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Resource Optimization for Smart Devices in Peer–to–Peer Home Cloud

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***Abstract*—Due to increasing use of smart devices, new trend of home cloud computing have to take house hold consumable electronic devices as a sharing resources to bring great convenience to consumers. The main challenge is to finding most suitable services or resources in home cloud. Every assignment of the application is accomplished when offloading an application to the home cloud with its individual storage, computation and bandwidth requirements. This paper addresses the problem of resource sharing amongst smart devices with mapping and scheduling of resources to virtual machines. The home cloud key objective is to utilize the vacant computing resources among a variety of smart devices at residence in order to distribute more powerful and narrative functionalities to the users. Particle Swarm Optimization (PSO) algorithm for resource optimization ensures effective utilization and optimization of resources.**

Index Terms— Cloud computing, Virtual Machines, Resource Allocation, PSO.

I. INTRODUCTION

Cloud computing is a software technology, also a result of growth and implementation of earlier technologies such as parallel computing, grid computing and distributed computing technologies [1].
Cloud computing service providers propose their services based on three fundamental models. Viz., Platform-as-a-Service (PaaS), Infrastructure-as-a-Service (IaaS) and software-as-a-service (SaaS). Whereas Infrastructure-as-a-service is the larger part and each higher level model conceptual from the details of the lower level models. Platform-as-a-service in the Cloud is defined as a set of required software and necessary product development tools are supplied on the service provider's infrastructure. Developers can create applications which services are provided as platform over the Internet. Platform-as-a-Service providers may use application programming interfaces, website portals or gateway software installed on the customer's computer. In the Software-as-a-Service model the service provider gives the software product, hardware infrastructure and user interaction with front end. Infrastructure-as-a-Service is to start, stop, access and configure their virtual servers and storage [12].
Cloud computing has primarily incorporated with service management automation, standardized technologies and virtualization for providing scalable computing facility and high performance data investigation [1].
Virtualization is a technique for facilitating virtual servers that run on bunch of a number of physical servers. Virtualization creates huge number less powered servers from the lesser number of high powered servers to

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reduce the space cost, power and other infrastructure [2].
Generally Infrastructure-as-a-Service platform offers two types of instances viz, Reserved instances and On-demand instances. Reserved instances are appropriate for foretelling workloads. Practical workload may be fluctuant, using of reserved instance may not be cost effective.
The current rush forward in the fame of Infrastructure-as-a-Service Cloud systems can be credited to the on-demand availability of computing resources such as processor cores, memory, disks etc., Virtual machines are hosted on all physical servers. Incoming request or application may claim virtual machines of different capacities. On-demand request allows the cloud users to hourly purchase the computing facility to attain cost effective service for the unpredictable workloads and packages of virtual machines are billed based on the usage [3].
In a Cloud computing, Resource allocation, Interoperability and Portability, Availability of Service and Limited Scalability, Security and Privacy are the major important research challenges and still required to be improved [1].
This paper addresses the problem of resource sharing amongst smart devices, deals with mapping and scheduling of resources to virtual machines. Virtual machine provisioning includes availability of virtual machines each one with diverse capabilities of processor cores, memory, disks.

II. LITERATURE REVIEW

Along with the development of cloud computing technology, researchers spotlight on the resource sharing among smart devices in the home network, various resource allocation methods have been anticipated for Cloud computing to provide cost effective and quality of service.
Parvathy S Pillai and Shrisha Rao [3] presented a new methodology for dynamic resource allocation using uncertainty principle of game theory. In this method, the game is planned to be participate among VM agent and the cloudlet. Each VM agent-cloudlet permutation can outward appearance their pay-off matrix. Each agent endeavor to formulate the cloudlet to pay and figure its own list of combination.
Zhe hao [6] presented resource provisioning using improved Ant colony algorithm. In this technique, Ant is in g_i at instant t_i, whilst probing the resource to convene the circumstance in the network, the primary step is to investigate the vicinity that is adjacent to $g_{i..}$ The ant on the node decides the next hop based on the pheromone of its nearest node and chose the node that has the max pheromone in the path.
Yanzhi wong and et al [7] projected a new method of resource provisioning for aggressive cloud service providers based on game theoretic framework. In this method, the service pool consists of service demands of solitary sort application that are originating from all the clients. A service demand is free to be shipped to any server be in the right place to any cloud service provider for the reason that all the servers in the cloud can prop up such application type. As extended to service demand is shipped to server formed a committed virtual machine for that service demand loads the request executable and starts execution. The overall revenue of each Cloud service provider is to step-up the total revenue attained from servicing the demand.
Hossein Morshedlou and Mohammed Reza Meybodi [8] proposed a resource provisioning technique using proactive resource provisioning method. In this approach, whenever the resource leakage is faced by service provider or its resource provisioning strategy, it discovers which virtual machines are best nominee to release the required resources. Releasing resources of these virtual machines builds it possible to use the released resources for managing significant requests of the queue. Service provider endeavors to abandon the requests which are less important. Based on significance of users and consistency stage of virtual machines total of n pair wises can be constituted.
Jinhhao Liu and et al [11] proposed Aggressive Resource Provisioning method called SPRNT, which does mapping among workload metrics and actions, is hoard in CMAC (Cerebeller Model Articulation) table. The CMAC table is restructured by an insistent reward policy to build the decision engine proficient of regulate the resource provisioning effectively. With the deployment of insistent reward policy, the proceedings that significantly increase resource provisioning are encouraged to be selected by the decision engine when the resources are not satisfactorily provisioned.
Kastas Katsails and et al [10] proposed Dynamic Weighted Round Robin Scheduling algorithm to achieve service level agreements. In this technique, as an alternative of constructing one decision in the lead to each service achievement, it will bunch collectively number of decisions and store them in a vector. The next unused decision in the vector is chosen when the servers become empty. Major drawback of this technique is some decisions are constructed earlier with normal less information about system state.

Wei *et al.* [18] work on combining smart home and clouds with peer – to – peer network, where every smart home shares its consumable resources like computing power, memory and others. Son *et al.* [19] Based on personal virtualization for information sharing among consumer provides cloud computing services in a secure manner. Lee *et al.* [17] used home cloud for exploiting unused resources in various consumables at homes to provide narrative and more functionality to users. Takatori *et al.* [17] shows saving the cost of buying a home services using home gateway to a cloud. Using home gateway as a services home cloud can be more advantages like security isolation, resource isolation and fault isolations. He also addressed the resource constraint limitations. Igarashi *et al.* [20] proposed new cloud enhanced home controller. In this resources of the local home controller are augmented with external cloud resources accessed over the network and also some architecture is scaled to support multi vendors.
For home services, Fu *et al.* [25] proposed a new method on the semantic service search in cloud for home network consumers, where the data are encrypted for security. Jeong *et al.* [26] proposed a new method of zone-aware service system, it utilizes the user's nomadic resource, i.e. consumers personal digital assistance device that has a sensing or networking capability, such as a smart phone, smart watch, and mobile sensor, as part of the smart home service infrastructure. The new system is easily modified, updated, and efficiently implemented. Guo *et al.* [28] proposed a new method to resolve the intra-datacenter traffic difficulty in a chunk-based public cloud storage service for smart homes and is used to reduce the peak load.

III. PEER – TO – PEER HOME CLOUD ARCHITECTURE

Conventional home cloud offer idle resource distribution for the neighbors in need. The end users may necessitate to offload tasks to distant execution environment in adjacent homes, since assignment offloading to smart electronics devices in adjacent houses be able to get more rapid transmission speed measure up to to offloading to the remote public cloud. The proposed system, home cloud infrastructure consists two layers depicted in fig 1. Smart devices are connected to home gateway via wireless network. The virtualization container is installed in a system to administer the smart electronic devices and assign virtual machine resources. In home cloud gateways are associated with each other via Internet. For resource allocation in home cloud, the resource controller decides which device determination be used to execute the offload task for an request

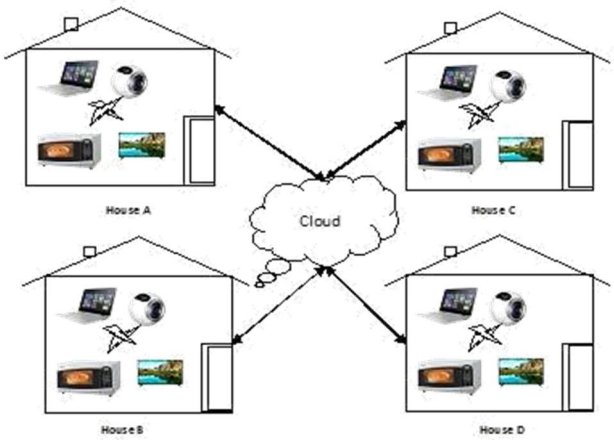

Figure 1. Home Cloud Architecture

Resource controller contains three functions, smart device manager, resource monitor, and resource manager. Smart device manager records the distribution cost and resource parameters. Resource monitor collects cumulative status and performance metrics of smart devices. Resource manager uses the monitoring information and obtains the resource allocation policy, based on the resource requirements resource distribution algorithm provides the optimal allocation strategy.

IV. RESOURCE ALLOCATION

The various resources from the homes are preoccupied as the services. The application is poised by numerous dependent tasks, as numerous may provide the same function, the resource manager selects the suitable resources for each task based on the optimization goal.

The resource manager is to selects the best possible contestant from all possible contestants by taking into account of the objective and multiple constrain (e.g. cost, sharing time, and availability). The Particle Swarm Optimization algorithm is adopted and the location of each constituent part represents a contestant result to the predicament. The number of tasks corresponds with the dimension numbers of the particle. Location values of a constituent part represent the resource service guide for a task

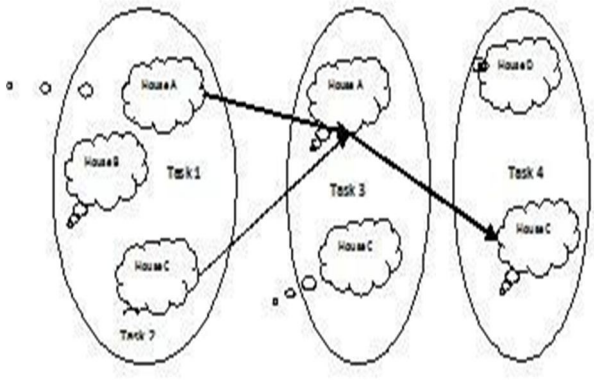

Figure 2. Resource Allocation Example in home cloud.

Particle Swarm Optimization

Particle Swarm Optimization (PSO) is prejudiced by the communal activities of animals. In Particle Swarm Optimization algorithm, the residents are the amount of constituent part in a problem gap, and constituent part is initialized arbitrarily. Each constituent part is having vitality value and it is evaluated by vitality function to be optimized in each production Each constituent part be familiar with its preeminent location and the preeminent location so far among the complete cluster of constituent part. Particle Swarm Optimization algorithm try to make available all resources to a set of given assignments and mapping of all assignments to a set of agreed resources.

Algorithm 1 Scheduling heuristic.

Step1: Compute average cost of all resources

Step2: Put assignment weight as average computation cost

Step3: Put edge weight between tasks

Step4: Compute PSO({ti})

Step5: for all tasks {ti}, Assign tasks {ti} to resources {pj}

Step6: Dispatch all the mapped tasks

Proposed system calculates the average computation cost (ACij) of all tasks. Average computation cost (ACij) can be calculated for any request by accomplishing each task of request on a sequence of recognized resources. ACij is inversely proportional to the computation time. Similarly, proposed system stores the average communication cost (ACoi) between resources. (ACoi) is inversely proportional to the time taken. The primary step is to figure out mapping of all tasks. This mapping optimizes the overall cost of computation time for the application.

Algorithm 2 PSO algorithm.

Step1: Set constituent part measurement as identical in size.

Step2: Initialize constituent part location randomly.

Step3: For each constituent part, compute its vitality value.

Step4: If the vitality value is improved than the earlier value, set the present vitality value.

Step5: Select best constituent part.

V. CONCLUSION

This paper addressed the difficulty of provisioning on-demand virtual machine. With rapid development of consumer electronics smart home improves the people life style. Virtualization of these devices becomes practical construction of home cloud. Home cloud allows resources to be communal among end user smart electronic devices and also to be communal among adjacent houses. In home clouds multi assignment applications can be offloaded of the home gateway by extending the functionalities. The developed Particle Swarm based algorithm ensures optimized resource utilization among the home cloud. This optimized resource utilization algorithm shares time and reliability and also saves the cost.

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