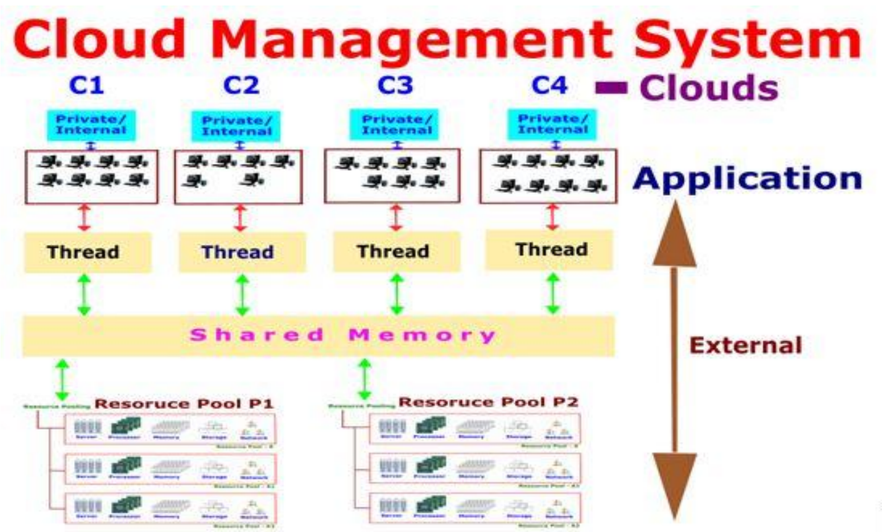

Fig 9 SCSM Model for Cloud Management Systems

The process of execution is based on the program size (SLoC), more number lines the execution process will be slow in uni-processor than multi-processor. Complex software application with more source lines of code (SLoC) than the program is sliced and given to different multi-processors, where as cloud computing the programs can be implemented by different teams members from different geographical areas and their programs can be handover to different processor available in resources pool and while running different software threads and there is no condition that they do have constant data variablesamong them. Every program slices will also have common data and this common data is shared on the shared memory locations with unique id and it is the head-ache of operating system, the delay between multi-processor and cloud computing will ups and downs based on availability of the data. Snoopy

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cache is topic related to shared memory in the processor executing active job(s), snoopy cache are used in commodity computers or normal PCs that share the same memory buffer and each machine of its own memory as shown in below figure 10. When a commodity machine want to have a variable data that is in main memory buffer, before reading the data the machine who want data will lock it and after modifying the lock related to cache is released or free the variable data for another processor.

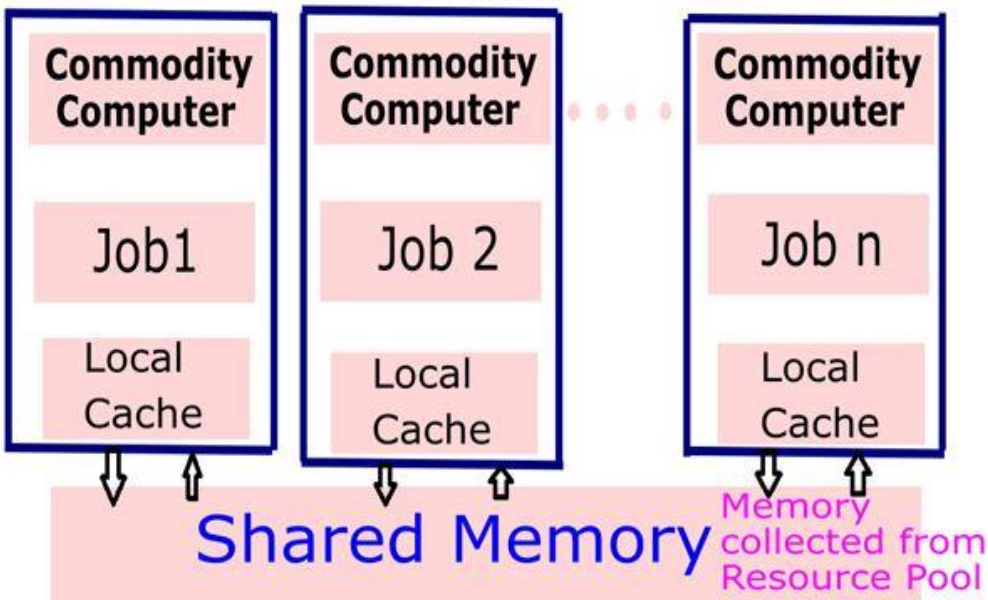

Fig. 10 SCSM Model for Cloud Management System

Main memory can fix or collected from fixed memory that is available from resource pool. In cloud computing resource pools can be in n number based on availability. They can grow or shrink based on availability. In resource pool we have processor, main memory, databases and different networks and these resources can be used efficiently by the team of software professional or business users or end users as per their requirements. Different commodity computers can choose networks, processors, main memory and databases. The main memory they want to use for their task can be fixed and can have variable data which they want to share among the processors. The program can be divided into parts and some two parts requires data that is shared in the main memory and when one processor require data, information is send to cache and cache will check the data that is available or locked. If locked waits for release and unlock applies lock on the data so that any other processor required that data will be waiting till it is unlock. After modifying the data then it is passed to back to share memory that is main memory. Likewise communicating each processors and shared memory can be used to increase performance.

Implementation

We are having different operating systems for different networks and single user operating systems where as for commodity computers they resemble normal PCs we can use Microsoft Windows and often we can use Windows for a local network systems. However we can use

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Linux and another open source operating systems. Operating systems can be single user and multi user and multi user is obviously better than other one and performance wise multi user operating system good. Obliviously test result show no much difference between multi user and commodity computing. They differ based on the availability of the variables at various slices of the program and it is similar to parallel processing.

$$CPUtime = Seconds = PrograminstructionsXcyclesperinstructionsXClockcycles$$

$$= 10{,}000{,}000 \text{ X } 2.5 \text{ X } (1/\text{clock rate})$$

$$= 10{,}000{,}000 \text{ X } 2.5 \text{ X } 5 \text{ X } 10^{-9}$$

= 0.125 seconds

Above formula is for single CPU, when we have more CPUs then the CPU is divided by the number of processors and time will be reduced more and performance graph is shown in below figure 11.

Test Results

Below graph is related to performance between the single core and multi-core commodity systems, commodity systems are nothing but normal PCs or systems or machines. When more than one system are combined to evaluate a task then the performance will increase. Table 1 gives the comparisons between single core and multi-core processors.

Table 1 Comparisons between Single and Multi-core processors

	Single core Processor (45 nm)	Multi-core Processor (45 nm)
Vdd	1.0V	1.0V
Input/output Pins	1280 (ITRS)	5000 (App)
Chip-package data	7.8 Gb/s	10 Gb/sN
Operating Frequency	7.8 Ghz	2.5 Ghz
Bandwidth	125 GByte/s	1.5 TeraByte/s
Power	429.78w	100.05w
Total number of pins on chips	3840	10000 (App)

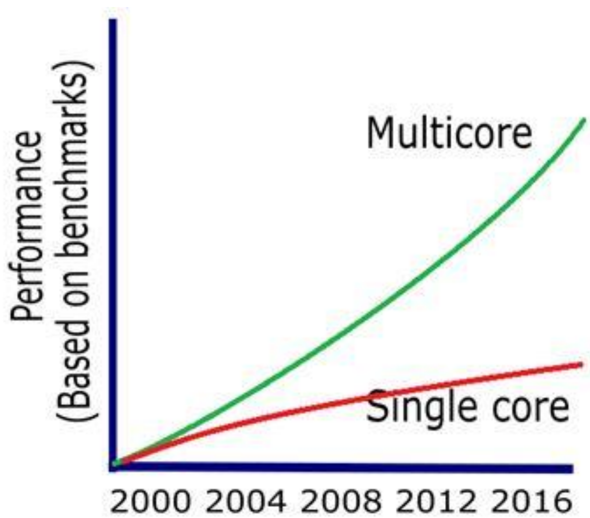

Fig 11 Performance graph

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Conclusion

Cloud means very big that is huge systems are gathered to work for some purpose, purpose can be business, government related, business related or any other computer related applications purpose. During this COVID period most of the software and IT companies have huge demand for cloud systems because of WFH. Software professionals are geography located at different places and perform some task related to their profession everyday. They need common place to perform and work. This type of scenario requires commodity computers and one common shared memory for resource pooling. After completing we can free the memory resources and it can be accommodated for other purpose. By doing so we can increase the performance of the requirements tasks.

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