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SELECTED PAPERS BOOK

A number of selected papers presented at ICSOFT 2006 will be published by Springer, in a book entitled Software and Data Technologies. This selection will be done by the conference chair and program co-chairs, among the papers actually presented at the conference, based on a rigorous review by the ICSOFT 2006 program committee members.

FOREWORD

This volume contains the proceedings of the first International Conference on Software and Data Technologies (ICSOFT 2006), organized by the Institute for Systems and Technologies of Information, Communication and Control (*INSTICC*) in cooperation with the Object Management Group (*OMG*), sponsored by Enterprise Ireland and the Polytechnic Institute of Setúbal and hosted by the School of Business of the Polytechnic Institute of Setubal.

The purpose of this conference is to bring together researchers, engineers and practitioners interested in information technology and software development. The conference tracks are "*Software Engineering*", "*Information Systems and Data Management*", "*Programming Languages*", "*Distributed and Parallel Systems*" and "*Knowledge Engineering*".

Software and data technologies are essential for developing any computer information system, encompassing a large number of research topics and applications: from programming issues to the more abstract theoretical aspects of software engineering; from databases and data-warehouses to management information systems and knowledge-base systems; Distributed systems, ubiquity, data quality and other related topics are included in the scope of ICSOFT.

ICSOFT 2006 received 187 paper submissions from more than 39 countries in all continents. To evaluate each submission, a double blind paper evaluation method was used: each paper was reviewed by at least two internationally known experts from ICSOFT Program Committee. Only 23 papers were selected to be published and presented as full papers, i.e. completed work (8 pages in proceedings / 30' oral presentations), 44 additional papers, describing work-in-progress, were accepted as short paper for 20' oral presentation, leading to a total of 67 oral paper presentations. There were also 26 papers selected for poster presentation. The full-paper acceptance ratio was thus 12%, and the total oral paper acceptance ratio was 35%.

In its program ICSOFT includes a panel to discuss the future of software development, by six distinguished world-class researchers; furthermore, the program is enriched by one tutorial and six keynote lectures. These high points in the conference program, involving top researchers worldwide, experts in different knowledge areas, have definitely contributed to reinforce the overall quality of the conference.

The program for this conference required the dedicated effort of many people. Firstly, we must thank the authors, whose research and development efforts are recorded here. Secondly, we thank the members of the program committee and the additional reviewers for their diligence and expert reviewing. I would like to personally thank the Program Chairs, namely Boris Shishkov and Markus Helfert, for their important collaboration. The local organizers and the secretariat have worked hard to provide smooth logistics and a friendly environment, so we must thank them all and especially Mónica Saramago for her patience and diligence in answering many emails and solving all the problems. Last but not least, we thank the invited speakers for their invaluable contribution and for taking the time to synthesize and prepare their talks.

A successful conference involves more than paper presentations; it is also a meeting place, where ideas about new research projects and other ventures are discussed and debated. Therefore, a social event including conference banquet was organized for the afternoon and evening of September 13 (Wednesday) in order to promote this kind of social networking.

We wish you all an exciting conference and an unforgettable stay in the lovely city of Setúbal. We hope to meet you again next year for the 2nd ICSOFT, in Barcelona (Spain), details of which will be shortly made available at http://www.icsoft.org.

Joaquim Filipe

INSTICC/Polytechnic Institute of Setúbal, Portugal

(Conference Chair)

CONTENTS

INVITED SPEAKERS

KEYNOTE LECTURES

PROGRAMMING LANGUAGES

FULL PAPERS

SHORT PAPERS

POSTERS

SOFTWARE ENGINEERING

FULL PAPERS

SHORT PAPERS

POSTERS

DISTRIBUTED AND PARALLEL SYSTEMS

FULL PAPERS

SHORT PAPERS

TOWARDS A QUALITY MODEL FOR GRID PORTALS

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Keywords: Quality models, Grid portals.

Abstract: Researchers require multiple computing resources when conducting their computational research; this makes necessary the use of distributed resources. In response to the need for dependable, consistent and pervasive access to distributed resources, the Grid came into existence. Grid portals subsequently appeared with the aim of facilitating the use and management of distributed resources. Nowadays, many Grid portals can be found. In addition, users can change from one Grid portal to another with only a click of a mouse. So, it is very important that users regularly return to the same Grid portal, since otherwise the Grid portal might disappear. However, the only mechanism that makes users return is high quality. Therefore, in this paper and with all the above considerations in mind, we have developed a Grid portal quality model from an existing portal quality model, namely, PQM. In addition, the model produced has been applied to two specific Grid portals.

1 INTRODUCTION

Nowadays, many users have access to, and require, multiple computing resources to conduct their computational research (Dahan et al., 2004). This makes the use of distributed resources necessary. For this reason and with the aim of providing dependable, consistent and pervasive access to distributed resources, the Grid emerged (Li et al., 2003). The real and specific problem that underlies the Grid concept is coordinated resource sharing and problem solving in dynamic, multi-institutional virtual organizations (Foster et al., 2001).

Specifically, the Grid couples a wide variety of geographically distributed resources such as PCs, workstations and clusters, storage systems, data sources, databases and special purpose scientific instruments and presents them as a unified, integrated resource (Li et al., 2003).

The main problem with the Grid, however, is the difficulty involved in using grid resources. That is due to its complex architecture. Therefore, in order for scientists to use grid resources effectively as a problem solving infrastructure, transparent and easy-of-use interfaces to the complex set of grid resources are necessary (He and Xu, 2003). Nowadays, Grid Portals are coming into existence to resolve this problem. They can be considered as a mechanism for providing user-friendly access to grid resources, and consistent access patterns, as well as easy usage of grid services. The original objective of this portal type was to create web-accessible problem-solving environments (PSEs) that allowed scientists to access distributed resources, and to monitor and execute distributed Grid applications from a Web browser (Lin and Walker, 2004). Although at the beginning these portals were aimed at researchers, nowadays they can be used by any user who wants to use distributed resources.

Many Grid portals exist at the present time. An immediate effect of this widespread presence is the increasing range of resources available at the click of a mouse, that is, without the user wasting time and money by physically moving from one place to another (Cox and Dale, 2001; Singh, 2002). It is because of this that portals must offer a good level of quality, thus users are attracted to them and come back regularly.

Bearing this in mind, as well as the lack of quality models specifically for Grid portals, in this paper we present a Grid portal quality model (G-PQM) created from an existing portal quality model, namely, PQM (Portal Quality Model) (Moraga et al., 2004b).

The rest of the paper is organised as follows. In section 2 the quality model for Grid portals is shown while in section 3 this quality model is applied to two Grid portals. Finally, section 4 concludes and outlines further work.

2 QUALITY MODEL FOR GRID PORTALS

Grid portals appeared because of the need to make access by researchers to Grid resources easier. The developers of Grid portals seek to ensure that users return to their portal often. However, the only mechanism that makes users return is high quality (Offutt, 2002). Therefore, a quality model which is specifically for Grid portals, namely G-PQM (Grid Portal Quality Model), has been developed. The usefulness of this model is two-fold. On the one hand, this model helps users to evaluate the different Grid portals and to choose the one with the highest quality. And on the other hand, the model's dimensions can be used as indicators to help developers when building the portal.

To develop G-PQM a quality model for web portals, namely PQM (Portal Quality Model), was used as the basis. PQM is composed of six dimensions and seeks to determine the strong and weak points of a specific portal. We can also define corrective actions for the weaknesses, and improve the quality level of a portal (Moraga et al., 2004a). In order to adapt this model to Grid portals, some definitions of the dimensions have been modified and, additionally, some dimensions have been inserted. In Figure 2, we can see the different phases used in developing the Grid portal quality model, G-PQM.

In our introduction, the first phase "Study of the Grid portals context" was presented.

2.1 Adaptation of the PQM Dimensions

We have adapted the following PQM dimensions:

- **Tangible**: This dimension indicates if "the Grid portal contains all the software and hardware infrastructures needed according to its functionality".
  - *Adaptability*: ability of the Grid portal to be adapted to different devices (for instance, PDA, PCs, mobile phone, etc.).
  - *Transparent access*: ability of the Grid portal to provide access to the Grid resources while isolating the user from their complexity.
- **Reliability**: It is the "ability of the portal to perform the specified services". In addition, this dimension will be affected by:
  - *Fault tolerance*: capability of the Grid portal to maintain a specified level of performance in the event of software faults (ISO, 2001) (for example, a fault during the sending or the execution of a job).
  - *Availability*: The portal must be always operative in order for users to be able to access it and use its Grid resources anywhere and anytime.
  - *Search Quality*: The results that the portal provides when undertaking a search must be appropriate to the request made by the user.

Quality in the use of resources: the user can use Grid resources under specified conditions with the portal.

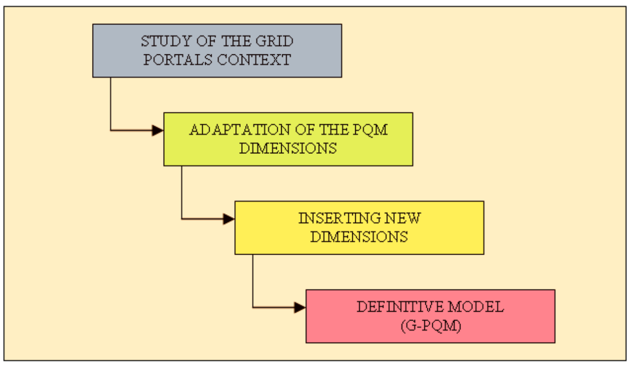

Figure 1: Phases for the construction of the G-PQM model.

- **Responsiveness**: It is the "willingness of the Grid portal to help and to provide its functionality in an immediate form to the users". In this dimension, we note the following sub-dimensions:
  - *Scalability*: This refers to the ability of the portal to adapt smoothly to increasing workloads coming about as a result of additional users, an increase in traffic volume or the execution of more complex transactions (Gurugé, 2003).
  - *Efficient access*: This relates to the response times experienced by portal users (Gurugé, 2003).
- **Empathy**: We define this dimension as the "ability of the Grid portal to provide caring and individual attention". In this dimension, we observe the following sub-dimensions:
  - *Navigation*: The Grid portal must provide simple and intuitive navigation when being used.
  - *Presentation*: The Grid portal must have a clear and uniform interface.
  - *Integration*: All the components of the Grid portal must be integrated in a coherent form.
  - *Personalization*: The portal must be capable of adapting to the user's priorities.
- **Data and information files quality**: This dimension is defined as the "quality of the data contained in the portal and of the files which specify the available services in the portal and the names of devices responsible for these services". According to Dedeke and Kahn, we can distinguish four different subdimensions (Dedeke and Kahn, 2002):
  - *Intrinsic*: this indicates what degree of care was taken in the creation and preparation of data/files.
  - *Representation*: this indicates what degree of care was taken in the presentation and organization of data/files for users.
  - *Contextual*: to what degree the data/files provided meet the needs of the users.
  - *Accessibility*: this indicates what degree of freedom users have to use data, define and/or refine the manner in which data/files are inputted, processed or presented to them.

2.2 Inserting New Dimensions

The following dimension has been added:

- **Security**: This is "the ability of the portal to prevent, reduce and properly respond to malicious harm" (Firesmith, 2004). This dimension will be affected by:
  - *Access control*: capability of the portal to allow access to its resources only to authorized persons. Thus, the portal must be able to identify, authenticate and authorize its users.
  - *Security control*: the capability of the Grid portal to carry out auditing of security and detect attacks. The auditing of security shows the degree to which security personnel are enabled to audit the status and use of security mechanisms by analyzing security-related events. In addition, attack detection seeks to detect, record and notify attempted attacks as well as successful attacks.
  - *Confidentiality*: Ability to maintain the privacy of the users.
  - *Integrity*: the capability of the portal to protect components (of data, hardware, and software) from intentional or unauthorized modifications.

2.3 Definitive Model (G-PQM)

Taking into account the dimensions which have been adapted as well as the dimensions that have been introduced, the following model results (Figure 3):

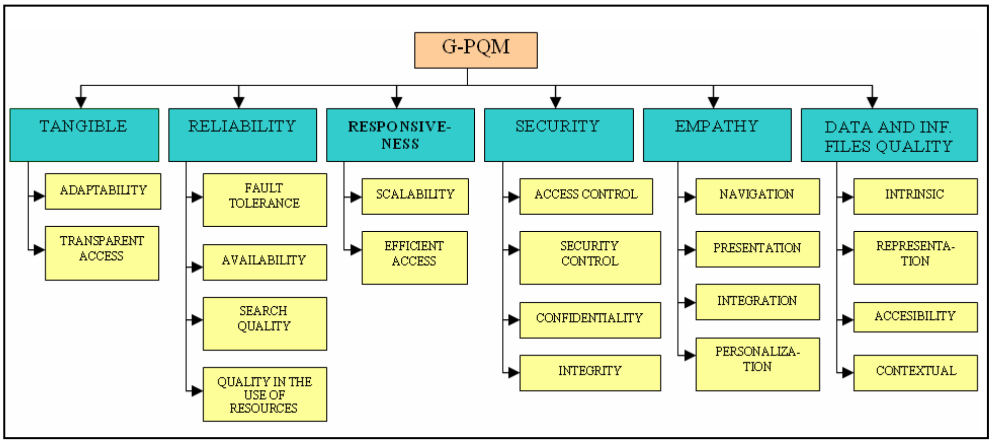

Figure 2: Characteristics and subcharacteristics of G-PQM.

3 APPLYING G-PQM

Having defined G-PQM, the next step is to apply it to some Grid portals with the objective of determining, on the one hand, the extent to which these portals satisfy the dimensions identified in the Grid portal quality model; and on the other hand, to identify possible improvements in the quality of these portals.

In our first approach, G-PQM has been applied to two Grid portals. It should be noted that we have applied G-PQM from the point of view of the users. G-PQM is, however, directed at portal developers. For this reason, some of the identified dimensions or sub-dimensions may not be measured (in this case, we will assign the value "not evaluable" to the (sub) dimension). In spite of this, we can obtain an overall assessment of the quality of these Grid portals.

3.1 GridPort Demo Portal

As a first step, the model has been applied to the GridPort demo portal which is a fully operational test portal that is intended to serve as a starting point for those interested in grid portal development (the reader can find more information about this portal at http://gridport.net/main/). This portal has been developed using the GridPort toolkit which enables the rapid development of highly functional grid portals that simplify the use of underlying grid services for the end-user (GridPort, 2006). The GridPort demo portal includes portlets that allow a user to do the following: view static and dynamic information about the resources in a grid, obtain short-term proxies from a myproxy server, submit batch jobs to resources on the grid, and browse and transfer files between resources on the grid (GridPort, 2006).

The outcomes obtained are the following:

- Tangible:
  - Adaptability: The following software packages are prerequisites to using the GridPort Demo Portal: JDK 1.4.2, Jakarta Ant 1.6, TomCat, etc. These packages cannot be installed on all devices.
  - Transparent access: GridPort has Grid portlets whose aim is to provide transparent access to resources.
- Reliability:
  - Fault tolerance: Not evaluable.
  - Availability: During the testing, the portal was available anywhere and anytime.
  - Search Quality: Not applicable because the portal does not have a search engine.
  - Quality in the use of resources: Not evaluable.
- Responsiveness:
  - Scalability: The portal is not limited to a specific number of users.
  - Efficient access: During the testing, the time between the request for a page and obtaining it was found to be acceptable.
- Security:
  - Access control: The portal has mechanisms to identify (asking for username and password) and authenticate (has GridSphere authentication modules) users. Moreover, it has the capacity to authorize certain users to use certain resources.
  - Security control: Not evaluable.
  - Confidentiality: Not evaluable.
  - Integrity: users cannot carry out unauthorized actions.
- Empathy:
  - Navigation: The navigation is simple and intuitive.
  - Presentation: The interface is clear and uniform.
  - Integration: All the components of the Grid portal appear in a coherent, integrated form.
  - Personalization: The portal can adapt to the user's priorities.
- Data and information files quality:
  - Intrinsic:
    - From the point of view of data: Not evaluable.
    - From the point of view of information files: Not evaluable.
  - Representation:
    - From the point of view of data: During the testing, the data were presented in an organized form.
    - From the point of view of information files: Not evaluable.
  - Contextual:
    - From the point of view of data: the information obtained during the testing satisfied our needs.
    - From the point of view of information files: Not evaluable.
  - Accessibility:
    - From the point of view of data: users do not influence the manner in which data are inputted, processed or presented to them.
    - From the point of view of information files: Not evaluable.

We must take into account the fact that we have carried out the assessment from the point of view of the end user. That being so, we do not have all the necessary data, so the conclusions obtained from applying G-PQM are not as definitive as they should be. However, we can see that the main characteristics which must be improved are:

adaptability (because the number of minimum requirements is excessive and this makes it impossible to adapt the portal to an arbitrary device) and data accessibility (because users cannot influence the way in which data are inputted, processed or presented to them). The rest of the characteristics which have been assessed, have given a favourable result. It would likewise be interesting to obtain more information related to the portal, for the purpose of detecting other weak points. We could thereby improve portal quality.

3.2 OGCE Portal

Secondly, we have applied the model to the OGCE portal, whose objective is to create an environment that facilitates the use of Grid resources. The results obtained from applying G-PQM are:

- Tangible:
  - Adaptability: The minimum requirements are: 500 MB free hard-disk space, Pentium III or higher (or a similarly capable processor)_and 128 MB free RAM.
  - Transparent access: OGCE Port (release 2) has Grid portlets which manage remote files, execute remote commands, etc. Furthermore, this portal has inter-portlet communication tools that allow portlets to share data.
- Reliability:
  - Fault tolerance: Not evaluable.
  - Availability: The portal was available anywhere and anytime.
  - Search Quality: Not applicable because the portal does not have a search engine.
  - Quality in the use of resources: Not evaluable.
- Responsiveness:
  - Scalability: The portal is not limited to a specific number of users.
  - Efficient access: The response time was very high in some testing, and the request was not even met in some instances.
- Security:
  - Access control: The portal has mechanisms to identify (asking for username and password) and authenticate (has GridSphere authentication modules) users. Moreover, it has the capacity to authorize certain users to use certain resources.
  - Security control: Not evaluable.
  - Confidentiality: Not evaluable.
  - Integrity: users cannot carry out unauthorized actions.
- Empathy:
  - Navigation: The navigation is simple and intuitive.
  - Presentation: The interface is clear and uniform.
  - Integration: All the components of the OGCE portal are integrated in a coherent way.
  - Personalization: The portal is capable of adapting itself to the user's priorities.
- Data and information files quality:
  - Intrinsic:
    - From the point of view of data: Not evaluable.
    - From the point of view of information files: Not evaluable.
  - Representation:
    - From the point of view of data: During the testing, the data were presented in an organized form.
    - From the point of view of information files: Not evaluable.
  - Contextual:
    - From the point of view of data: the information obtained during the testing satisfied our needs.
    - From the point of view of information files: Not evaluable.
  - Accessibility:
    - From the point of view of data: users do not influence the way in which data are inputted, processed or presented to them.
    - From the point of view of information files: Not evaluable.

As with the previous case, we have applied our model from the point of view of the end user, so there are some dimensions which cannot be assessed. However, taking into account the dimensions we *have* assessed, we can see that the following tasks to improve portal quality could be carried out: reduction of the number of minimum requirements, so as to allow the portal to adapt itself to any device; improvement of the efficiency of access; and above all, avoidance of a request not obtaining an answer and elimination of the appearance of a blank screen. On the other hand, we have obtained favourable results for the rest of the characteristics we have assessed. It will also be of interest to us to obtain information related to the dimensions which have not been assessed.

4 CONCLUSIONS AND FUTURE WORK

Nowadays, many scientists require the use of the Grid to conduct their computational research. However, its use is not a trivial task. For this reason, and with the aim of allowing an easy access to Grid resources via a Web browser interface, Grid portals have come into existence.

Many different Grid portals can be found at the present time. Therefore, it is easy for users to move from one Grid portal to another, without the user wasting time and money. Thus, for users to be attracted to a particular Grid portal and come back regularly, the portal must offer a good level of quality.

Bearing all this in mind, a quality model for Grid portals, namely G-PQM, has been presented. This model can be used, on the one hand, to assess the quality level of a specific Grid portal, and on the other hand, to identify its weakness and define corrective actions which improve its level of quality. In addition, this model has been applied to two grid portals and some corrective actions have been defined in order to improve their level of quality.

Future work includes the validation of the model characteristics through surveys. In addition, measures for each one of the characteristics and sub-characteristics must be identified. Thereby, the G-PQM will be finished.

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