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Survey on Resource Allocation Strategies for Ubiquitous Computing in IoT Environment

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ABSTRACT: An efficient resource allocation is a fundamental requirement in high performance ubiquitous computing. Due to limited resources availability, efficient assignment of resources to the requested process is important. An important research problem in these environments is how to assign resources to applications (matching) and order the execution of the applications (scheduling) to maximize some performance criterion without violating any constraints. This survey paper presents the study on various resource allocation strategies.

KEYWORDS: Dynamic Resource Allocation, Resource Management, Resource Scheduling

I. INTRODUCTION

Cloud Computing is an essential ingredient of modern computing systems. Computing concepts, technology and architectures have been developed and consolidated in the last decades; many aspects are subject to technological evolution and revolution. Cloud Computing is a computing technology that is rapidly consolidating itself as the next step in the development and deployment of increasing number of distributed application. Cloud computing is nothing but a specific style of computing where everything from computing power to infrastructure, business apps are provided as a service. It's a computing service rather than a product. In cloud, shared resources, software and information is provided as a metered service over the network. When the end user accesses some service in cloud, he is not aware of where that service is coming from or what platform is being used or where it is being stored.

Cloud computing platforms, such as those provided by Google, IBM, Microsoft, Amazon, etc., let developers deploy applications across computers hosted by a central server. So these all applications can access a large network of computing resources that are deployed and managed by a cloud provider. Software developers obtain the advantages of a managed computing platform, without having to commit resources to build and maintain the network. One important problem that must be addressed effectively in the cloud is how to manage QoS and maintain SLA for cloud users that share cloud resources.

The cloud computing paradigm makes the resource as a single point of access to the number of clients and is implemented as pay per use basis. Though there are number of advantages of cloud computing such as virtualized environment, equipped with dynamic infrastructure, pay per consume, totally free of software and hardware installations, prescribed infrastructure and the major concern is the order in which the requests are satisfied which evolves the scheduling of the resources. Allocation of resources has been made efficiently that maximizes the system utilization and overall performance. Cloud computing is mainly sold or rented on demand on the basis of time constraints basically specified in hours or minutes. So the scheduling has to be done in such a way that the resource utilization has need done efficiently.

In cloud computing environment, resource allocation or load balancing takes place at two levels. First, when an application is uploaded to the cloud, the load balancer assigns the requested process to physical computers, attempting to balance the computational load of multiple applications across physical computers. Second, when an application receives multiple incoming requests, these requests should be each assigned to a specific requested application instance to balance the computational load across a set of instances of the same requested application. For example Amazon

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EC2 uses elastic load balancing (ELB) to control how incoming requests are handled. Application designers can direct requests to instances in specific availability zones, to instances demonstrating the shortest response times or to specific instances.

In the following sections a review of existing resource allocation techniques like Linear Scheduling, Topology Aware Resource Allocation and Resource Allocation for parallel data processing is described briefly.

II. RESOURCE ALLOCATION ITS SIGNIFICANCE

Resource allocation is process of assigning the available resources in an economic way and efficient way. Resource allocation is the scheduling of the available resources and available activities required by those activities while taking into consideration both the resource availability and the project time. Resource provisioning and allocation solves that problem by allowing the service providers to manage the resources for each individual request of resource.

Resource Allocation Strategy (RAS) is all about the number of activities for allocating and utilizing scarce resources within the limit of cloud environment so as to meet the needs of the cloud application. It requires the type and amount of resources needed by each application in order to complete a user job.

From the perspective of a cloud provider, predicting the dynamic nature of users, user demands, and application demands are impractical. For the cloud users, the number of tasks of job needs to be completed on time with minimal cost. Hence due to limited resources, resource heterogeneity, environmental necessities, locality restrictions and dynamic nature of resource demand, we need an efficient resource allocation system that suits cloud environments.

Cloud resources consist of virtual resources. The physical resources are shared across multiple computer requests through virtualization and provisioning. The virtualized resources are described through a set of parameters detailing the processing, memory and disk needs. Provisioning of cloud can be done by mapping virtualized resources to physical ones. The software and hardware resources are allocated to the cloud applications on-demand basis [1].

III. RELATED WORK

Dynamic resource allocation problem is one of the most important and challenging problem in the resource management problems of cloud computing environment. The dynamic resource allocation in cloud computing environment has attracted attention of researchers in the last few years. Many researchers those working on cloud computing around the world have come up with new ways of facing this challenge. Dynamic resource allocation is one of the most challenging problems in the resource scheduling problems. The dynamic resource allocation in cloud infrastructure has capture attention of the number of research community in the last decade. Many researchers around the world have given number of solution for this challenging problem i.e. dynamic resource allocation in cloud infrastructure.

Now a days number of growing companies has popularized an architectural paradigm based on a huge number of commodity servers. Problems like regenerating a web index or processing crawled documents are split into several independent subtasks, distributed among the available nodes, and computed in parallel. Simplify the development of such number of distributed applications on top of these architectures; some of the cloud provider companies have also built customized data processing frameworks. Examples are Google's MapReduce, Yahoo's Map-Reduce-Merge etc.

In [8] authors have explained the algorithm for negotiation protocol for resource provisioning in detail. In [1], authors have made a comparison of many resource allocation strategies. In [9] authors propose a model and a utility function for location-aware dynamic resource allocation. Comparison of number of available resource allocation policies is covered in [10]. In [11] author has used a Genetic Algorithm for scheduling of tasks in cloud computing

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systems. This paper is not only intended to address any specific resource allocation strategy, but to provide a review of some of the existing resource allocation techniques.

Nephele is data processing framework used for dynamic resource allocation offered by today's Infrastructure-as-a-Service (IaaS) clouds for both, task scheduling and task execution. Some tasks of a job can be assigned to different types of virtual machines (VMs) which are automatically started and terminated during the job execution. This literature survey focuses on resource allocation mechanisms and its impacts on cloud providers and cloud users. This survey paper would greatly benefit the cloud users and researchers.

IV. RESOURCE ALLOCATION STRATEGIES ALGORITHM

Recently many resource allocation strategies have come up in the literature of cloud computing environment as this technology has started maturing. Number of Researcher communities around the world have proposed and implemented several types of resource allocation. Some of the strategies for resource allocation in cloud computing environment are discussed here briefly.

A. Topology Aware Resource Allocation (TARA)

Different types of resource allocation strategies are proposed in cloud. The author mentioned in [2] the architecture for resource allocation in Infrastructure-as-a-Service (IaaS) based cloud systems. Current Infrastructure-as-a-Service of cloud providers are usually unaware of the hosted application's requirements and therefore allocate resources independently of its needs, which can significantly impact performance for distributed data-intensive applications.

An architecture which adopts a methodology to guide allocation decisions taken by the IaaS is proposed to address this resource allocation problem. The architecture uses a prediction engine with a lightweight simulator to estimate the performance of a given resource allocation and an algorithm to find an optimized solution in the large search space. Results showed that Topology Aware Resource Allocation reduced the job completion time of these applications by up to 59.

1) Architecture of TARA: Topology Aware Resource Allocation [2] is composed of two major parts: a prediction engine and a fast genetic algorithm-based search technique. The prediction engine is the entity responsible for optimizing resource allocation. When it receives a resource request, the prediction engine iterates through the possible subsets of available resources (each distinct subset is known as a candidate) and identifies an allocation that optimizes estimated job completion time. However, even with a lightweight prediction engine, exhaustively iterating through all possible candidates is infeasible due to the scale of IaaS systems. Therefore a genetic algorithm-based search technique that allows TARA to guide the prediction engine through the search space intelligently is used.

2) Prediction Engine: The prediction engine maps resource allocation candidates to scores that measure their fitness with respect to a given objective function, so that TARA can compare and rank different candidates.

3) Objective Function: The objective function defines the metric that TARA should optimize. For example, given the increasing cost and scarcity of power in the data center, an objective function might measure the increase in power usage due to a particular allocation.

4) Application Description: The application description consists of three parts: i) the framework type that identifies the framework model to use, ii) workload specific parameters that describe the particular application's resource usage and iii) a request for resources including the number of VMs, storage, etc.

5) Available Resources: The final input required by the prediction engine is a resource snapshot of the IaaS data centre. This includes information derived from both the virtualization layer and the IaaS monitoring service.

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The information gathered ranges from a list of available servers, current load and available capacity on individual servers to data centre topology and a recent measurement of available bandwidth on each network link.

B. Linear Scheduling Strategy for Resource Allocation

Considering the processing time, resource utilization based on CPU usage, memory usage and throughput, the cloud environment with the service node to control all clients request, could provide maximum service to all clients [3]. Scheduling the resource and tasks separately involves more waiting time and response time. A scheduling algorithm named as Linear Scheduling for Tasks and Resources (LSTR) is designed, which performs tasks and resources scheduling respectively. Here, a server node is used to establish the IaaS cloud environment and KVM/Xen virtualization along with LSTR scheduling to allocate resources which maximize the system throughput and resource utilization.

Resource consumption and resource allocation have to be integrated so as to improve the resource utilization. The scheduling algorithms mainly focus on the distribution of the resources among the requestors that will maximize the selected QoS parameters. The QoS parameter selected in our evaluation is the cost function. The scheduling algorithm is designed considering the tasks and the available virtual machines together and named LSTR scheduling strategy. This is designed to maximize the resource utilization.

Algorithm [3]:

- 1) The requests are collected between every predetermined interval of time
- 2) Resources $R_i \Rightarrow R_1, R_2, R_3, \dots, R_n$
- 3) Requests $RQ_i \Rightarrow RQ_1, RQ_2, RQ_3, \dots, RQ_n$
- 4) Calculate Threshold (static at initial)
- 5) $Th = \hat{\sum} R_i$
- 6) for every unsorted array A and B
- 7) sort A and B
- 8) for every RQ_i
- 9) if $RQ_i < Th$ then
- 10) add RQ_i in low array, $A[RQ_i]$
- 11) else if $RQ_i > Th$ then
- 12) add RQ_i in high array $B[RQ_i]$
- 13) for every $B[RQ_i]$
- 14) allocate resource for RQ_i of B
- 15) $R_i = R_i - RQ_i$; $Th = \hat{\sum} R_i$
- 16) satisfy the resource of $A[RQ_i]$
- 17) for every $A[RQ_i]$
- 18) allocate resource for RQ_i of A
- 19) $R_i = R_i - RQ_i$; $Th = \hat{\sum} R_i$
- 20) satisfy the resource of $B[RQ_i]$

The dynamic allocation could be carried out by the scheduler dynamically on request for additional resources. This is made by the continuous evaluation of the threshold value. The resource requests are collected and are sorted in different queues based on the threshold value. The requests are satisfied by the VM's. Evaluation is made by creating VM in which the virtual memory is allocated to the longer and shorter queues based on the best fit strategy. This scheduling approach and the calculation of dynamic threshold value in the scheduler are carried out by considering both task and the resource. This improves the system throughput and the resource utilization regardless of the starvation and the dead lock conditions.

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C. Advantages and Limitations of Resource Allocation

Advantages:

- The individual entries are indicated with a black dot, a so-called bullet.
- The text in the entries may be of any length.
- The biggest benefit of resource allocation is that user neither has to install software nor hardware to access the applications, to develop the application and to host the application over the internet.
- The next major benefit is that there is no limitation of place and medium. We can reach our applications and data anywhere in the world, on any system.
- The user does not need to expend on hardware and software systems.
- Cloud providers can share their resources over the internet during resource scarcity.

Limitations:

- Since users rent resources from remote servers for their purpose, they don't have control over their resources.
- Migration problem occurs, when the users want to switch to some other provider for the better storage of their data. It's not easy to transfer huge data from one provider to the other.
- In public cloud, the client's data can be susceptible to hacking or phishing attacks. Since the servers on cloud are inter-connected, it is easy for malware to spread.
- Peripheral devices like printers or scanners might not work with cloud. Many of them require software to be installed locally. Networked peripherals have lesser problems.
- More and deeper knowledge is required for allocating and managing resources in cloud, since all knowledge about the working of the cloud mainly depends upon the cloud service provider.

D. COMPARATIVE STUDY

An optimal RAS should avoid the following criteria as follows:

- Resource Contention - Resource contention arises when two applications try to access the same resource at the same time.
- Scarcity of Resource - Scarcity of resource arises when there are limited resources and the demand for resources is high.
 - Resource Fragmentation - Resource fragmentation arises when the resources are isolated. There would be enough resources but cannot allocate it to the needed application due to fragmentation into small entities.

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- Over Provisioning - Over provisioning arises when the application gets surplus resources than the demanded one.
- Under Provisioning - Under provisioning of resources occurs when the application is assigned with fewer numbers of resources than it demanded.

V. CONCLUSION

Cloud computing technology is increasingly being used in enterprises and business markets. A review shows that dynamic resource allocation is growing need of cloud providers for more number of users and with the less response time. In cloud paradigm, an effective resource allocation strategy is required for achieving user satisfaction and maximizing the profit for cloud service providers. This paper summarizes the main types of RAS and its impacts in cloud system. Some of the strategies discussed above mainly focus on memory resources but are lacking in other factors. Hence this survey paper will hopefully motivate future researchers to come up with smarter and secured optimal resource allocation algorithms and framework to strengthen the cloud computing paradigm.

REFERENCES

1. V. Vinothina, Dr. R. Shridaran, and Dr. Padmavathi Ganpathi, A survey on resource allocation strategies in cloud computing International Journal of Advanced Computer Science and Applications, 3(6):97–104, 2012.
2. Gunho Lee, Niraj Tolia, Parthasarathy Ranganathan, and Randy H. Katz, Topology aware resource allocation for data-intensive workloads, ACM SIGCOMM Computer Communication Review, 41(1):120–124, 2011.
3. Abirami S.P. and Shalini Ramanathan, Linear scheduling strategy for resource allocation in cloud environment, International Journal on Cloud Computing: Services and Architecture (IJCCSA), 2(1):9–17, 2012.
4. Daniel Warneke and Odej Kao, Exploiting dynamic resource allocation for efficient parallel data processing in the cloud, IEEE Transactions on Parallel and Distributed Systems, 2011.
5. Atsuo Inomata, Taiki Morikawa, Minoru Ikebe and Md. Mizanur Rahman, Proposal and Evaluation of Dynamic Resource Allocation Method Based on the Load Of VMs on IaaS, IEEE, 2010.
6. Dorian Minarolli and Bernd Freisleben, Utility based Resource Allocations for virtual machines in cloud computing, IEEE, 2011.
7. Jiyani, Adaptive resource allocation for preemptable jobs in cloud systems, IEEE, 2010.
8. Bo An, Victor Lesser, David Irwin and Michael Zink, Automated Negotiation with commitment for Dynamic Resource Allocation in Cloud Computing, Conference at University of Massachusetts, Amherst, USA.
9. Gihun Jung and Kwang Mong Sim, Location-Aware Dynamic Resource Allocation Model for Cloud Computing Environment, International Conference on Information and Computer Applications (ICICA), IACSIT Press, Singapore, 2012.
10. Chandrashekhar S. Pawar and R.B. Wagh, A review of resource allocation policies in cloud computing, World Journal of Science and Technology, 2(3):165-167, 2012.
11. Sandeep Tayal, Tasks Scheduling Optimization for the Cloud Computing systems, International Journal of Advanced Engineering Sciences and Technologies (IJAEEST), 5(2): 111 - 115, 2011.
12. Amazon Web Services LLC. Amazon Elastic Compute Cloud (Amazon EC2). <http://aws.amazon.com/ec2/>, 2009.
13. Amazon Web Services LLC. Amazon Elastic MapReduce. <http://aws.amazon.com/elasticmapreduce/>, 2009.
14. Amazon Web Services LLC. Amazon Simple Storage Service. <http://aws.amazon.com/s3/>, 2009.
15. D. Bhattre, S. Ewen, F. Hueske, O. Kao, V. Markl, and D. Warneke, Nephel/PACTs: A Programming Model and Execution Framework for Web-Scale Analytical Processing. In SoCC10: Proceedings of the ACM Symposium on Cloud Computing 2010, pages 119-130, New York, NY, USA, 2010. ACM.
16. R. Chaiken, B. Jenkins, P.-A. Larson, B. Ramsey, D. Shakib, S. Weaver, and J. Zhou. SCOPE: Easy and Efficient Parallel Processing of Massive Data Sets. Proc. VLDB Endow., 1(2): 1265-1276, 2008.
17. H. Chih Yang, A. Dasdan, R.-L. Hsiao, and D. S. Parker. Map-Reduce-Merge: Simplified Relational Data Processing on Large Clusters. In SIGMOD 07: Proceedings of the 2007 ACM SIGMOD International conference on Management of data, pages 1029-1040, New York, NY, USA, 2007. ACM.
18. M. Coates, R. Castro, R. Nowak, M. Gadhik, R. King, and Y. Tsang. Maximum Likelihood Network Topology Identification from Edge-Based Unicast Measurements. SIGMETRICS Perform. Eval. Rev., 30(1): 1120, 2002.