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A Green Approach Towards Hybrid Cloud Operability

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ABSTRACT

With increase in demand of technology and orchestration, the cloud computing can be seen on trail now days in respect of almost every field. But due to the advancement and growth of clouds, there has been an indiscriminately increase in power consumption because of data centers hosting, In fact Cloud applications consume huge amounts of energy, contributing to high operational costs and carbon footprints to the environment. And moreover existing and new technologies and tools are leveraged to realize these classes of variability. This paper proposes a new approach to reduce energy utilization in data centers with an optimization of clouds application through hybrid clouds. Further, we cover architectural principles to follow during the design of flexible cloud applications and we introduce an abstract architectural pattern to enable data variability. To increase the number of customers, a flexible application design is of major importance. It enables customers to adjust the application to their individual needs in a self-service manner.

KEYWORDS: Orchestration, Optimization, Workflow, Virtualization, Paradigm,Decentralization

1. INTRODUCTION

"21st century" an era of technology with greatest innovation and invention, which has optimized our dependencies in every aspect? The great advancement can be seen in IT computing such that, users will access Internet services over lightweight portable devices rather than through some descendant of the traditional desktop PC. Because users won't have (or be interested in) powerful machines, who will supply the computing power? [1]

Now if we talk about Cloud computing, it is nowadays being used to deliver on demand storage and processing power. This environment allows the leasing of resources to improve the locally available computational capacity, supplying new computing resources when necessary. In a cloud, the user accesses computing resources as general utilities that can be leased and released [2].

Berkeley report [17] stated "Cloud Computing, the long-held dream of computing as a utility, has the potential to transform a large part of the IT industry, making software even more attractive as a service". The main benefits to the cloud users is the avoidance of up-front investment, the lowering of their operating cost, the maintenance cost reduction, and the scalability provided on demand. These cloud features provide elasticity to the user's computing environment, being able to adapt the computer system to the user needs.[3]

On contrary data centres hosting Cloud applications consume huge amounts of energy, contributing to high operational costs and carbon footprints to the environment. Therefore, we need Green Cloud computing solutions that can not only save energy for the environment but also reduce operational costs. [4]

One of the greatest environmental concerns of the industry is their data centres [5], which have increased in number over time as business demands have increased, with facilities housing a rising amount of evermore powerful equipment [6]. As data centres run into limits related to power, cooling and space, their ever-increasing operation

has created a noticeable impact on power grids [7][8].

The initiatives is aimed at a framework in *optimization* of the cloud architecture taking into account the tradeoffs involved in maintaining acceptable dependability requirements with minimal power at runtime.

2. HYBRID CLOUDS BREIF VIGNETTE

Workflows have been used to represent a variety of applications involving high processing and storage demands. As a solution to supply this necessity, the cloud computing paradigm has emerged as an on demand resources provider. While public clouds charge users in a per-use basis, private clouds are owned by users and can be utilized with no charge. so a public cloud and a private cloud are merged to form a new type cloud called hybrid cloud. In a hybrid cloud, the user has elasticity provided by public cloud resources that can be aggregated to the private resources pool as necessary.[9]

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Virtualization [10] is the process of presenting a logical grouping or subset of computing resources so that

they can be accessed in abstract ways with benefits over the original configuration. The virtualization software abstracts the hardware by creating an interface to virtual machines (VMs), which represents virtualized resources such as CPUs, physical memory, network connections, and peripherals.

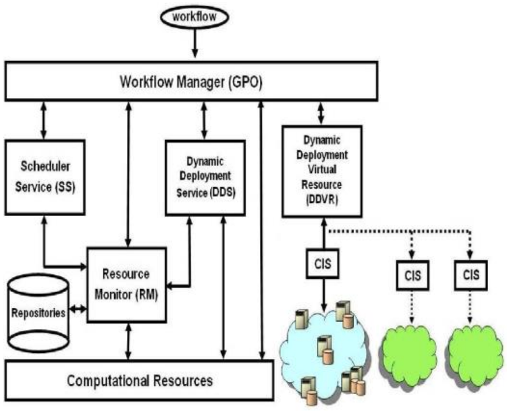


Fig. 1 The hybrid architecture.

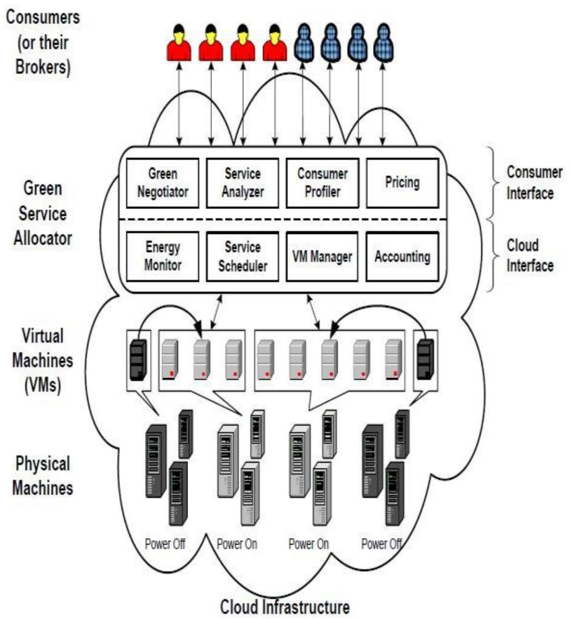
1.1 **EnvironmentalSustainability:**

We expect the Community Cloud to have a smaller carbon footprint than vendor Clouds, on the assumption that making use of underutilized user machines requires less energy than the dedicated data centers required for vendor Clouds. The server farms within data centers are an intensive form of computing resource provision, while the Community Cloud is more organic, growing and shrinking in a symbiotic relationship to support the demands of the community, which in turn supports it.

1.2 **Service Composition:**

The great promise of service oriented computing is that the marginal cost of creating the application will be virtually zero, as all the software required already exists to satisfy the requirements of other applications. Only their composition and orchestration are required to produce a new application [11], [12]. Within vendor Clouds it is possible to make services that expose themselves for composition and compose these services, allowing the hosting of a complete service-oriented architecture [14]. However, current service composition technologies have not gained widespread adoption [13]. Digital Ecosystems advocate service compos ability to avoid centralized control by large service providers, because easy service composition allows coalitions of SMEs to compete simply by composing simpler services into more complex services that only large enterprises would otherwise be able to deliver [15]. So, we should extend decentralization beyond resource provision and up to the service layer, to enable service composition within the Community Cloud.

3. CHALLENGES FACED BY CLOUDS INFRASTRUCTURE:



"The total estimated energy bill for data centers in 2010 is $11.5 billion and energy costs in a typical data center double every five years", according to McKinsey report [16].

Normally, data center resources are statically allocated to applications, based on peak load characteristics, in order to maintain isolation and provide performance guarantees. The average data center consumes as much energy as 25,000 households [19]. As energy costs are increasing while availability dwindles, there is a need to shift focus from optimising data center resource management for pure performance to optimising for energy efficiency while maintaining high service level performance.[4] Since the variability of different cloud for different application, has increase the manageability of private clouds and public clouds. Prior to the establishment of cloud computing, hardware virtualization has introduced flexibility to hardware management. It forms the basis for on-demand use of cloud resources. Due to hardware virtualization, resources are no longer bound to physical servers. Therefore, their provisioning can be automated and is offered via management interfaces to cloud users. Recently, significant effort was made by the industry to standardize these interfaces [19], [20][21]. **Green Cloud computing** is envisioned to achieve not only efficient processing and utilization of computing infrastructure, but also minimize energy consumption. This is essential for ensuring that the future growth of Cloud computing is sustainable . Otherwise, Cloud computing with increasingly pervasive front-end client devices interacting with back-end data centers will cause an enormous escalation of energy usage. To address this problem, Cloud resources need to be allocated not only to satisfy QoS requirements specified by users via Service Level Agreements (SLA), but also to reduce energy usage.[4]

4. NEED OF HYBRID CLOUD

Many cloud offerings [22], [23], [24], [25] also brought this flexibility of the infrastructure to the application level. Configurable applications are offered to customers (referred to as "Software as a Service", SaaS). Configurable platform services can be used by customers to develop and execute custom applications (referred to as "Platform as a Service", PaaS). Also, there are offerings that allow users to flexibly compose individual services and platform services into custom applications (referred to as "Composition as a Service", CaaS [26]). In this scope, flexibility is enabled by two types of compositions [27]. "Horizontal composition" refers to the orchestration of services themselves. "Vertical composition" refers to the combination of service implementation, required middleware and runtime environments (especially, different clouds) which can optimize the usage of the clouds in their usability and provide a user a flexible approach for he user and even this enables tenants to individually distribute application components among computing environments forming a hybrid cloud.

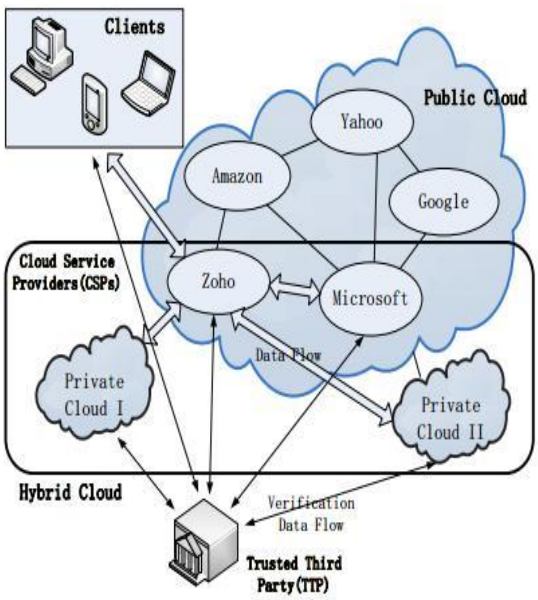


Figure 2: Cloud data storage architecture for hybrid clouds

[28]In cloud computing, one of the core design principles is dynamic scalability, which guarantees cloud storage service to handle growing amounts of application data in a flexible manner or to be readily enlarged. By integrating multiple private and public cloud services, hybrid clouds can

effectively provide dynamic scalability of service and data migration. For example, a client might integrate the data from multiple private or public providers into a backup or archive file (see Figure 3), or a service might capture the data from other services from private clouds, but the intermediate data and results are stored in hybrid clouds [29].

5. AN INITIATIVE CHECK ON HYBRID CLOUDS ASSOCIATED TO ITS GREEN IMPACTS

The cloud architecture is *dynamically* scaling up to accommodate such growth. Such growth necessitates dynamic approaches for maintaining and monitoring an acceptable level of Quality of Service (QoS).For meeting QoS and dependability, requirements is critical and can't be neglected in favor of power savings.

CO_2 emissions increases as we move towards the heavily optimization on the cloud. For example, it would be expecting that more servers/nodes to be deployed and consequently more cooling power would be required In this position statement, we report on the activities of the ongoing EPSRC/University of Birmingham Bridging the Gap Fellowship on Green Cloud. The initiatives is multidisciplinary and aimed at a framework for *dynamic self-optimization* of the cloud architecture taking into account the tradeoffs involved in maintaining acceptable dependability requirements with minimal power at runtime[33] .

Activities leading to green cloud [33]

a. Power data analyzer in the cloud in relation to QoS.
b. Modeling power and Quality of Service (QoS) demands and new meters for QoS per cloud power value.
c. Economics-inspired approach for self-optimizing the cloud architecture.
d. Implementation framework using Dynamic Data Simulation Systems (DDAS).

To the extent that data centre efficiency has become an important global issue, leading to the creation of the Green Grid[30], an international non-profit organization mandating an increase in the energy efficiency of data centres. Their approach and virtualization has improved efficiency [31][32], but is optimizing a flawed model that does not consider the whole system, where resource provision is disconnected from resource consumption. For example, competing vendors must host significant redundancy in their data centres to manage usage spikes and maintain the illusion of infinite resources. So, we would argue that an alternative, more systemic approach is required, where resource consumption and provision are connected, to minimize the environmental impact and allow sustainablegrowth.

6. SUMMARY AND OUTLOOK:

We have presented a new outlook of hybrid cloud computing in an eco friendly way, it plays a significant role in the reduction of data center energy consumption costs and thus helps to develop a strong, competitive Cloud Computing industry. Since, desired variability of flexible cloud applications are described how they enable the Cloud using certain architectural principles, techniques and tools. Users are now able to create individualized composite applications using a self-service portal. Application providers may use the presented framework to offer application components and referential orchestrations thereof to customers. The provisioning of application

components is adjusted individually. This results in customer specific application component distribution among different clouds, especially to support hybrid cloud environments.
And even research will raise the understanding of evolution trends in dynamic systems and improve their quality and robustness through dependability and power measurement and control.

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