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| **Topic of Research** | **:** | **A Dynamic Resource Allocation Framework for Cloud Computing Environment** |

## Findings

Keywords: Cloud Computing, Resource Allocation, Virtualization, Workload Prediction, Task-Scheduling

In a cloud computing environment, it is important to be able to dynamically allocate resources in order to meet the needs of different users and applications. In this thesis, we present a dynamic resource allocation framework that can be used in such an environment. This framework makes use of several techniques, including resource virtualization, resource monitoring, and load balancing, to provide an efficient and effective way of allocating resources. Resource allocation is a key factor in determining the performance of applications and services for Cloud Computing. To date, most resource allocation schemes have been static, meaning that they do not consider the dynamic nature of cloud environments. A dynamic resource allocation framework is one that can adapt to the changing needs of applications and services in a cloud environment. Such a framework can result in improved performance and utilization of resources, as well as reduced costs. There are many challenges involved in developing a dynamic resource allocation framework, but it is an important area of research that can have significant benefits for cloud computing.

The resource allocation problem in cloud computing is a complex one that has received considerable attention in recent years. The goal of resource allocation is to efficiently utilize the resources of a system to meet the demands of the workload. In cloud computing, the resource allocation problem is further complicated by the need to dynamically allocate resources in response to changing workloads. Despite the challenges, there have been several proposed solutions to the resource allocation problem in cloud computing. One promising approach is known as the "dynamic resource allocation framework".

For analytical applications in research, a detailed literature review of resource allocation aspects such as task scheduling and energy efficiency has been conducted. During the literature review, a taxonomy of various energy efficiency techniques was proposed. The study of task scheduling algorithms and energy-efficient algorithms has been conducted based on several task scheduling parameters. In order to identify the parameters that require more attention from the research community, the advantages and limitations of these techniques have been analysed and compared. Additionally, a graphical representation of this analysis has been provided. The aim of this literature review is to provide future directions to researchers who wish to work in this area of research.

In the development of a framework for dynamic resource allocation, many aspects need to be considered. In the research work, a multi-objective machine learning framework has been proposed to predict the upcoming workload of cloud users in order to balance load and conserve energy in cloud data canters. Various machine learning approaches have been applied and compared to determine the most effective approach for predicting workload. Task scheduling is one of the most important aspects during resource allocation in cloud computing. A resource aware Min-Min (RAMM), task scheduling algorithm has been proposed and compared with the other existing algorithms. The proposed algorithm is different in that it schedules a task that has a minimum execution time to a resource that has a minimum completion time. When the minimum completion time resource is engaged with another task, it assigns the next minimum completion time resource to that task, which reduces the waiting time and decreases the makespan.

There is evidence that scientific workflow management systems are effective in several fields, including astronomy, social science, bioinformatics, and neuroscience. A traditional data management system and computing infrastructure cannot be used to conduct big data analytics. To be effective, big data analytics systems require high performance computing. In a wide range of fields, such as optimization and interdisciplinarity, cloud computing has found applications. Providing an operative storage solution for the huge data storage problem and offering a cost-effective solution to the computing hardware requirements, it appears to be an obvious solution to the big data problem. In this study, we examine existing approaches and systems for implementing big data scientific workflows in the cloud with the goal of identifying open research problems and identifying specific research initiatives in these areas.

A discussion of different scientific management systems and frameworks has been conducted, along with an explanation of how the cloud paradigm fits into the scientific workflow concept for big data analytics. In addition, it discusses challenges and opportunities associated with scientific workflows in the era of edge computing.

A network of smart devices and sensors is known as the Internet of Things (IoT) and is based on wired and wireless networking technologies that allow devices to exchange information with each other in real time. A cyber-physical ecosystem can be viewed as a network of edge-nodes that communicate with each other to carry out one or more user's tasks assigned to the network. We investigate and categorize cloud-based resource allocation techniques for IoT environments. Additionally, these algorithms are discussed regarding their limitations and improvements.

Fundamentally, this thesis targeted the challenges of dynamic resource allocation in cloud environment, this thesis proposed a multi-objective framework, resource aware Min-Min (RAMM) task scheduling algorithm, comparison and analysis of various resource allocation techniques including, task scheduling and energy-efficiency algorithms. A study of cloud-based solutions for bigdata scientific workflow has been conducted and the best solution has been provided following the analysis. IoT-based cloud resource allocation techniques have been identified for future work.

CloudSim and MATLAB tools are used during the experimental phase of the research.