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Importance and Various Types of Task Scheduling in Cloud Computing System

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Abstract

Cloud Computing has arisen as quite possibly the main new computing procedures in the undertaking. A blend of advances and cycles has prompted an insurgency in the manner that computing is created and conveyed to end client. Cloud Computing traces all the way back to 1950 for example the enormous scope centralized servers were made accessible to huge undertakings. Basically, the cloud architecture is built with the combined perspective of cloud provider, user, and the broker. Scheduling is the most important task in any working framework, and it is controlled by the CPU. This is due to the fact that resources are not stored in a particularly designated manner, but rather in a strictly handy manner in order to ensure maximum skills. Cloud computing is a relatively new technology that allows users to access computer infrastructure and other services on a demand basis. Various types of task schedulers have been developed to make use of the vast amount of cloud-based resources users can access while also improving the management of data centers. We can say that cloud computing has transformed IT by allowing users and consumers to access services via the Internet. These services range from hardware to software, saving money on both the expense of setting up physical resources and the cost of obtaining the appropriate software licenses. The task scheduling problem is one of the most important and prominent challenges facing the cloud computing system.

Keywords: Cloud computing, scheduling, task, virtual machine, etc.

1. INTRODUCTION

Cloud computing is characterized as "a model for empowering omnipresent, advantageous, on request network admittance to a common pool of configurable computing assets (e.g., networks, workers, storage, applications, and services) that can be quickly provisioned and delivered with negligible management exertion or service supplier cooperation". Cloud computing follows compositional plans and service provisioning models that stray from the customary viewpoints, plan and services of conventional data innovation. Cloud computing offers data innovation assets provisioned (primarily through the Internet) in a Service Oriented Architecture (SOA) where clients just compensation for the assets they devour [1][2].

The introduction of cloud computing systems is a watershed moment in modern information technology (IT), necessitating the development of an efficient and powerful architecture that can be used to a variety of systems that demand complicated processing and large-scale data storage. Cloud computing is a platform that can enable elastic applications in order to manage a limited number of virtual machines and computing servers to provide application services at a certain point in time. When it comes to multi-tenant computing environments, the cloud is a good choice since it allows users to share resources. It is necessary to verify and schedule available resources in the cloud using an effective task scheduler so that they may be assigned to customers depending on their demands. With the fast expansion of contemporary computer systems, the requirement for an effective task scheduler has become an essential necessity in order to attain and maintain maximum performance has become an urgent necessity. It is the responsibility of task scheduling algorithms to map workloads submitted to a cloud environment onto available materials in such a way that the overall response time and latency are reduced while the throughput and utilization of resources are maximized. Conventional task scheduling algorithms such as Shortest-Job-First (SJF), Round Robin (RR), and First-Come-First-Serve (FCFS), Multilevel queue scheduling (MQ), Max-Min, and Min-Min have achieved breathtaking results in different computer system types over the years, but they have always been plagued by major problems such as increased waiting time in RR and FCFS and starvation in SJF and Max-Min [3][4].

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Cloud Computing has arisen as quite possibly the main new computing procedures in the undertaking. A blend of advances and cycles has prompted an insurgency in the manner that computing is created and conveyed to end client. Cloud computing is characterized by National Institute of Standards and Technology (NIST) as: "a model for empowering helpful, on demand network admittance to a common pool of configurable computing resources(e.g., networks, workers, stockpiling applications and services) that can be quickly provisioned and delivered with insignificant management exertion or service supplier connection". The cloud computing worldview upgrades dexterity, scalability, and accessibility for end clients and ventures. Cloud Computing gives advanced and proficient computing platform, and decreases equipment and software venture cost, just as carbon impression For instance, Netflix, as it out growed its data place capacities, settled on a choice to move its site and web-based feature from a customary data community execution to a cloud environment. This progression permitted the organization to develop and extend client base without building and supporting data place impression to meet its development prerequisites [5][6].

2. HISTORY OF CLOUD TECHNOLOGY

Cloud Computing traces all the way back to 1950 for example the enormous scope centralized servers were made accessible to huge undertakings. There the centralized computers' equipment infrastructure was gathered and introduced in worker room; the clients had the option to get to the data at worker by their imbecilic terminals. Later in 1970, IBM delivered an Operating System (OS) called Virtual Machine (VM) that permitted administrators to have numerous virtual systems on a solitary actual hub. Each VM runs on visitor OS hand their own memory, CPUs and equipment gadgets alongside consoles, systems administration and CD-ROMs in spite of the way that those assets would be shared. Consequently virtualization idea turned into an innovation driver and it went about as an impetus for some greatest advancement in computing. In 1990s, the media transmission businesses came to its meaningful conclusion to-point data association as virtualized private organization associations with a similar service quality at a diminished rate. So the market pattern changed this way - "these workers are modest, allowed us to concentrate out how to join them". This move just cleared the venturing stone for Cloud Computing. A system would introduce the entirety of the assets as though they were in a solitary actual hub, by installing a piece of software called hypervisor across numerous actual hubs [7][8].

The significant advantage of the idea driving cloud computing is that the normal client doesn't need a PC that is very incredible to deal with complex database ordering assignments. With this resource, cloud computing clients from everywhere the world can appreciate the advantages of colossal processing power without significant capital or specialized expertise. The weighty utilization of transmission capacity that includes the web of today is the thing that makes the innovation work, as already networks were substantially less powerful because of moderate transfer and download speeds that were accessible at that point. Another main consideration that changed the scene was the possibility that large numbers of modest PC equipment could be outfit to make a limitlessly organized data place similarly comparable to a more modest measure of more costly, better worker equipment[9][10].

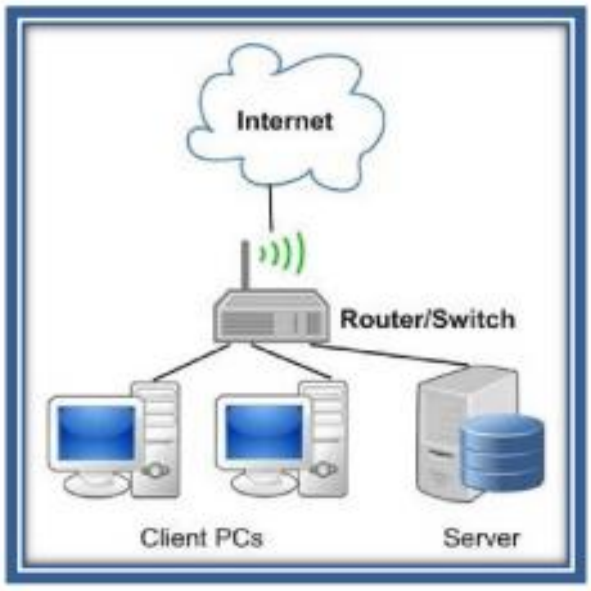

Figure 1: Cloud to denote Internet

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It is fascinating to know the justification the name 'Cloud Computing'. The root of the term cloud computing is dark, yet it seems to get from the act of utilizing drawings of adapted clouds to indicate networks in outlines of computing and correspondences systems. The name 'Cloud Computing' was propelled by the 'Cloud' image (Figure 1) that is frequently used to address the Internet in stream outlines and chart since Cloud computing implies conveying facilitated service over the Internet.

3. CLOUD ARCHITECTURE

Basically, the cloud architecture is built with the combined perspective of cloud provider, user, and the broker. The cloud conceptual reference model include of cloud carrier, consumer auditor, provider and broker [11][12].

3.1 Cloud Consumer

The cloud consumer is regarded as a major stakeholder, and it represents a company or individual that obtains Cloud Computing services from a cloud provider for the purpose of doing their business. Cloud consumers can receive service from cloud providers in accordance with the terms of their service level agreements (SLAs). It outlines technical performance criteria, service contracts, and costs, quality of service, security and remedies in the event of a performance failure. A cloud customer can use any type of cloud service, including SaaS, PaaS, and IaaS, to accomplish their goals [13][14].

3.2 Cloud Auditor

A cloud auditor is a third party who has the ability to conduct an independent assessment of service checks with the purpose of expressing an opinion on the results. They may assess the privacy implications of cloud services, as well as their performance and security measures, among other things. A contractual condition allowing third parties to review the security measures of cloud service providers, according to Vivek Kundra, should be included in agencies' contracts".

3.3 Cloud Provider

The job of the cloud provider is extremely crucial, as well as the most challenging. An elastic pool of resources such as servers, networks, storage and engineered systems is provided by a cloud provider, who uses cloud enabling technologies such as distributed computing, autonomic computing, internet technologies, and virtualization to meet the demands of customers on an as-needed basis. Service orchestration, cloud service management, service deployment, privacy and security are just a few of the categories in which cloud providers may be classified according to their capabilities.

- **Service Orchestration:** The paradigm for service orchestration is composed of three layers. The first is the service layer, which defines the interfaces that cloud users may use to access computing resources that are provided as services. SaaS (Software as a Service), PaaS (Platform as a Service), and IaaS (Infrastructure as a Service) are the three degrees of service offered. Individuals and groups can use the services, and they can access and use them at the same time. It is followed by a layer known as the resource abstraction and control layer, which allows physical resources to be conceptually partitioned with the use of virtualization technologies. This layer is in charge of access control, resource allocation, and use monitoring, among other things. Third, the physical resource layer, which includes all physical computing resources such as servers, networks, storage components, power, cooling systems, and other aspects of the physical components, as well as all other layers of computer resources [15][16].
- **Cloud Service Management:** All of the service-oriented tasks are addressed from the perspectives of provisioning and configuration, business support, portability or interoperability, and interoperability or portability. This section focuses on supplying resources quickly, modifying resources quickly, monitoring and metering, reporting and service level agreement (SLA) management, among other things. Business support activity is comprised of a collection of business-related services that are handled in conjunction with cloud users, companies, and supporting procedures. For cloud users, it provides features such as customer management, contract management, inventory management, accounting, and invoicing, as well as reporting, auditing, pricing, and rating.
- **Security and Privacy:** Cloud security is a critical problem since it must be protected from the physical layer all the way up to the application layer. It handles cloud security needs such as authorization, availability, authentication, confidentiality, integrity, management, audit, identification, monitoring, threat detection, and security policy management, as well as cloud computing security controls such as encryption. In order to maintain privacy, the cloud provider should take appropriate measures to safeguard Personally Identifiable Information (PII). Information about a person's identification, such as their place of birth, date of birth, name, social security number, biometric information, and so on, is used to track or recognize that person's identity.

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3.4 Cloud Broker

Because of the rapid advancement of Cloud Computing, the consolidation of Cloud Computing services has become too complex for cloud customers to handle. Instead of directly contacting a cloud provider, a cloud user may choose to contact a cloud broker to gain access to services. A cloud broker is a company that facilitates the negotiation of cloud services between cloud consumers and cloud providers on their behalf. A cloud broker can provide services such as service intermediation, service aggregation, and service arbitrage, among other things.

3.5 Cloud Carrier

A cloud carrier serves as an intermediary between cloud providers and cloud consumers, facilitating the delivery and connection of Cloud Computing services. User access is provided by a variety of means, including telecommunication networks, local area networks, transport agents, and other access devices. Moreover, in accordance with the service level agreement, a cloud carrier must provide dedicated and secure connections between cloud users and cloud providers [17][18][19].

4. TASK SCHEDULING

Scheduling is the most important task in any working framework, and it is controlled by the CPU. This is due to the fact that resources are not stored in a particularly designated manner, but rather in a strictly handy manner in order to ensure maximum skills. Because cloud services need a significant level of control and management of resources, effective scheduling is essential for the efficient management of projects and activities. Scheduling is critical to the operation of the management system. This problem is known to be NP-complete in generally due to the nature of the scheduling problem involved. Clients submit tasks to a broker or scheduler who then uses the information to execute the scheduling algorithm, allowing the system to begin taking task. In cloud-based infrastructure, real machines are virtualized into unified resources known as virtual machines, which are shared by multiple users (VMs). With the scheduler, you can control how and when resources (VMs) are used, and you can also control which tasks are done on each of these resources. It assigns tasks to the most appropriate virtual machine so that the computing process may be completed in order to meet the Quality of Service (QoS) restrictions imposed by users, such as deadlines and costs. This QoS-based optimization tries to minimize execution costs or to make execution time as fast as feasible while staying within a defined budget range. Scheduling refers to the process of allocating system resources to different activities. When it comes to cloud computing, scheduling is utilized to achieve excellent performance and the highest system throughput.

Cloud computing is a relatively new technology that allows users to access computer infrastructure and other services on a demand basis. Also of note, cloud computing has risen to become one of the most advanced technologies due to its rapid development and excellence in providing services to businesses, institutions, and users in an efficient, timely, and cost-effective manner in order to meet the needs of the users and ensure their satisfaction. User tasks are transmitted over the internet to cloud computing service providers, who are responsible for scheduling the tasks of customers into the resources available in a manner consistent with the service level agreement (SLA) contract between the user and service providers, as well as meeting the quality of service (QoS) requirements agreed upon in the SLA. Task scheduling in a cloud computing environment is a significant problem since it is concerned with increasing the use of resources such as processing power, memory, bandwidth, storage, and so on.

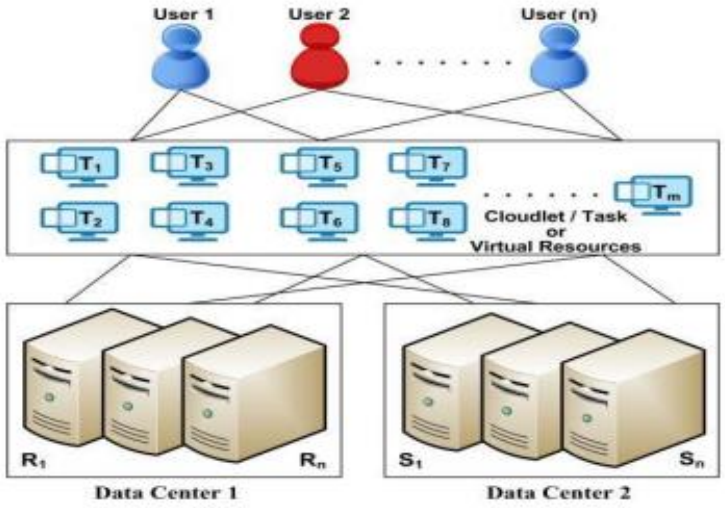

Figure 2: Task Scheduling in Cloud Computing

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5. TYPES OF SCHEDULING IN CLOUD

Various types of task schedulers have been developed to make use of the vast amount of cloud-based resources users can access while also improving the management of data centers. These include Job scheduling, Virtual Machine scheduling, Workflow scheduling, Storage scheduling, and Task scheduling, to name a few. Detailed descriptions of the many types of scheduling strategies are provided in the subsequent sections:

- **Job Scheduling:** Job scheduling is comparable to how the operating task distributes tasks among its available resources. When evaluating a task, it considers the priority of other tasks currently in the queue, as well as the arrival time, waiting time, execution time, and deadline of the task in task. This aids in the accurate mapping of the task to the resources at the appropriate moment. Job scheduling features are included into the cloud computing environment. A job scheduler may be thought of as a user portal that has a greater sense of control over all of the jobs.
- **Virtual Machine Scheduling:** At first, the cloud service provider establishes a resource pool of virtual machines for its customers. One of the most difficult difficulties encountered by IaaS is the creation of virtual machines. There are several requirements that must be met before a virtual machine can be created, including meeting the Service Level Agreement (SLA), which defines how each host is linked with its Virtual Machine. In addition, throughout the scheduling procedure, a virtual machine transfer is carried out.
- **Workflow Scheduling:** Working flow diagrams are a collection of task representations that have a relationship to one another. Typically, a Directed Acyclic Graph (DAG) is used to describe workflows, in which each vertex represent a task and each link reflects the precedence and flow between two tasks in the workflow. According to the amount of resources and the type of resources assigned, as well as how it impacts the time required for the workflow to be completed, an assessment of the economic burden is made.
- **Storage Scheduling:** It is referred to as storage scheduling when a big data block with a large size and diverse data kinds (Video, Audio, and Text) is kept in clusters at different geographical locations. When the data amount raises, much like with big data, it creates significant complications. According to the information acquired from the resources and storage locations, storage scheduling divides a huge block of data into smaller pieces.

6. CONCLUSION

We can say that cloud computing has transformed IT by allowing users and consumers to access services via the Internet. These services range from hardware to software, saving money on both the expense of setting up physical resources and the cost of obtaining the appropriate software licenses. The task scheduling problem is one of the most important and prominent challenges facing the cloud computing system. Task Scheduling is concerned with assigning user-generated tasks to the appropriate resources given by the service provider. The primary goal of any task scheduling algorithm is to ensure fairness among the jobs throughout their execution and to decrease waiting time, as well as to enhance performance, quality of service, such as throughput end-to-end latency, and overall system performance. When providing services to a large number of users simultaneously in cloud computing, you must consider the reaction time of each individual user, and you cannot make consumers wait for an excessive amount of time.

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