

Towards Building E-Government on the Grid¹

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Abstract. This paper introduces the goal of ShanghaiGrid and its sub-project E-government on the Grid. The main existing problem of the E-government is how to integrate each government agency's resources to form cross-agency services for citizens. Grid technique provides an ideal way to solve this problem. The workflow middleware, transaction middleware, and the real-name citizen mailbox are discussed in detail.

1 Background

Shanghai has become the largest economic center and important port city in China, with a land area about 6,340 square kilometers and a population of 16 million people. Household PC penetration rate reached 60.4% and Internet user penetration rate reached 32% in 2003. It is the entrepreneur city of 2010 Shanghai World Expo. The municipal government is working towards building Shanghai into a modern metropolis and into a world economic, financial, trading and shipping center by 2020. It has been always paying attention to the development and establishment of information industry and society. The Information Service technology would enable the municipal government to integrate its information resources dispersed in different organizations and strengthen collaboration and information sharing.

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2 The current state of E-government in Shanghai

With the development of Information technique, the E-government in Shanghai is developing rapidly and steps into the period of interactive government administration. The main achievements in 2003 are list below [1]:

- Shanghai Public Affairs Network has been established and put into operation.
- The portal website of Shanghai-China offers 542 online service items as well as 653 forms for download. Users can personalize their portal and subscribe the information they need. Daily visit to the website reached 180,000 times.
- Four major databases such as population, legal identity, geographical information and macro-economics have taken shape and been put into use.

Although Shanghai's E-government is at the one of the top positions in China, it still has some weakness:

Current E-government infrastructure can not effectively solve the problem of "isolated island of information". The portal website provides more than 500 services, but most of them only provide simple tasks in certain area, cross-domain and cross-department services are rarely found. For the security and policy issue, the information and data can not be shared directly by each agency of the government, which leads to something could be done online must be done manually through each department agency. In some situation, citizens may file over more than ten different forms which download from the portal and manually hand in to several government agencies using traditionally approach, and each form contains similar data. The first reason that caused this situation from technique view is each government agency has its own database and for security and policy reason, the data can not be shared directly with each others, that we called "isolated island of information". The second reason is the trust issue. How can the government agency identify that the one who fill the form online is the right person?

The current web portal service is citizen-centered, which means through the web portal, citizens can get the information they need and feedback their suggestion and feelings back to the government. Using the web portal simplified the delivery of services to citizens. But the web portal service now mainly serves individuals, the Government-to-Business and the Government agency to agency should be further stressed. E-government is not good just for citizens - business benefits too. Like citizens, business wants government to deliver information and services in an easier, cheaper, more

accessible and responsive, integrated, and customer-oriented way, so they can more easily meet their legal and regulatory obligations [2].

So how to provide coordinated, seamless and secure access to massive amount of data held across various agencies in a government in heterogeneous environment is a big problem in developing E-government. Another problem is how to build a shared platform to deliver all kinds of services to the user in the city.

3 The Shanghai City Grid project

Grids offer us a new vision, infrastructure and trend for the coordinated resources sharing, problem solving and services orchestration in dynamic, multi-institutional virtual organizations. With the convergence of business and technology trends, Grid computing is rapidly moving out of its original home in High Performance Computing(HPC) and squarely into the business computing mainstream[3][4].

The Shanghai city Grid which called ShanghaiGrid was put forward in the end of 2003 to enhance the digitalization of the city and face the challenges and capture the opportunities of Grid by the science and technology commission of Shanghai municipality. The participants are Shanghai Jiao Tong University, Tongji University, Fudan University, Shanghai University, Shanghai Supercomputer Center, Shanghai Transportation Information Center, East China Institute of Computer Technology, IBM, Intel, etc. Several other grand fundamental research projects such as NHPCE (1999-2001), CNGrid (2002-2006), ChinaGrid (2002-2005), E-Science Grid (2002-2005), Spatial Information Grid (2001-2005), etc are also carried out in China [5]. The primary goal of ShanghaiGrid is to “develop a set of system software for the information grid and establish an infrastructure for the grid-based applications. By means of flexible, secure, open standards sharing and coordinating of computational resources, data information and dedicated services among virtual organizations, this project will build an information grid tailored for the characteristics of Shanghai [5].”

The ShanghaiGrid project has several sub-projects, E-government Grid is one of them.

4 E-government On the Grid

4.1 Why using Grid technique

We believe that the grid technology would enable the municipal government to integrate its information resources dispersed in different organizations and strengthen collaboration and information sharing. This will be invaluable for improving the efficiency of government and its emergency response speed. Currently, we use Globus Toolkit 3 (GT3) [6] which is the de facto standard in Grid world as the basic infrastructure of the E-government. The main reasons that using the Grid technique and GT3 are listed below:

1. Grid is an ideal way to resolve the problem of “isolated island of information”. The real and specific problem that underlies the Grid concept is coordinated resource sharing and problem solving in dynamic, multi-institutional virtual organizations (VO) [3]. If we regard each government agency as an individual VO, then we can apply sophisticated method used in Grid to coordinate each agency’s resources which include databases, computational resources, storage resources, etc. Enabling integration of distributed resources is one of the important aspects in E-government.
2. General-purposed, open-standard protocols are widely used in Grid environment. For large distributed applications, it is one of the key issues.
3. GT3 is an open-source middleware for the Grid. Open-source is very important for the Government because government can really know what happens beneath the application, and it can be modified to meet the requirement of the E-government in which we have already designed a set of middleware to support the E-government applications. Moreover, GT3 provides good technical solutions for key problems such as authentication and authorization (implemented as GSI [6]), resource discovery and monitoring service (implemented as MDS [6]), access and integration of data from separate data sources (implemented as Open Grid Services Architecture Data Access and Integration, OGSA-DAI [7]), etc. These services and libraries lower the complexity and technical threshold in development E-government.
4. Grid can provide super computational power. In most case, E-government do not need such computational power, but in some emergency conditions such as terrorism attack, nature disaster and basic facility misfortune, on the one hand we

need real time data integration , on the other hand we need super computational power to quick response to these disasters.

5. Grid can reduce the Total Cost of Ownership (TCO) of the government; fully utilize the IT resources existing in the government.

4.2 E-government conceptual framework

The E-government project was launched at 2003 as a part of the ShanghaiGrid project. Currently we put focus on the design of the middleware which provide common solution for ShanghaiGrid which we will discuss in the next section. The conceptive framework is shown in Fig.1.

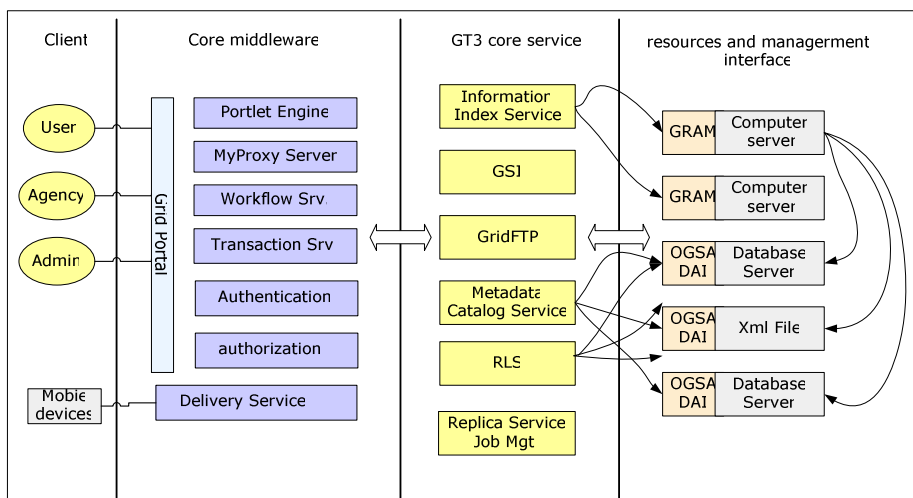


Fig. 1. Conceptual framework

Grid Resource Allocation and Management (GRAM) [13] is used to request and use remote system resources, to submit job and control them within a standard interface. The OGSA-DAI also provides common interface that can be used to access remote database which we will discuss later. GT is used to build Grid Environment, which provides a set of services and tools that facilitate the development such as the Metadata Catalog Service (MCS) [14], Replica Location Service (RLS) [15], Grid Security Infrastructure and etc. A set of core middlewares such as workflow service,

transaction service, information service are developed to meet the requirement of building E-government. The delivery service [16] is used to support the mobile device access the Grid environment.

5 The implementation of core middleware

5.1 Workflow service

First of all, we believe that workflow is very important for E-government. Workflow has grown to be a primary method in managing process. A well pre-defined workflow can provide efficient and easy-to-use service for end users. Users do not need to know the process, but only fill in information, and wait for the results. All the processes are transparent for users.

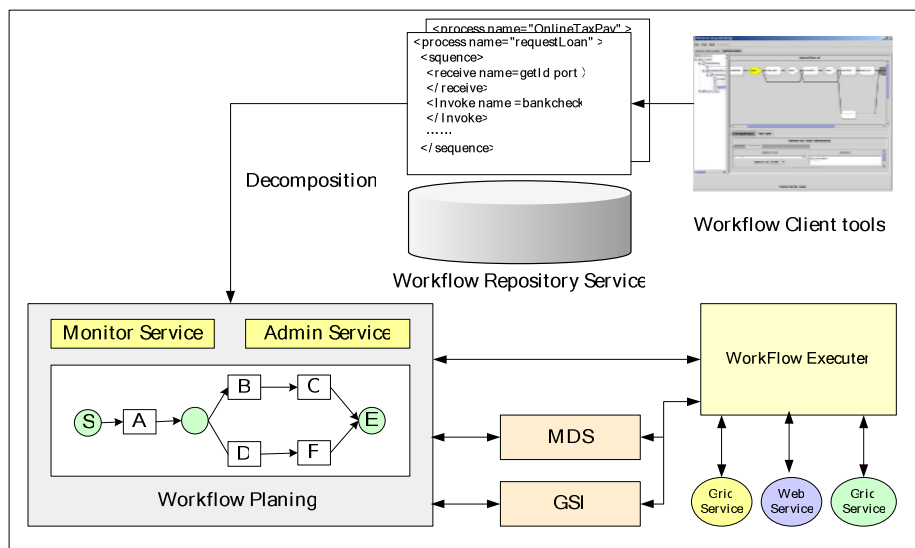


Fig. 2. Workflow middleware

Traditional workflow applications are widely used in government agencies. But they lack the ability of interoperation and rarely across agency. In Grid environment, we can compose Web Services or Grid Services distributed in various government agencies into one workflow. Fig.2 shows the framework of the workflow management

system. More detailed work could be found in [8]. So far, workflows are composed by administrators using the existing Grid Services and web services with Business Process Execution Language for Web Services (BPEL4WS) [9]. A set of client tools were developed to support that mission.

5.2 Transaction support

In Grid environment, transaction support is another big issue. We divide transaction as: i) Atomic transactions (AT). AT is used to coordinate activities having short-lived application and executed within limited trust domains.

ii) Compensation transaction (CT). CT is used to coordinate activities having long-lived application. In order to improve the concurrency, a compensation model must be applied in CT.

The detail implementation of the transaction model can be found in [10].

5.3 Authentication and authorization

Grid provides a common security infrastructure, but there still exists the problem of authentication: how we can justify Id with a real person?

The Real-Name Citizen Mailbox (RNCM) is now carried out by the Shanghai Government as well as the Real-Name Company Mailbox. Citizens in Shanghai can freely register a desired mailbox account, but he/she must go to certain place setting up by government agency to fill in some forms, and government officer there will manually checks the ID card to activate the mail account. Through this approach, government can use the mailbox account to identify a real person. Citizen can use his/her mailbox receives the bills, endowment insurances, medicare and other information. In the first ten days when this method released, about 60,000 citizens registered and activated the mail account [11]. This is valuable information in E-government. In future, if every person who registered the mailbox could get CA certification, much more applications could be applied in E-government. Currently, the user's mailbox account and password would be the basic authentication method for citizen. Although using real-name mailbox is a good way to solve the problem of the citizens' identification, privacy issue must be taken into account. Investigation

shows 100% citizen show interesting in the mailbox and about 50% person consider the privacy issue [11].

MyProxy [12] is used in Grid environment as the repository storing Grid credentials. User using portal user name and password could get certain Grid credential through MyProxy.

5.4 Data Integration

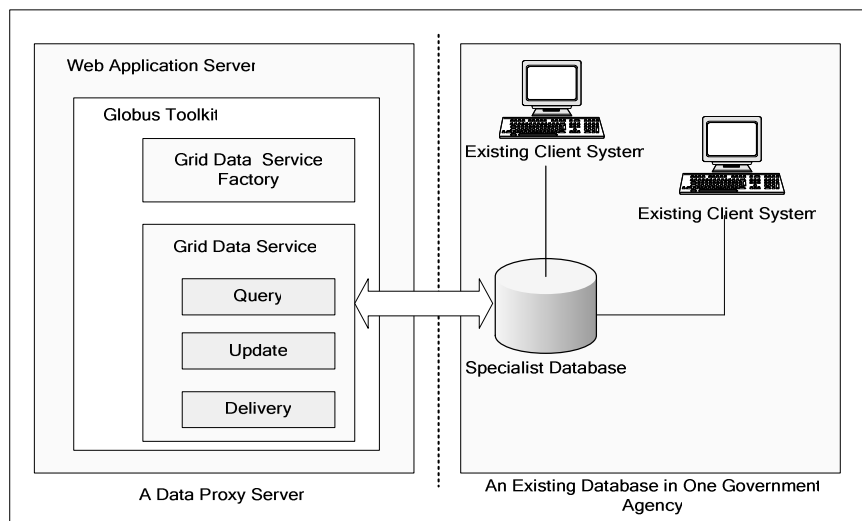


Fig. 3. Using data proxy server to share data among each government agency in Grid

To integrate various data among each government agency in a secure environment is a big challenge. Traditionally, government would like to build data warehouses to collect data from each government agency and present these read-only data to the public. But this approach limits the data exchange.

To do real time data integration, we use the OGSA-DAI to integrate data from each government agency. Fig. 3 shows a data proxy server used as a gateway of current existing database. The GT provides a basic grid environment such as security, authentication. Through the Grid data service factory, Grid applications can create a Grid data service, which could be used to query, update the data in the specialist database. Using these methods, the existing client system could not be modified and the policy could be easily maintained.

6 Discussions

The frequent asked question about our model is why using Grid services and not Web Services? It is a difficult question. We know most work could be done in the same way by using Web services. But first of all, the project is about developing a Grid platform to support various Grid applications which include E-government. Second, we think that GT gives us a uniform solution or framework to meet the needs of developing such applications and we can use a set of open-source projects to avoid security issues such as potential 'back door' problem.

7 Conclusions

In this paper we introduce the ShanghaiGrid project and its sub-project E-government on the Grid. Some key middlewares are introduced in detail. Although Grid technique and the de facto standard Globus Toolkit are developing quickly, we hold the confidence that Grid technique is an ideal way to build large distributed applications. A real-name citizen mailbox is introduced to solve the problem of how to identify real person with his electric id. The E-government project is ongoing project which we put much work on the common middleware currently that could be applied in Shanghai-Grid environment as well as E-government project.

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