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Towards Developing Grid-based Portals for E-Commerce on-Demand Services on a Utility Computing Platform

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Abstract

Trends and current practices in the design and development of grid-enabled portals (GeP) reveal the need to identify and fulfill certain additional relevant requirements in order to build applicable and usable grid-enabled portals for evolving computing platforms such as the utility computing (UC). This paper reports an investigation of the minimum relevant additional requirements that must be fulfilled to attain effective GeP design for UC. A GeP prototype for the Grid-based Utility Infrastructure for Small, Micro, and Medium Enterprises (SMME) Enabling Technology (GUISET) initiative – a UC platform was developed, and an analytic evaluation experiment undertaken in the study to elicit these additional requirements using a set of benchmark requirements (standards) revealed that it fulfilled the minimum requirements to be suitable for UC context. The result of the study underlines the need for more controlled experiments in portal prototyping in order to foster the practice of GeP design for UC.

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Keywords: Grid-enabled portal requirements; Grid-enabled portal development; Utility Computing.

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1. Introduction

The utility grid computing paradigm is a variation of the conventional grid computing model in which resources and services are provided and utilized solely on per user request basis (Rappa, 2004). It is essentially based on the pay-as-you-use service provisioning business model. In a typical grid environment, Grid-enabled portals (GeP) build upon the familiar Web portal model to offer virtual organizations (VO) or community of users a uniform access to computational resources and services (Akram et al., 2005; Russel et al., 2006). So far, the design of conventional grid-enabled portals has been largely influenced by traditional functional requirements of the grid platforms (Yanli et al., 2006). However, the peculiar characteristic of UC which implements a pay-as-you-use business model imposes new requirements that must be satisfied to realize usable GeP for UC (Foster and Kesselman, 1999; Eilam, 2003; Pagden, 2003; Phillip, 2004). Studies in design prototyping of GeP of UC platforms have been rarely reported in literature, which means there is a lack of sufficient formal guidelines for the design of GeP for UC. Hence, more experimentation is needed in order to determine the composition of an adequate guidelines for the design of GeP for UC, and by so doing foster the practice of design and development of GeP for UC.

This paper reports an investigation of the minimum relevant additional requirements that must be considered and fulfilled in order to attain effective design of usable GeP for UC. We have developed a prototype GeP for Grid-based Utility Infrastructure for SMME Enabling Technology (GUISET). GUISET is aimed at technologically enabling the business activities of Small, Micro and Medium Enterprises (SMME) by facilitating an affordable access to relevant technologies on a *pay-as-you go* basis. The GUISET portal is equipped with a set of features to address the identified relevant additional requirements for UC apart from the traditional functional requirements for grid portals. An analytic evaluation experiment was done using a set of benchmark requirements to determine if the minimum set of identified relevant requirements considered necessary for the design of usable GeP for UC platforms are fulfilled in the portal prototype. The result of the evaluation revealed that the designed GUISET portal prototype fulfilled the minimum requirements to be suitable for the utility computing context.

2. Background and Related Works

2.1. The GUISET Framework

The GUISET framework is conceptualized as a suite of service-oriented on-Demand Applications such as: e-Commerce, e-Tourism, e-Health, e-Business, e-Government. (Phillip, 2004; Adigun, 2005; Khosrow-Pour, 2006). It is depicted as a Mobile Grid-enabled Utility Computing Architecture aimed at helping under-resourced SMMEs reduce their operating overhead cost to the barest minimum by providing e-Commerce services and applications on-demand (Adigun, 2008). It is a three (3) layered architecture. It comprises of (i) Multimodal Interface layer (ii) Middleware layer and (iii) Grid Infrastructure layer. This is shown in Figure 1.

The Multi-modal interfaces layer houses the various application interfaces designed for accepting customer subscription. The interfaces run on a Grid client which can be a mobile device or laptop. Each client is a potential Grid service provider or resource. The services available are also advertised through these interfaces. This layer also provides a template for customer specification of service parameters. These templates are then passed to the utility broker for a SLA-driven validation of all completed templates. The Middleware Layer comprises the utility broker, enabling information bus for dynamic services selection. The utility broker component works with validated service specification templates. It initiates a negotiation process with customer until a mutual agreement is reached and a contract is established. It also invokes a subscription manager that enforces and manages updates to all existing contracts. The billing component of the broker

collaborates with subscription manager to determine what and how services should be billed. The Service Layer Agreement, SLA management dynamically increases or decreases user Quality of Service, QoS requirements automatically as dictated by policies or as the premium subscribers choose from time to time. The Grid infrastructure layer is the resource repository that stores all the services and resources.

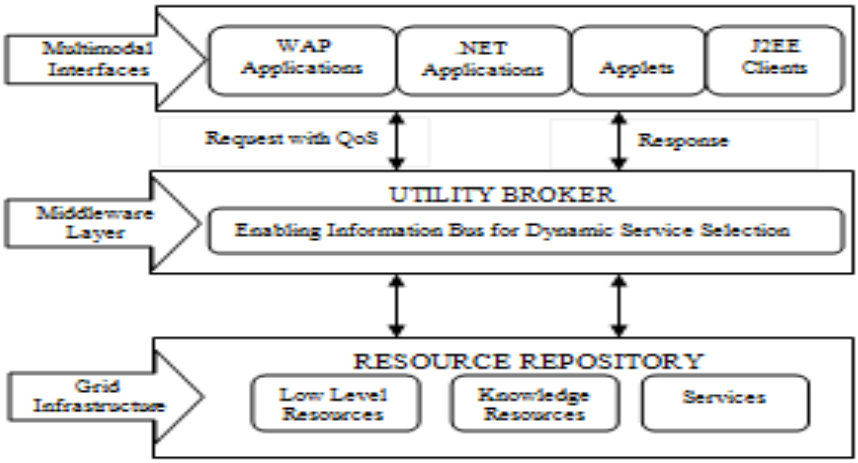

Fig.1. The GUISET Framework (Adigun, 2008)

2.2. Related Work

Prior to this work, in a *portlet-based Grid portal architecture* was proposed by Yanli et al., 2006 to enable and facilitate the flexibility and easy reusability of portals by encapsulating one or more Grid services to a portlet referred to as Grid Portlet. Different compositions of the Grid portlets provide end users such as developers with different functionalities. Thus, developers can easily develop and compose some of the Grid portlets. Grid portlets are managed by a portlet container, which runs portlets and provides them with the required runtime environment and manages their lifecycle (Yang, 2006). The architecture was designed for integrating existing technologies under a common interface in order to facilitate user-customized Grid portal environment configuration and also enhance Grid portal reusability. The work showed the feasibility to combine Grid systems and portlet technology. GT 3.2 (*www.globus.org*) was adopted as the underlying Grid system and a portal prototype was developed using JetSpeed 2 (*portals.apache.org/jetspeed-2/*) which is Java Specification Request, JSR-168 compliant (*developers.sun.com/jsr168*), as the portal framework.

3. The GUISET portal framework

The GUISET Portal is built on a portal framework adapted from the work done by Yanli et al., 2006. The adapted framework was standardized by introducing the Web Services for Remote Portals, WSRP standard and specification (*www.oasis-open.org*). This depicted in the figure 2. A key component of the framework is the grid-enabled portal layer that also houses the WSRP-compliant portal framework. Other key components of the framework include the portal container which runs portlets for encapsulating the various services and provides them with the required runtime environment and manages their lifecycle, and the underlying Grid technologies consisting of the Grid middleware and varieties of the Globus toolkits.

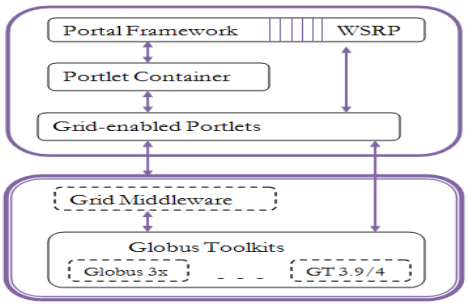

Fig. 2. The grid-based portal framework

In figure 3, an illustration of the logical design of the developed grid-enabled portal is presented.

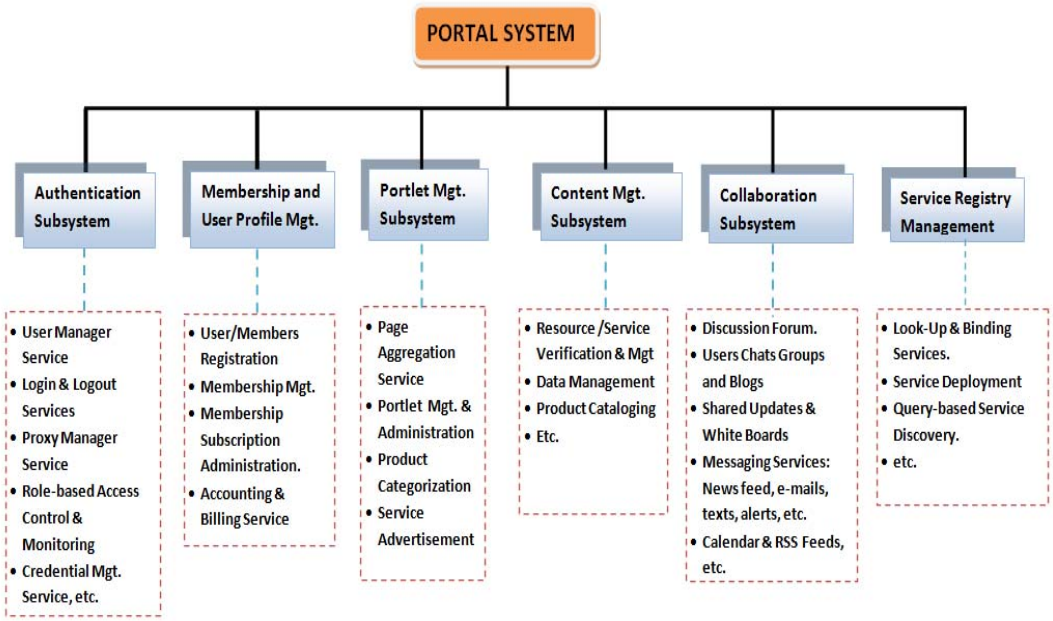

Fig. 3. The Conceptual Layout of the GUISET portal

• Authentication

The responsibility for authentication of users is placed on this authentication subsystem. It ensures that only valid users are granted access in accordance with the user access control policies.

• Users' Membership and Profile Management

This subsystem is responsible for the management of users' registration, and profile management. It administers the members' subscriptions and services, accounting and billing.

• Portlets Management

The portlets management subsystem handles the overall management of the various service portlets. It therefore also employs the one or more of the following services: Portlets Management & Administration Service, Page Aggregation Service, Product/Service Categorization & advertisement.

- Content Management

The content management system handles the administration and management of the various contents of the portal – data, services, resources, products, etc. It employs one or more of the following services: Data Management, Resource/Service Verification & Management, Product Cataloging, etc.

- Collaboration

It entails some of the following services: Discussion Forum, User Chat Rooms, Blogs and White Boards, Calendars, Messaging Services – shared Updates, News feed, e-mails, texts, alerts, etc. It is believed that members can leverage on this collaborations to enhance their businesses and for better consolidated business service delivery.

- Service Registry Management

This Subsystem is responsible for the administration and management of the service registry. This registry serves as a service repository. It employs some of the following services: Look-Up & Binding Service, Service Deployment, Query-based Service Discovery, etc.

4. The GUISET portal implementation

A proof of concept design prototype of the GUISET portal is built on the standardized framework in fig. 3. Liferay 5.2.3 portal tool kit bundled with Tomcat 6.0.18, was used to build the portal system. (*www.liferay.com*). The Globus toolkit, GT 4.0 a basic grid software infrastructure was simulated as the underlying. Liferay is built in with relevant features like Content Management System (CMS) (*www.jcp.org*), WSRP compliant producer and consumer, Single Sign-On (SSO), support for and many other latest technologies. It has a very clean architectural design based on best practices of J2EE, which allows it to be used with a variety of containers ranging from lightweight servlets containers like Tomcat and Jetty, to fully fledged J2EE-compliant servers like Borland ES, JBoss.

The basic underlying parameter for the building of the portal is based on the portlet technology as illustrated in figure 2. Portlets are used to encapsulate various services available on the portal. In other words, each service can be termed a portlet (service portlet). The client's access to the portal is a Web client and a generic client is included to enable both applications and client requests for both portal and non-portal services. Each registered client can look-up, find and bind services to build a personal and customized service portal on the main GUISET portal. However, both the GUISET portal and client have the capability to find and bind to services published in the service registry. Both portals look for WSRP services only which are portlets. Services exposed on the GUISET portal have either a Native Component or Portlets as their backend.

5. Summary and Conclusion

This work identified minimum relevant additional requirements based on literature reviewed, investigated and then developed a grid-enabled portal prototype for Grid-based Utility Infrastructure for SMME-enabling Technology (GUISET) initiative – a utility computing platform, with a number of these requirements fulfilled. This study has relevance to this practice and also provides a model for national economic development. This is because, it reveals the minimum relevant requirements apart from the traditional requirements that must be fulfilled to realize effective design of grid-enabled portals for the utility context, and the implementation of the GUISET portal offers a usable prototype that facilitates the realization of UC (On-Demand) platform for improved wealth creation and affordable access to scarce and expensive computing, particularly among

SMMEs and rural-based businesses. GUISET is not an application but, an infrastructure that accommodates various services as a suite of service-oriented on-Demand Applications such as e-Commerce, e-Agriculture, e-Health, e-Tourism, e-Government, etc. It therefore aims at technologically enabling the business activities of SMMEs by facilitating an affordable access to relevant technologies on a *pay-as-you-use* basis. The perspective of grid-enabled portal for utility computing embraced by this study is not yet common in the literature, hence it is valuable for the advancement of literature and industry practice. The result of the evaluation of the GUISET portal prototype using a set of benchmark requirements (standards) revealed that it fulfilled the minimum requirements to be suitable for the utility context.

References

[1] Rappa M "The Utility Business Model and The Future Of Computing Services," IBM Sys, Journal., Vol. 43(1), 2004.
[2] A. Akram A, Dharmesh C, Xiao W, Yang X, Allan R. A Software-Oriented Architecture for Portals Using Portlets, CCLRC e-Science Centre, CCLRC Daresbury Laboratory Warrington WA4 4AD, UK, 2005.
[3] Russell M, Novotny J, Oliver W. GridSphere's Grid Portlets, Computational Methods in Science and Technology 12(1), pp. 89-97, 2006.
[4] Yanli C, Jian C, Minglu, L, Lei C. Portlet-based Portal Design for Grid Systems, Proc. 5th IEEE International Conference on Grid and Cooperative Computing Workshops (GCCW 05), IEEE Press, 2006, 0-7695-2695-0/06
[5] Foster I, Kesselman C. The Grid: Blueprint for a New Computing Infrastructure, Morgan-Kaufman, 1999.
[6] Eilam T. Using a Utility Computing Framework to Develop Utility Systems, IBM Sys. Journal, Vol. 43(1), 2004.
[7] Pagden E. The IT Utility Model-Part I, Sun Professional Services, Sun BluePrintsTM Online, July 2003.
[8] Phillip T. Utility Computing - Identifying the Application Domain and Its Boundaries, an MSc. thesis in Computer Science and Business Administration, submitted to the department of Informatics, University of Zurich, Switzerland, Dec. 2004.
[9] Adigun M, cMigiro S. ICTs, e-Commerce and rural development: the case of arts and crafts SMEs in rural KwaZulu-Natal, Commonwealth Youth and Development, (3)2, pp 65-83, 2005.
[10] Khosrow-Pour M, Encyclopedia of E-commerce, E-Government and Mobile Commerce, Information Resources Management Association, USA, 2006.
[11] Adigun M. "GUISET: An Architecture and A Vision, an Idina Hour Presentation at the Center of Excellence, e-Service, Unizul, KZN, South Africa. August 20th 2008.
[12] Adigun M, bEmuoyibofarhe J, cMigiro S, Challenges to Access and Opportunity to use SMME enabling Technologies in Africa, a presentation at 1st All Africa Technology Diffusion Conference, Johannesburg South Africa, June 12-14, 2006.
[13] Yang X, Martin T, Mark H, Mark, C, Ligang H, Peter M, Survey of Major Tools and Technologies for Grid-enabled Portal Development, Proc. UK e-Science All Hands Meeting (NeSC 06), University of Cambridge Press, 2006, ISBN 0-9553988-0-0UK.
[14] Globus Toolkits, http://www.globus.org/toolkit/, 2010.
[15] Jetspeed-2, http://portals.apache.org/jetspeed-2/, 2010.
[16] Introduction to JSR-168. http://developers.sun.com/prodtech/portalserver/reference/techart/jsr168/
[17] Web Services for Remote Portlets, WSRP, http://www.oasis-open.org/committees
[18] Liferay Portal Enterprise, http://www.liferay.com , 2010.
[19] Content Management System, http://www.jcp.org/en/jsr/detail?id=170, 2011.
[20] Kaisler S. Software Paradigms, John Wileys & Son, 2005, pp. 99-100.