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CONTENTS

GRID COMPUTING IN NIGERIA UNIVERSITIES: A Framework for Decision Support Purposes Using Existing ICT Infrastructures

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Abstract

The continuous need for computing resources can be overwhelming to many Nigerian Universities. The major reason being the financial implication of meeting such needs is much more than they can bear at present. In this work, we present a solution to these worries – Grid computing. Grid computing harnesses the existing infrastructure of the university allowing for synergistic and collaborative use of computing existing resources to solve problems. This work will serve as an eye opener to Nigerian universities on the how to optimally put existing infrastructure to use. The Grid computing system was exemplified through a conceptual DSS for Clarity.

Keywords: Grid, Cloud, DSS, Synergy, Universities

INTRODUCTION

Universities are typical examples of distributed systems, they usually consist different units, departments and sections all performing usually distinct tasks for the overall purpose of meeting the university's set goals and objectives. This can imply that they use different data in different ways to accomplish different goals. However these seemingly independent nature of a university's subsets does not depict an entirely accurate picture, as all the disparate data kept by the subsets are in one way or another interrelated and therefore creates a somewhat invisible atmosphere of interdependence. These interrelated data stored in different computer systems by the different subsets of a university would be generalized and referred to as computer resource in this work. Another perspective to computer resource that would be employed in this work is the computer infrastructure i.e. the processors, memory and other hardware infrastructure.

As time continues to pass and research and development continues to grow in Nigerian universities, a greater need for computing resources would continue to suffice. These resources would be needed for reasons varying from storage space for records of staffs and students, to the need for greater computational power for processor intensive tasks to complex computations and problems. The incessant strike and continuous underfunding of university education by the Nigerian government might not be enough to accommodate the cost implications of such impending growth (Folorunso et al, 2006). In this paper, we present a viable and realistic alternative – Grid Computing. Grid computing is the use of hundreds, thousands or millions of geographically and organizationally disperse and diverse resources to solve problems that require more computing power than is available from a single machine or from a local area distributed system.

In this paper we explore Grid computing to shed light on its usefulness to Nigerian universities.

Grid Computing

Grid computing extends the original ideas of the internet to sharing widespread computing power, storage capacities and other resources(Yang, et al, 2009). It can be thought of as a distributed and large scale cluster computing and as a form of network distributed parallel processing. (Manjula & Karthikeyan, 2010). It leverages on existing IT infrastructure to optimize computing resources and manage data as well as computing workloads. Grids are collections of heterogeneous computation and storage resources scattered along distant network domains(Manjula & Karthikeyan, 2010). Grids automatically help users find, allocate and use available computer resources (Amador et al, 2009).

Grid computing is considered suitable for Nigerian universities because (Berman et al, 2003):

- It is able to make more cost effective use of the available amount of computer resources in the university preventing underutilization or overutilization.
- It provides a way to solve problems that cannot be tackled without enormous computing power. This is very useful for research.
- It shows that the resources of the many computers present in Nigerian universities today can be cooperatively and synergistically harnessed and managed in collaboration towards a common objective.

Grid computing is now an integral part of science and industry, finding application in business, medicine,

pharmacy, tomography, datamining, nuclear simulation, environmental studies, climate modeling, neuroscience, astrophysics etc (Kaufman et al, 2003). The architecture of grid computing gotten from Manjula & Karthikeyan (2010) is shown in figure 1 below.

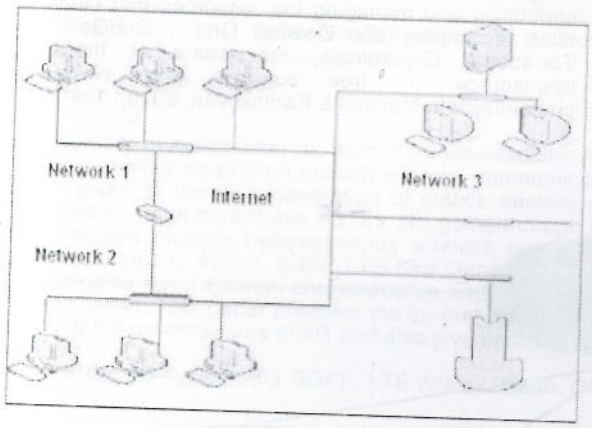

Fig. 1: An Example of a Grid Structure

Grid computing has evolved into "CLOUD COMPUTING". Cloud computing provides an on-demand resource provisioning. It is the same as Grid computing with the major difference been the type of user using it (Myerson, 2009). It is considered the convergence and evolution of several concepts from virtualization, distributed application design, grid and enterprise IT management to enable a more flexible approach for deploying and scaling applications. Cloud computing eliminates the cost and complexity of buying, configuring and managing the hardware and software needed to build and deploy applications, these applications are delivered as a service over the internet and the hardware and systems software in the data centers that provide those services (Manjula & Karthikeyan, 2010).

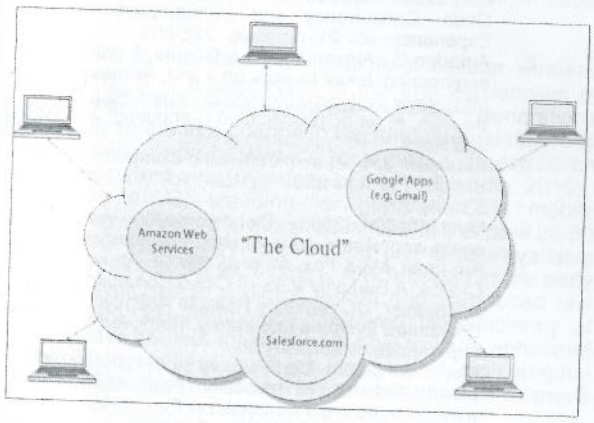

Fig 2. Cloud Architecture

Grid and cloud computing have a lot in common, they are both scalable. This scalability is accomplished by load balancing of application instances running separately on a variety of operating systems and connected through web services. However, in terms of hardware, the difference and advantages of cloud computing are (Armbrust et al, 2009): The illusion of infinite computing resources available on demand, thereby eliminating the need for cloud computing users to plan far ahead for provisioning. The elimination of an up-front commitment by cloud users, thereby allowing universities to increase hardware resources only when the need arises.

The ability to pay for use of the computing resources on a short-term basis as needed (e.g. processors by the hour and storage by the day) and release them as needed. Example of cloud computing resources are Amazon S3 which provides a web service interface for the storage and retrieval of up to 5 GB of data (Klems, 2008). The difference between cloud computing and Grid computing is further highlighted in Table 1 which compares two popular live systems.

Table 1: Comparison of EGEE and Amazon Cloud

	EGEE Grid	Amazon Cloud
Target Group	Scientific Community	Business
Service SLA	Short-lived batch-style processing (job execution) Local (between EGEE project and the resource providers)	Long-lived services based on hardware virtualization Global (between Amazon and users)
User Interface	High-level interfaces	HTTP(S), REST, SOAP, Java API, BitTorrent
Resource-side middleware	Open Source (Apache 2.0)	Proprietary
Ease of use	Heavy	Light
Ease of Deployment	Heavy	Unknown
Resource Management	Probably similar	
Funding Model	Publicly funded	Commercial

(Source: Manjula & Karthikeyan, 2010).

SAMPLE APPLICATION

To show the applicability of Grid computing in University environments and shed more light on possible usage we considered a conceptualized design for a Decision support system (DSS) and applied the DSS to solve a simple but pervasive problem of clearance for outgoing students and staff of the Tai Solarin University. Decision support systems aid in quick and accurate decision making using data from the subject domain. Traditionally student or staff clearance involves the individual going to the different departments to get cleared and eventually submitting the signed clearance form to the necessary office for processing of certificate/release documents or entitlements as the case may be.

This simple illustration states the potential of Grid computing in a university environment. The idea however over simplifies and underestimates the advantages that can be derived from grid computing which is only limited by the system developer's imagination. There are various middleware that helps in controlling and managing the resources that Grids can offer. Examples are Optimal Grid , GridGain, Ice, Terracotta, Gigaspaces, etc. some of them are opensource i.e. free software and allows for customization (Manjula & Karthikeyan, 2010).

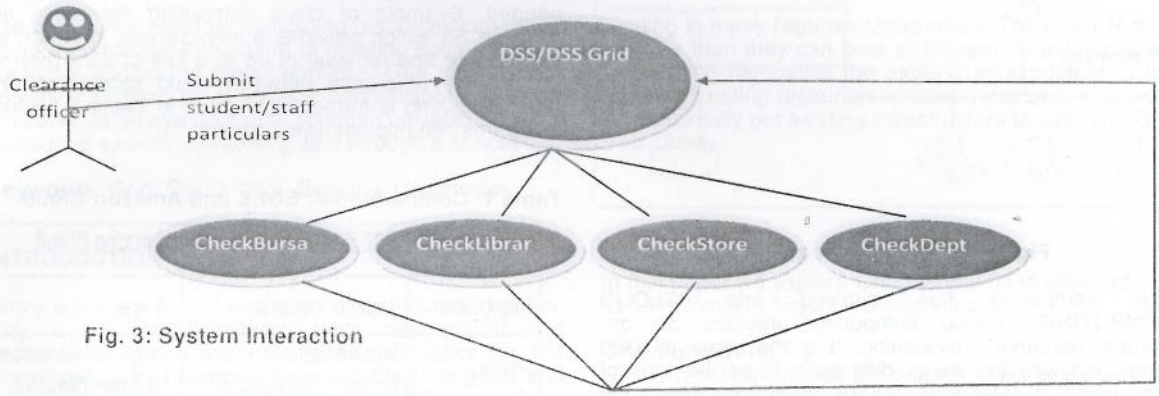

Fig. 3: System Interaction

In this case, we assume a clearance officer with a Clearance DSS. The officer enters the individuals identification particulars and the system connect to the networks for each clearing department submitting the id to their systems which in turn carries out the processing and returns the result to the DSS. The DSS then suggests decisions based on the results. The interaction between user and system is illustrated in the figure below.

Discussion

In Fig. 3 below we see how the student's or staff's information is inputted into the system for processing, the grid computing based DSS takes the input from the DSS grid and send it to the individual department's grid for processing, the output is returned to the DSS grid where the decision is made by the clearance officer.

CONCLUSION AND FUTURE WORK

Computer resources do not have to be scarce and limited, Universities can harness their present computing infrastructure to meet their increasing computing needs through grid computing. The application of Grid computing can go a long way to solve many university's problems and computational needs. Universities can also consider the use of cloud computing for even greater resource availability.

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