

E-Government using Grid Technology: Developing a Grid framework for G2G E-Communication and Collaboration System

Sirajul Haque

Riaz Ahmed Memon

University of Sindh, Jamshoro, Pakistan

Email: dr.sirajhaq@gmail.com

Akram Shaikh

Mehran University of Engineering and Technology, Jamshoro, Pakistan

Abstract

This research is focused on exploring the Grid Framework for the E-government communication and collaboration system. The use of grid technology in G2G e-government system provides the adaptive communication and collaboration between them. It also meet massive requirement of processing huge amount of data which is needed at the various levels of government for the decision making processes. The research aimed to develop Grid infrastructure framework for G2G e-communication and collaboration system that improves communication of information and collaboration between the different levels of government systems. It is also provide better use of information and IT resources for implementation of the government strategies and policies. The research after analyzing the potential benefits of grid technology has proposed a viable Grid Framework for the application of E-Government system in the public sector organizations.

Keywords: E-Government technology; grid technology; grid service infrastructure; grid e-government framework.

1. Introduction

E-Government also known as digital government, online government or in a certain context transformational government refers to government's use of information and communication technology (ICT) to exchange information and services with citizens, businesses, and other arms of government. E-Government may be applied by legislature, judiciary or administration in order to improve internal efficiency, the delivery of public services, or processes of democratic governance. The primary delivery models are Government-to-Citizen (G2C), Government-to-Business (G2B) and Government -to--Government (G2G). The most important anticipated benefits of e-government include improved efficiency, convenience, and better accessibility of public services. While e-government is often thought of as "online government" or "Internet-based government," many non-Internet "electronic government" technologies can be used also in this context. Some non-internet forms include telephone, fax, PDA, SMS text messaging, MMS, wireless networks and services. There are also some technology-specific sub-categories of e-government, such as m-government (mobile government), u-government (ubiquitous government), and g-government (GIS/GPS applications for e-government) (Dada, 2006).

The scope of a grid technology could range from a small departmental network to a vast collection of resources and services running in multiple locations, spread across the organization, and owned by many

organizational groups, government bodies, enterprises, or academic institutions. The rise of the information society and the use of new technologies have brought new challenges and opportunities to governments around the world. In order to remain responsive to these challenges, Grid technology has the potential to become ubiquitous electronic services which can improve infrastructure utilization, increase access and integration of huge amount of data and enable new levels of communication and collaboration between the different levels of G2G e-government system (Buyya and Venugopal, 2005). Currently, E-government is used through internet technology. It is still at nascent stage of implementation in many developing countries. There is no such uniform IT infrastructure for the Government-to-Government system. There is need for such a framework which brings better communication and collaboration amongst the different levels of government systems with the low cost investment. The research has synthesized the data that has been taken from different sources of information a related to this research project. The information is referred from the internet websites related to the Grid Technology i.e. www.Gridcomputing.com, www.Alchemi.net, www.globus.org, www.gridalliance.com. The information is also referred from the published papers in the conferences and research journals.

2. Application of E-government technology

E-government has emerged as one of the principal tools by which administrations can improve their governance arrangements both internally, for improved efficiency and effectiveness and externally, for improved relations with stakeholders. This is because the introduction of e-government has a broad and cross-cutting impact across policy sectors and government processes. The application of ICTs to existing organisations is not by themselves modernise government. Instead, the focus should be on how ICTs can be used to improve government structures and processes and on how the culture of our public administrations can be renewed in order to make the most of these changes. E-government can develop the strategic connections between public sector organizations and their departments, and make a communication between government levels (e.g. central, city, and local). This connection and communication improve the cooperation between them through facilitating the provision and implementation of the government strategies, transactions, and policies, and also better use and running of government processes, information, and resources. Government-to-Government systems are types of e-government systems that support relation between different structures of government. It helps in sharing some basic information among different governmental bodies which avoids parallel data collections and reduces the costs respectively (Khoja, 2004).

The government processes and procedures are simplified to cut red tape, facilitate delivery of services, increase productivity of the bureaucracy, and increase savings. The transactions between central and local governments, department-levels and attached agencies and bureaus, as well as government and its employees would be enhanced. Government would have its own intranet with efficient document management and better citizen and government relationship. The governments are major users of information and communication technologies (ICTs). In OECD group countries, use of ICTs in government sector is now well established and had been an integral part of how governments do business. This group consisted of 12 countries: Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Korea, Mexico, Netherlands and the United States. Governments' use of ICTs has widened to encompass a full range of technologies and applications for mass processing tasks, using mainframe computers in areas such as collecting national statistics and processing taxation returns. Since more a decade, governments have used Internet-based technologies, particularly the World Wide Web and e-mail. There is scarcely an aspect of government activity that does not involve the use of ICTs (Ramaswamy and Selien, 2007).

The importance of the internet technology in the overall framework of ICT use in government will be a matter for debate for a long time to come. The reports focus more on use of ICT that involves more established ICT applications. This is in recognition of the fact that use of the internet is in its relative infancy, and as such raises more issues for public administrators and governments generally than the use of more established technologies. The Internet, building on the established base of ICT use by governments, offers new opportunities for governments to do their job better, and it is primarily for this reason that governments are focusing on it. However, e-government is more than Internet use or online service delivery (Ramaswamy and Selien, 2007).

The emergence of the Internet and parallel developments in processing capacity and data storage over the 1990s have significantly altered the environment for the application of ICT across society and in government. Internet based e-government projects have been found expensive and difficult to implement. E-government is also about change. When the development, funding and implementation of ICT projects in government go wrong, they can lead to highly visible cost overruns and service delivery failings, and act to stifle broader reforms. Internet-based options have raised further issues, such as dealing with emerging customer expectations, heightened privacy concerns and public-private boundaries. Technology does play an important role of making possible the strategic use of information. As mentioned earlier, e-governance is not about technology; instead it is about identifying what are the key governance needs that need to be fulfilled, and then envisaging models by which these needs could be fulfilled appropriately and with ease (Ramaswamy and Selien, 2007).

Several developing countries realizing the role ICT in the governance sector are putting into practice innovative e-Governance models that may be technologically simple but are drastically changing the way information is distributed in the society. Based on primary experimentation and secondary research, some generic Digital Governance models which are being practiced in developing countries have been identified. All these models benefit from the intrinsic characteristics of ICTs: Enabling equal access to information to anyone who is linked to the digital network and de-concentration of information across the entire digital network. Information does not reside at any one particular level (or node) in Digital Governance Models but gets distributed across all the nodes. This is a fundamental change from the 'hierarchical' information flow structures that allow for unequal distribution of information and open greater possibility of exploitative use of information at all levels. With use of ICT, the information gets distributed along the network and this distribution of information may happen through private access to an ICT node, or through public access or through the use of convergent modes (Weerakkody et al., 2007).

2.1 Interactive service delivery model

Interactive-Service model is a consolidation of the earlier presented digital governance models and opens up avenues for direct participation of individuals in the governance processes. Fundamentally, ICT have the potential to bring in every individual in a digital network and enable interactive (two-way) flow of information amongst them. The potential of ICT for the governance is fully leveraged in this model and can bring lead to greater objectivity and transparency in decision-making processes. Under this model, the various services offered by the Government become directly available to its citizens in an interactive manner. It does so by opening up an interactive Government-to Consumer-to-Government (G2C2G) channel in various aspects of governance, such as election of government officials (e-ballots); online grievance-redressal; sharing of concerns and providing expertise; opinion polls on public issues etc.

The following E-Governance model is service delivery model. The application of this model is providing two-way processing of information. It facilitates the flow of information between various levels of government and stakeholders.

Digital Governance models are continuously evolving-- depending on the uses to which they are applied. The new ICT applications that are becoming possible, and most importantly, the changing political realities in the governance sphere (Ebrahim and Irani, 2005).

3. Application of grid technology

The invention of powerful computers and high speed networks has accelerated the growth of internet and also has changed the ways of using computers by the scientists and engineers. It has also changed the society in managing information and information services. These inventions of new technologies have made possible foundation for establishing a cluster of wide variety of distributed computer resources, which are geographically located at the different places. Further these technologies have also enabled seamless access to interaction among these distributed resources (Deyu and Weiwei, 2006).

Grid computing is a type of parallel and distributed systems that enables the sharing, selection and aggregation of geographically distributed autonomous resources dynamically at runtime depending on their availability, capability, performance, cost and users quality-of-service requirements. A Grid computing enables the sharing, selection, & aggregation of geographically distributed "autonomous" resources.

The Grid is one of several mechanisms to exploit the highly connected sea of networked computers, sensors and data repositories. The idea has been built around distributed environment. There are a large number of applications starved of computation resources, whereas an overwhelming majority of computers are often idle. This can be bridged by allowing computation-intensive applications to be executed on otherwise idle resources, no matter where the latter are located. Based on this mechanism, the Grid technology could be described as an infrastructure that tightly integrates computations and storage devices, software, databases, specialized instruments, displays and people from widespread locations, and under different management authorities. It is the move from the existing Internet, offering to everyone easy, inexpensive and consistent access to enormous portions of shared information to the next generation where processing power and access to specialized instruments will also be provided to everyone in a secure and effective manner (Gentzsch, 2005).

Grid computing has potentials to become a global web of ever-present electronic services which can improve infra-structure utilization, increase access, integration of data resources and creation of new applications in e-science, e-business and e-life. Since last four years, enterprise users and technology vendors are becoming aware of grid computing and its benefits for the enterprise. This awareness comes through the certain successful grid projects in the global research community. In these projects the essential grid benefits have been proven, i.e. remote access, improved resource utilization, collaboration in virtual organization and increased productivity (Luis et al., 2002).

During 1990 grid computing evolved in the name of High performance distributed computing. The evolution of Grid Technology was pushed by the ever-growing need for computing resources, availability of powerful network technology, servers, middle wares and applications. Grid computing evolution can be viewed in three waves i.e. Research wave, Business wave and Consumer wave. In the past, the organizations often develop different market solutions for different departments and each department has their own departmental high power computing environment. This kind of infrastructure was found very inefficient. On other hand Grid technology offers an economy of scale access to one common high power computing service for all the departments. This information technology infrastructure has brought up reliability and quality of service and also proved to be helpful in reducing hardware, software and operational cost and thus increased productivity (Gentzch, 2005). The following figure demonstrates the grid service infrastructure.

Government organizations for almost a decade have used internet-based technologies, particularly the World Wide Web and e-mail for exchange of basic information only. Internally, each level of government has got their own computer systems and they are being used in a traditional manner Grid technology is being used in many commercial computing and data intensive applications that involve aggregation and management of distributed data storage, such as drug discovery, credit-risk analysis and large scale document processing. The Government organizations in their nature of working are also frequently dealing with the huge of amounts of information for making their strategies and policies at different levels of government systems. In developing countries, 35% of e-government projects are total failure, 50% are partial failures, and only 15% are success. Therefore, research scholars have recommended further studies in this area. In the developing countries IT infrastructure is one of the major causes of e-government failures in the developing countries. The infrastructure is considered to be heart of the e-government. The strategic objective of e-government is to support and simplify governance for all parties; government, citizens and businesses Grid infrastructure framework for e-government that is capable of supporting and enabling the execution of e-government is a requirement for successful e-government implementation (Dada, 2006).

4. E-government using grid technology

Besides many problems, enabling of a virtual access to different levels of government systems i.e. Federal, Provincial and Local is one of the important aspects in E-Government systems. Currently, distributed system does provide virtual access to dispersed database resources but it does not provide a supercomputing power for data intensive applications. For that, Grid technique provides an ideal way to solve this problem. The Grid technique provides a virtual access to dispersed data sources available at the different levels of government systems with supercomputing capability in a way that it fetches required information from dispersed data resources at a minimum possible time.

The development of a Grid framework for G2G e-communication and collaboration system would optimize information process management at the different level government systems and provides rapid access to various levels of data resources available over the network. The proposed framework would provide a uniform platform to e-government applications at the different level of government systems to use super computational power especially for compute intensive e-government applications like budget application, taxes application and employees Government payroll applications to access required information located at the different levels of government systems. It does not only improve the functional efficiency between the different levels of government system but also foster new level of communication. For instance an government user need to fetch a state wise information regarding the annual budget from different database resources located at the different places at same time , in this situation, it need a huge computational power to extract the required information at shortest possible time from dispersed database resources available at the different levels of government systems. The viable framework will address the following existing challenges faced by the G2G e-communication and collaboration system in Pakistan.

- Addresses massive requirements of information processing capacity.
The government is one of the greatest consumers of high-performance compute power. In the past, this need has been met through hardware investments, therefore it requires
- It reduces Inefficiency and processing bottlenecks.
When resources are underutilized, large supplies of computing capacity are wasted while processing needs throughout the organization are unmet.
- Improves poor utilization of information.
Turning huge raw data into information for the decision-making requires both significant compute power and the ability to analyze.

5. Layered structure of proposed framework

The frame work is consisting of four major components of E-Government Grid infrastructure.

The framework is proposed in designing the layered structure for developing the E-government Grid Infrastructure. The three tiered system of government structure will be connected through grid nodes on the basis of above framework. The following grid-based e-government infrastructure in proposed for G2G e-communication and collaboration system at different levels of governments, i.e. Federal, Provincial and Local Government.

The figure shows the framework for the Grid infra-structure for the E-Government system. The above figure demonstrates one Provincial Grid center, two local grid centers which are connected to the Federal grid center.

The three tiered grid e-government infrastructure has been developed by using the interactive e-government model. The above model demonstrates three tiered grid e-communication and collaboration system for the three levels of government. The above figure shows that divisional grid nodes are connected to the provisional grid center and provincial grid center is connected to central grid center.

Conclusion

On the basis of research done on the three tired governmental structure of the government, it is concluded that the proposed framework is viable for developing G2G e-communication and collaboration system by using grid technology. The grid technology possesses substantial capability in accessing huge volume data available on any grid node. The research findings of this research work will contribute towards the use of grid technology in the e-government. Our proposed frame work would provide a viable Grid infrastructure to the G2G e-communication and collaboration system for improving their communication and coordination in performing their functions and sharing huge volume of information required in making the different public policies for the development of country.

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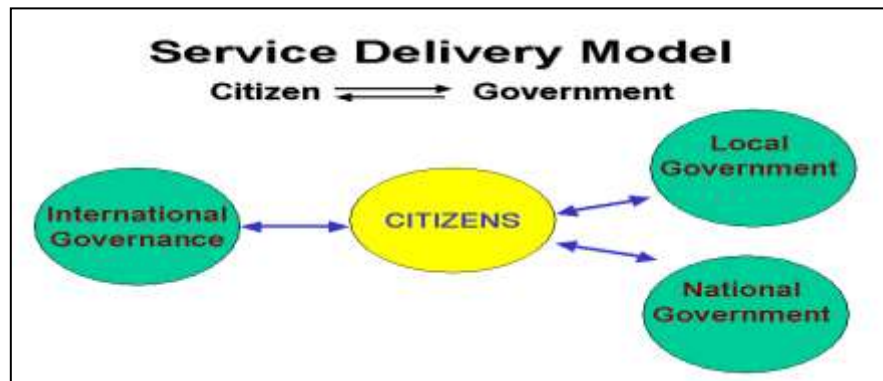
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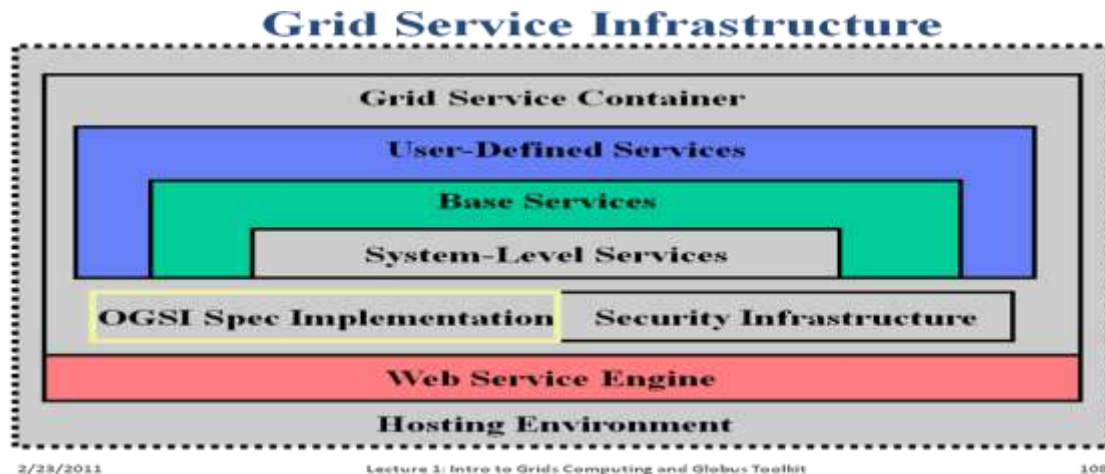
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Figure 1: Service delivery model of E-government.



Source: Ebrahim and Irani 2005

Figure 2: Grid service infrastructure



Source: Globus, 2011.

Figure 3: Layered structure for grid E-government infrastructure

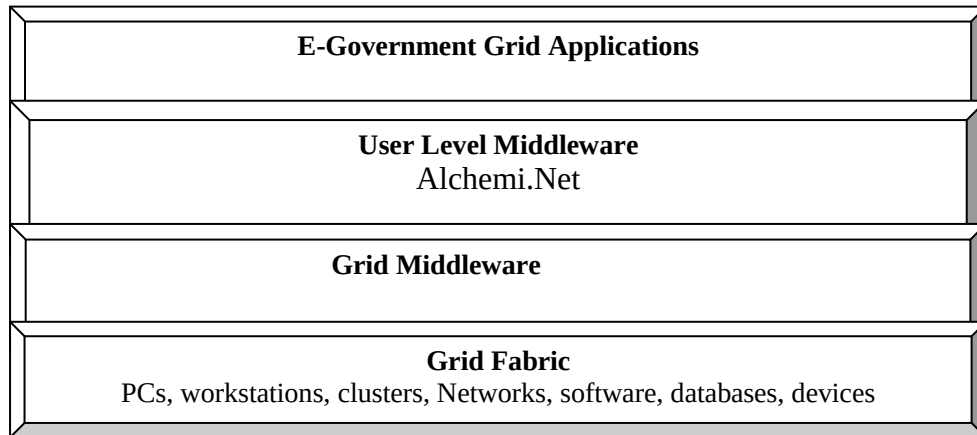


Figure 4: Grid-based E-government structure

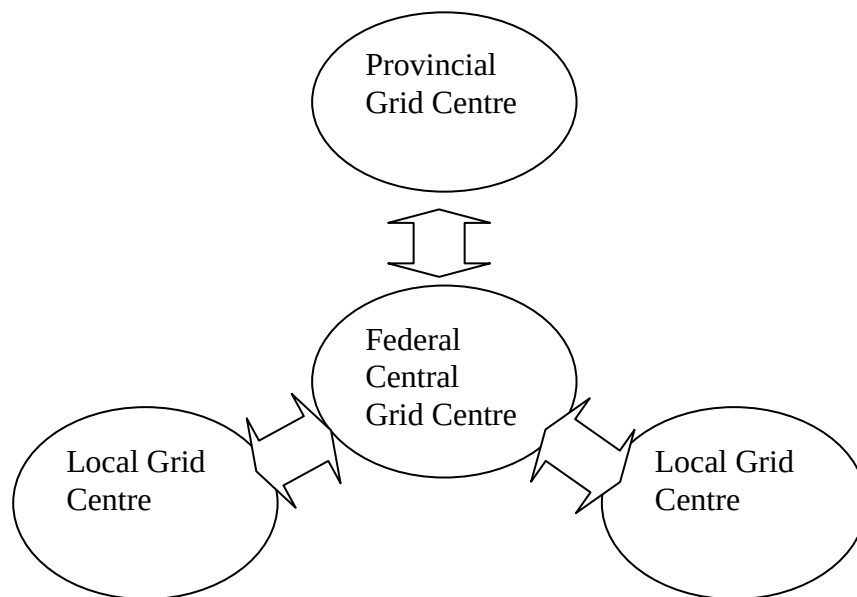


Figure 5: Three tiered framework for grid E-government infrastructure.

