Comparative Analysis of Cloud Computing Architectures Through an Extensive Literature Review

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Abstract - ***Services are not brand new; there have been network services since the invention of the internet People were able to login remotely, transfer files via the ftp protocol in the early years of the internet already. However in the last couple of years internet services offered online took on an even new dimension. Software is now capable of being offered online including big fast machines in someone else data centre running an application that is accessed using a familiar web browser, although someone else owns the application.***

Keywords - Cloud computing; data integrity; middleware, security of data, cloud services, data distribution, data flow management, data integrity, hybrid cloud computing architecture.

I. INTRODUCTION

At first it will be necessary to get a fundamental overview of the development of distributed computing, its first occurrence and how it evolved. It is also inevitable to clearly clarify what cloud computing is, which concepts it involves and how it distinguishes from all the other concepts that will be explained in the following chapter.

Secondly, the IT outsourcing theory is presented. Five different perspectives for IT outsourcing are explained in detail in a way to provide a basis to the framework development. Using different approaches, this research covers most of the literature published until now in terms of IT outsourcing.

Therefore, the convergence of IT outsourcing theories and the main concepts involving cloud computing are the foundation to understand the whole picture of this study and pave the way to answer the research question at hand.

Distributed Computing

Distributed computing refers to the very idea of using distributed systems that are generally multiple computers connected to each other via computer networks to collaboratively process a common goal. Those computers communication can be homogeneous or heterogeneous, distributed globally or locally. According to the characteristics of localization or equality, distributed systems have different subsets, such as supercomputers, grids, clusters, web 2.0 and clouds.

Before going further into the subsets of distributed computing, an illustration is provided to visualize the interconnection between the concepts that will be explained in the following

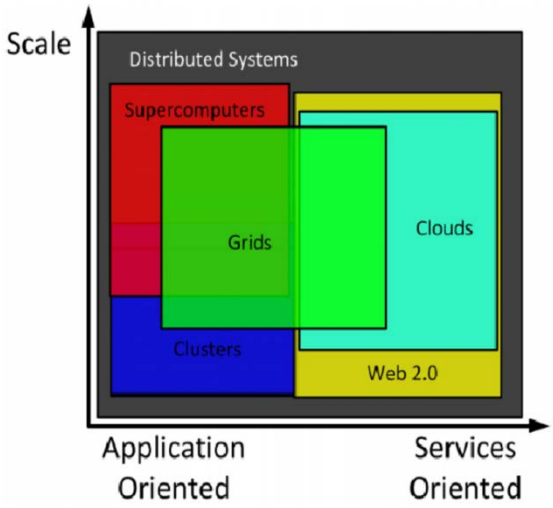

Fig. 1: Distributed Computing and its subsets

As an example for distributed computing, the Search for Extra-Terrestrial Intelligence, short SETI, is a prime example based on heterogeneous and globally located computers. Every participant is able to download the peace of software and then interconnect to a centralized server. The servers provide the input from their sensors with a huge amount of data, making the calculation of this data normally very complicated. While a single computer would not be able to do that in an appropriate amount of time, millions of computers that are interconnected anywhere in the world can.

Clusters

Characteristics of clusters are that the computers being linked to each other are normally distributed locally, and have the same kind of hardware and operating system. Therefore cluster work stations are connected together and can possibly be used as a super computer.

Grids

When defining grid computing it is necessary to differ it from clusters. While clusters are distributed locally and

obliged to use the same hardware and OS, grids involve heterogeneous computers that are connected to each other and distributed globally. The OS and hardware that run on those machines can also be different from each other.

The computers that are interconnected over the internet can come from anywhere while there is usually no obligation to pay. For this reason already it is obvious that grids being connected are not nearly as expensive as the supercomputers that are offered from IBM and other technology companies.

Clouds

Together with virtualization, clouds can be defined as computers that are networked anywhere in the world with the availability of paying the used clouds in a pay-per-use way, meaning that just the resources that are being used will be paid In the following the types of clouds will be introduced.

- *Public Clouds*

A public cloud encompasses the traditional concept of cloud computing, having the opportunity to use computing resources from anywhere in the world. The clouds can be used in a so-called pay-per-use manner, meaning that just the resources that are being used will be paid by transaction fees.

- *Private Clouds*

Private clouds are normally data enters that are used in a private network and can therefore restrict the unwanted public to access the data that is used by the company. It is obvious that this way has a more secure background than the traditional public clouds. However, managers still have to worry about the purchase, building and maintenance of the system.

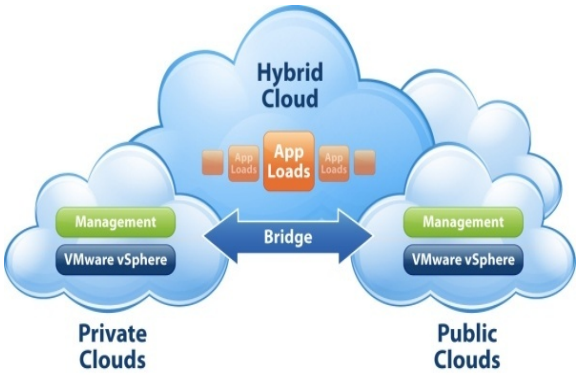

Fig. 2: Cloud Computing Types

Hybrid Clouds

As the name already reveals, a hybrid cloud is a mixture of both a private and public cloud. This can involve work load being processed by an enterprise data centre while other activities are provided by the public cloud.

Below an overview of all three cloud computing types is illustrated

Cloud Computing

Cloud Computing is now the usage of the clouds. It will be explained how cloud computing differs to the concepts that were introduced before. This will give a distinct definition of what cloud computing is. Afterwards the types of services that are being offered under the name of cloud computing, that is Infrastructure, Platform and Software as a Service, will be explained.

II. LITERATURE SURVEY

E. Pluzhnik, O. Lukyanchikov, E. Nikulchev and D. Biryukov,[1] Cloud computing is a new paradigm for hosting clusters of data and delivering different services over the network or Internet. With the growing popularity of cloud services not only the scope and types of services expand, but also the need for new solutions, “cloud” of tasks: providing security and data integrity, quality of service, construction of systems of data flow management and principles for data distribution in the cloud. However, this data network creates a lot of features. This article describes the development of middleware for hibrid cloud computing architecture.

M. Bahrami and M. Singhal, [2] The emerging field of Cloud Computing provides several advantages over traditional in-house IT services, such as accessing to elastic on-demand computing and storage over the Internet, and cost effective pay-per-use subscription plans. However, according to the International Data Corporation (IDC), cloud computing has several issues, such as a lack of standardization, a lack of customization, and limited interoperability. In addition, there is an increasing demand for introduction and migration of a variety of services to cloud computing systems, which are abstract their offering services into various *-as-a-Services (*aaS) layers. Although each such service provides a new feature (e.g., simulation services in cloud), it aggravates the issues due to the lack of standardization and inability to customize services by a vendor because each *aaS has its own features, requirements and output. In this paper, we propose a cloud architecture to alleviate issues associated with standardization and customization. In the cloud, the proposed architecture uses a single layer, called Template-as-a-Service (TaaS), to provide: (i) a single service layer for interaction with all resources and major cloud services (e.g., IaaS, PaaS, SaaS and *aaS), (ii) a standardization for existing services and future *aaS across different cloud environments, and (iii) a customizable architecture which

can be modified on demand by a cloud vendor, and its partners to provide the flexibility on cloud computing systems. A comparison with previous studies show that the proposed architecture provides customization and standardization for cloud services with minimum modifications.

SR. NO.	TITLE	AUTHORS	YEAR	METHODOLOGY
1	Developing middleware for hybrid cloud computing architectures	E. Pluzhnik, O. Lukyanchikov, E. Nikulchev and D. Biryukov	2015	Describes the development of middleware for hibrid cloud computing architecture.
2	DCCSOA: A Dynamic Cloud Computing Service-Oriented Architecture	M. Bahrami and M. Singhal	2015	Propose a cloud architecture to alleviate issues associated with standardization and customization.
3	Virtual laboratories in cloud infrastructure of educational institutions	E. V. Pluzhnik and E. V. Nikulchev	2014	Consider scientific and educational resources of the educational institution in order to ensure definiteness of the research.
4	Differentiated Performance Management in Virtualized Environments Using Nonlinear Control	T. Patikirikorala, L. Wang, A. Colman and J. Han	March 2015	Presents a new nonlinear control approach that enables achieving differentiated performance requirements effectively in virtualized environments through the automated provisioning of resources.
5	Virtual Infrastructure Management in Private and Hybrid Clouds	B. Sotomayor, R. S. Montero, I. M. Llorente and I. Foster	Sept.-Oct. 2009	IT infrastructure is deployed in a provider's data center as virtual machines. With IaaS clouds' growing popularity, tools and technologies are emerging that can transform an organization's existing infrastructure into a private or hybrid cloud.

E. V. Pluzhnik and E. V. Nikulchev, [3] MATLAB much used for the organization of computer laboratories in the cloud. The main components of the architecture are: use of SaaS- portal; autonomous system of automatic framework and control; hybrid cloud IaaS. We will consider scientific and educational resources of the educational institution in order to ensure definiteness of the research. Moscow Technological Institute is the largest Russian University, providing distance learning programs and possessing a powerful structure.

T. Patikirikorala, L. Wang, A. Colman and J. Han [4] the efficient management of shared resources in virtualized environments has become an important issue with the advent of cloud computing. This is a challenging management task because the resources of a single physical server may have to be shared between multiple virtual machines (VMs) running applications with different performance objectives, under unpredictable and erratic workloads. A number of existing works have developed performance differentiation and resource management techniques for shared resource environments by using linear feedback control approaches. However, the dominant nonlinearities of performance differentiation schemes and virtualized environments mean that linear control techniques do not provide effective control under a wide range of operating conditions. Instead of using linear control techniques, this paper presents a new nonlinear control approach that enables achieving differentiated performance requirements effectively in virtualized environments through the automated provisioning of resources. By using a nonlinear block control structure called the Hammerstein and Wiener model, a nonlinear feedback control system is integrated to the physical server (hypervisor) to efficiently achieve the performance differentiation objectives. The novelty of this approach is the inclusion of a compensation framework, which reduces the impact of nonlinearities on the management system. The experiments conducted in a virtual machine environment have shown significant improvements in performance differentiation and system stability of the proposed nonlinear control approach compared to a linear control system. In addition, the simulation results demonstrate the scalability of this nonlinear approach, providing stable performance differentiation between 10 applications/VMs.

B. Sotomayor, R. S. Montero, I. M. Llorente and I. Foster [5] one of the many definitions of "cloud" is that of an infrastructure-as-a-service (IaaS) system, in which IT

infrastructure is deployed in a provider's data center as virtual machines. With IaaS clouds' growing popularity, tools and technologies are emerging that can transform an organization's existing infrastructure into a private or hybrid cloud. Open Nebula is an open source, virtual infrastructure manager that deploys virtualized services on both a local pool of resources and external IaaS clouds. Haizea, a resource lease manager, can act as a scheduling back end for OpenNebula, providing features not found in other cloud software or virtualization-based data center management software.

III. PROBLIM IDENTIFICATION

Main feature of the application is an intermediate layer that implements the connection of user requests to the location of distributed data. Presence of unknown destination switching when using public cloud and mobile client makes it impossible to estimate the time of the algorithms. That is why one wants to use software technology to control all stages of the system. The hybrid infrastructure has many positive aspects of cloud computing: scalability, virtualization, as well as safety and security of data (due to the distribution of data).

The developer is usually tied to one or a couple of middleware technologies, building on them the entire system. All remote interaction between the objects and data exchange in the system is carried out based on the selected concept. This limits the abilities of the system. Moreover, often ineffective solution is selected to implement functionality not fitting the technology, because it is less labor-intensive. To solve these problems, a new unified middleware technology for programming distributed systems is advised, combining the concept of middleware technologies.

IV. CONCLUSION

Organizations are showing great interest in storing data on public clouds. This could be a result of the unprecedented growth of data recorded in the last few years. However the security issues associated with data storage over cloud is a major discouraging factor for potential adopters.

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