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Deploying an Application on Unused Resources (AUR) Using Transfer Learning

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Abstract-The digital world is growing leaps and bounds as more and more transactions and operations are performed online. Even many activities that re done on a daily basis are done online. As a greater number of operations are done online, there is a high demand for the resources to perform computations. Many times, the resources are left idle, which brings the under-utilization problem. The main of this paper is to gather the resources that are donated by private organizations and use it for the computations. To enhance the performance of this resource pooling and allocation, the paper uses the technique of Transfer learning. The paper also suggests certain incentives to the organizations that contribute their resources. The proposed model AUR is said to provide benefits when compared to other methods.
Keywords: Resource utilization, pooling, transfer learning.

Introduction

A vast number of devices that are connected to each other through internet has been on the growing. These devices include smartphones, drones, tablets, robots etc. This growth in numbers is predicted to be above the global population by three forth in the year 2030 [1]. Many devices at our hands and some devices in our home are getting connected. These connections are powerful, but it is leading to a growing pool of idle resources that are not fully utilised [2, 3]. These idle resources give an opportunity whereby these can be used as a distributed resource in addition to the cloud and edge servers [4-6]. The fundamental idea is to crowdsource these computing tasks within the system environment. This approach has created a new paradigm termed as 'Crowd Computing' (CC) [7-8].

In general, resources are available in abundant across the globe. These resources include computing servers, printers, files, networks etc. Though the resources are available in abundance, many times these resources are under-utilized. As the demand of resources is rapidly increasing in the cloud computing environment, resource pooling is considered as one of the efficient ways to share the load capacity among the multiple resources, this technique helps the organizations to utilize the unused resources such as spare computers, physical servers etc.

When the cloud computing scenario is considered, it's a complicated task to calculate the right cost for the usage by the cloud service providers. Recent times the Amazon initiated a procedure where it leased its unused resources. It adopted different pricing strategy, the main aim of it was to maximize the revenue generated and use the underutilized resource.

These primary challenges of revenue, underutilization of resources were researched upon. As a matter of fact, it was observed that many large organizations had free voluminous resources that could be used for the computation. Many times, the physical resources were utilized for a certain period of time and then it lay unused. The organization was still paying for these unused resources. One solution for this was to use cloud computing. To have a better revenue, and to efficiently make use of these resources, resources could be used through cloud computing architecture. When servers are left unused, they can be utilized by other users through the cloud computing approach. This was termed as Resource Pooling.

Motivating example

A CRS [9] method was proposed that was a recommendation system, that worked on the sensitive rumour detection and elimination. The main aim of the model was to identify the rumours in twitter and classify them into sensitive and non-sensitive rumours based on a threshold value. Next step was to eliminate the sensitive rumours, as these might cause ill feeling over the readers. This method was developed as a recommendation system that could be used by twitter or any other social media. But these social media's are already overloaded by the lots of comments, reviews that are posted on a second to second basis. Hence, the twitter or any other social media can use the resource pooling approach to deploy their recommendation systems.

This paper proposes a method AUR for an efficient resource pooling and also proposes an optimized resource usage.

Related Works

A number of methods were developed for this resource pooling and utilization. An exchange framework [10] was proposed where the method used the resource allocation strategies. This method could benefit both the consumers and the cloud service providers to use and trade the needed resources. Another model suggested resource management pricing techniques [11] and the authors also made a classification analysis on each of these techniques. To increase the occupancy rate and the enhance the system utilization, a drive system [12] was proposed.

An optimal dynamic pricing strategy was proposed to handle the issue of resource underutilization [13], where the user demands could be controlled. CaaS (Cache as a Service) model [14] was developed that aimed to maximize the cloud profit and performance. Another model was proposed where the author had used a joint adoption approach to make use of different pricing plans [15]. The basic aim was to maximize the revenue and the benchmark algorithm was used to compare the performance.

A two-phase gaming model [16] was developed that aimed to optimize the resource benefits and balance the users cost with provider benefits. The model also developed a virtual resource broker that could analyse the available resources and configure it in cloud environment. Thus, methods and models were developed for the resource pooling and deployment of applications in them.

Proposed System

The proposed AUR system is developed with the aim to use the unused resources for execution. There may be many unused resources that an organization holds. These unused resources and their details are gathered. The willingness to give their unused resources is got form the organizations. The unused resources are booked and used by the AUR as follows:

(i) Fixed booking – A fixed size of the resource is booked for a fixed amount of time

(ii) Elastic booking – A particular resource is booked and used. If need comes by, the new resources are got and utilized.

The proposed AUR model also has a continuous monitoring watch over the resources being got and used. A threshold is maintained for this usage. The resources can be used till a threshold of 80%. When this threshold is reached an alert message is triggered.

The organizations may need their resources at some point of time. If they need those resources which they have rented out, it will be given back to them. When the undergoing task is shifted from one resource to another a metadata is created for that task. It will hold all the details regarding the task under deployment. With this metadata at hand, the pending task can resume its execution on the new resource without the need to start from the beginning. The technique of transfer learning is also used to enhance the shifting process.

The twitter can make use of these resources rented from the organizations to deploy their recommendation systems. Incentives are given to the organizations that give in their unused resources. Corporate Social Responsibility (CSR) has been a management concept, through which the organizations integrate their social and environmental concerns in their operations. This renting out of their resources for a cause can be considered as the CSR act. If an individual gives in their unused resources a tax exemption can be

given to them. These are some of the incentives that can be given to the lenders who give in their resources.

The figure 1 gives a screenshot of the scenario where the resources are pooled from organizations and individuals.

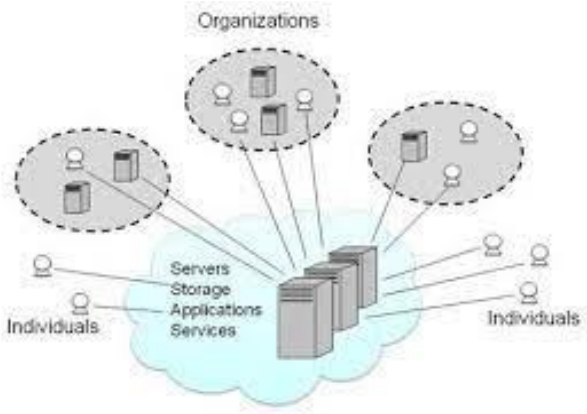

Figure 1. A scenario of resource pooling from organizations and individuals

The architecture of the proposed AUR model is given in figure 2. The corporate resources are the main resources which can be pooled together. The resources can be from a variety of resources like paid, idle, low-cost resources etc. These resources are allocated using the AUR model.

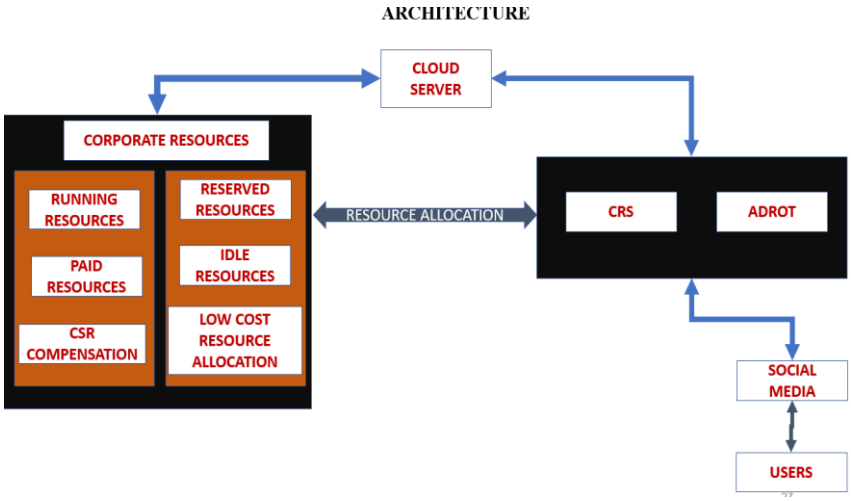

Figure 2. Architecture of the proposed AUR model

```
begin
gather_unused_resources()
get_willingness_from_organizations()
while unused_resources_available():
if fixed_booking_requested():
book_fixed_resource()
else if elastic_booking_requested():
book_elastic_resource()
 if need_new_resources():
 get_new_resources()
 utilize_new_resources()
end_if
 end_if
 continuously_monitor_resources()
 if resource_usage_threshold_reached():
 trigger_alert_message()
end_if
 if organizations_need_resources_back():
return_rented_resources()
end_if
 if task_shifted():
create_metadata_for_task()
 use_transfer_learning()
 resume_pending_task()
end_if
end_while
 end
```

Algorithm 1. Pseudocode of the proposed AUR model

The pseudocode for the resource allocation is given in Algorithm 1. The model works by gathering all the unused resources. Next it gets the willingness from the owners of the resources. The booking of the resources is done based on fixed or elastic booking. The allocated resources are also continuously monitored for their working. A threshold value is also set, and it is being monitored. If the threshold value is exceeded, then a trigger is alerted. If the organizations or the owners need their resources back, they are given back. Then the task is shifted to another resource that is available

.

Result Analysis

The proposed AUR method is compared with other existing method. A comparison graph is given in figure 2. The performance of the proposed method is better than the other existing method. The proposed method is better as it uses transfer learning to make any decision of the shifting to a new resource. The learning time of the system to make any new decisions is reduced.

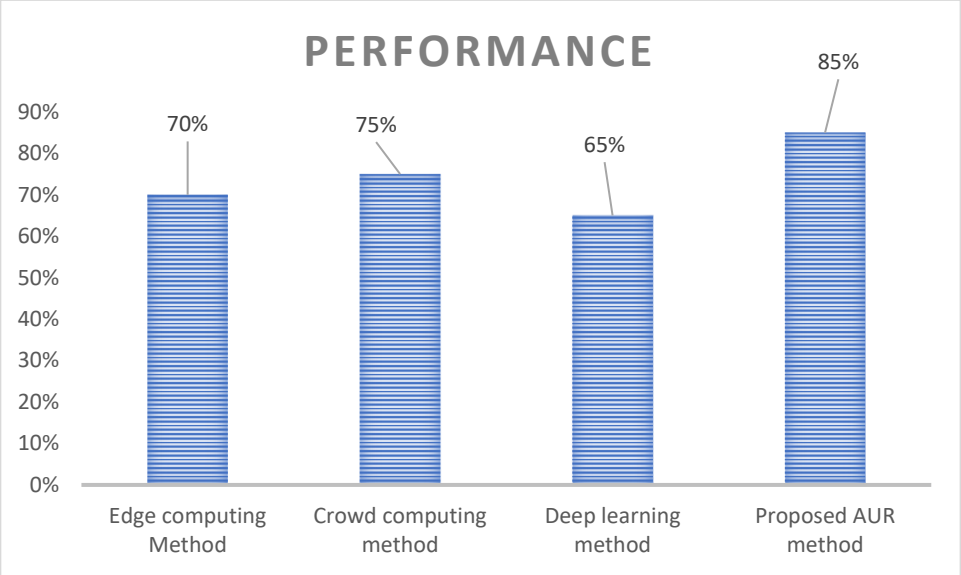

Figure 2. Graph showing a comparison of AUR method with other existing methods

Conclusion

The method proposed in this paper works on the concept of resource pooling. The motivating example as pointed out early is one of the applications where the AUR model can be used. As incentives are given to the organizations, there is a greater chance that many organizations will give their willingness and deliver their unused resources. The cost is reduced as resources are pooled and made use.

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