Smef 2007

Proceedings of the 4th Software Measurement European Forum

May 9 - 11, 2007

Rome, Italy

LibreriaClup

Istituto Internazionale di Ricerca
Know how to achieve

IIR is the world's largest knowledge and skills provider with a global network of 47 companies and 112 operating units. IIR has specialist companies providing groundbreaking strategies and proven technical expertise in both business functional areas and vertical markets - including management, marketing, sales, leadership, projects, HR, service, telecommunications, IT, pharmaceuticals, retail financial services, insurance, investment, manufacturing, energy, services, and the public sector. Founded as a newsletter company in 1973, IIR quickly built on its research and thought leadership capabilities to become the market leaders in conferences, seminars, exhibitions, publications, performance improvement and eLearning. Every year, IIR works directly with 650,000+ business executives to give them the 'know-how' they need to achieve.

DPO

DPO (Data Processing Organization Srl) is a qualified supplier of services in the ICT market. DPO's excellence areas are Software Measurement and Estimation, Requirements Management, Project & Risk Management. Besides producing the SFERA suite for Standard and Early & Quick Function Point Analysis and cost & time estimation for software projects, DPO provides specialized services and products to promote the continuous evolution of production and management processes for both public and private organizations. DPO's high quality standards come from its active role in the research field at international level and the continuous confirmation of certificated expertise of its personnel (eg IFPUG CFPS). DPO's professionals collaborate with acknowledged technical national and international committees in the software measurement area, as the Italian GUFPI-ISMA Function Point Counting Practices Committee, the Italian GUFPI-ISMA Software Benchmarking Committee, and the international COSMIC Full Function Point Measurement Committee.

SOGETI

Sogeti Nederland BV. is a leading IT services firm active for over 30 years. Our workforce of 1,900 employees provides top quality IT consultancy and services to leading companies in several industry sectors in the Netherlands. Our focus is local, but we are part of Sogeti Worldwide, offering IT services in the American, German, French, UK, Swedish, Swiss and Spanish markets. Sogeti Worldwide is a fully owned subsidiary of Cap Gemini SA in France.
The Expertise Centre Metrics (ECM) was founded in 2002 and is a unit within the Managed Delivery division. ECM supports organisations in getting to grips on investment in Information Technology. The primary service offerings of ECM are estimation, measurement and evaluation. In all result-driven projects of Sogeti, ECM provides support to Bid Management during the acquisition phase and to project managers during the project execution phase.

Proceedings of the
4rd Software Measurement European Forum

Smef 2007

May 9 - 11, 2007

Rome, Italy

ISBN 9 788870 909425

PROCEEDINGS OF THE 4th SOFTWARE MEASUREMENT EUROPEAN FORUM

ISBN 9-788870-909425

Finito di stampare nel mese di Aprile 2007
da DigitalPrint Service via Torricelli, 9 - 20090 Segrate (Mi)

Libreria CLUP Soc. Coop.
via Ampère, 20 20131 Milano
tel. 02.70.63.48.28 fax 02.70.63.48.33
e-mail: clup@galactica .it

Sede legale e amm.va: c.so di P.ta Vittoria 28, 20122 Milano

SOFTWARE MEASUREMENT EUROPEAN FORUM

Proceedings

of

SMEF 2007

9 - 11 May 2007

Centro Congressi FRENTANI, ROME (ITALY)

EDITOR
Ton Dekkers
Shell Information Technology International B.V.
The Netherlands

COVER PHOTO
Ton Dekkers

LibreriaClup

CONFERENCE OFFICERS

Software Measurement European Forum 2007

Conference Manager
Cristina Ferrarotti, Istituto Internazionale di Ricerca Srl., Italy

Conference Chairperson
Roberto Meli, DPO - Data Processing Organization, Italy

Program Committee Chairperson
Ton Dekkers, Shell Information Technology International B.V.,The Netherlands

Program Committee
Silvia Mara Abrahão, Universidad Politecnica de Valencia, Spain
Prof. Alain Abran, École de Technologie Supérieure / Université du Québec, Canada
Dr. Klaas van den Berg, University of Twente, The Netherlands
Dr. Luigi Buglione, ETS - Université du Québec / Atos Origin, Italy
Manfred Bundschuh, DASMA e.V, Germany
Prof. Gerardo Canfora, University of Sannio, Italy
Prof. Giovanni Cantone, University of Rome Tor Vergata, Italy
Carol Dekkers, Quality Plus Technologies, Inc, U.S.A.
Prof. Dr. Reiner Dumke, University of Magdeburg, Germany
Dr. Christof Ebert, Vector Consulting, Germany
Cao Ji, China Software Process Union, People Republic China
Dr. Thomas Fehlmann, Euro Project Office AG, Switzerland
Pekka Forselius, Software Technology Transfer Finland Oy, Finland
Cristine Green, EDS, Denmark
Susanne Hartkopf, Fraunhofer IESE, Germany
Harold van Heeringen, Sogeti Nederland B.V., The Netherlands
Heungshik Kim, Samsung, South Korea
Rob Kusters, Eindhoven University of Technology / Open University, The Netherlands
Miguel Lopez, University of Namur, Belgium
Dr. Nicoletta Lucchetti, SOGEI, Italy
Dr. Jürgen Münch, Fraunhofer IESE, Germany
Sandro Morasca, Università dell'Insubria, Italy
Pam Morris, Total Metrics, Australia
Serge Oligny, Bell Canada, Canada
Dr. Anthony Rollo, Software Measurement Services Ltd., United Kingdom
Luca Santillo, independent consultant, Italy
Habib Sedehi, University of Rome, Italy
Charles Symons, United Kingdom
Frank Vogelezang, Sogeti Nederland B.V., The Netherlands

Software measurement is sometimes mistakenly perceived by the business community of developers as a work overload, a luxury we cannot possibly afford in a strongly competitive business market.

On the contrary, beyond being useful for measuring our own personal contribution to production and for making the right decisions on how to improve our own production process, software measurement turns out to be absolutely essential when such a process produces consequences at corporate level, in other words, it has to be matched with stakeholders expectations. In this situation what is really needed is to be able to manage our own software project or service as well as to be able to objectively report its actual state and its prospective developments to customers, managers, auditors that are called upon to provide their consent or alternatively contribute to the decision making process.

A critical factor for a successful collection and use of field measurements is the measurement full integration into other production processes: in other words measurement should become undistinguishable and inseparable from production. To be able to do so, measurement should be cost-effective, fast, unambiguous and user-friendly. Once information is gathered, it should be fed into and become part of the corporate decision-making and governance process which should look at information as quality decision nourishment.

It is therefore essential to ensure outstanding data quality, as well as appropriate and accurate processing practices, likewise derived information (indicators) should be properly distributed and displayed in the most appropriate format depending on the end receivers it should be aimed at. International standards have long been introduced by law (de jure) and by consensus (de facto) as to how raw data should be transformed into information that meet a specific need at a more general, abstract and complex level.

The time is ripe for these standards to be put in place by defining the most appropriate working practice depending on each individual situation. Transforming raw elementary data into business information takes a systemic measurement approach that can be pursued by developing a corporate ICT Measurement System (a solid building block of the organiseation) the foundations of which consist of Measurement programmes (temporary initiatives through which the Measurement System is being developed and enhanced).

Within any Measurement System it is important to acknowledge the role played by functional and technical metrics, each with its own application field. IFPUG Function Point and COSMIC Full Function Point are the most prevailing functional measurement methods currently available on the market. They work side by side with size estimation techniques, such as Early&Quick FP, which allow estimating ahead of time and approximately the actual measurement when there is neither time, nor resources to allocate to standard evaluation. To complete the picture of the Measurement System tools, mention should be made of basic productivity and benchmarking data sources such as the one made public by ISBSG. They are essential in designing market productivity models supported by internal and specific business models, allowing combining software functional size measurement with managerial variables (e.g. time, cost, effort and staff) that its development, enhancement and supporting activities may require over time.

The more measurements and estimations are automated, the lower the cost of the measurement endeavour, which is key to the success of the Measurement System. The event will be a unique opportunity for all ICT professionals to share both their knowledge and experience on Software Measurement Topics and also meet potential customers and partners from all over the world.

SMEF aspires to remain a leading international event in Europe for experience interchange and knowledge improving on a subject, which is increasingly critical for the ICT governance.

- Measuring software products and processes to improve ICT Governance.
- Develop your competences in Software Measurement.
- Learn how to build complex indicators starting from raw elementary data.
- Learn how to setup an ICT Measurement System in your organiseation.
- Meet some of the major software measurement experts in the world.
- Explore the state of the art in this evolving discipline.
- Compare your own experience with other participants' experience.
- Enter a world wide professional network.
- Submit your own ideas to software measurement opinion leaders.

Cristina Ferraroti
Roberto Meli
Ton Dekkers

TABLE OF CONTENTS

Software Measurement European Forum 2007

10. References

[1] Akao, Y. et. al. (1990), Quality Function Deployment (QFD); Productivity Press, University Park, IL.

[2] Engeler E. (1995), The Combinatory Programme, Birkhäuser, Basel, Schweiz.

[3] Fenton, N.; Krause, P.; Neil, M. (1999), "A Probabilistic Model for Software Defect Prediction", IEEE Transactions on Software Engineering, New York, NY.

[4] Fehlmann, Th. (2004), "The Impact of Linear Algebra on QFD", in: International Journal of Quality & Reliability Management, Vol. 21 No. 9, Emerald, Bradford, UK.

[5] Fehlmann, Th. (2005), Six Sigma in der SW–Entwicklung, Vieweg–Verlag, Braunschweig–Wiesbaden.

[6] Fehlmann, Th. (2006), "Six Sigma Revisited", EuroSPI^2 Conference Proceedings, 2006.

[7] Herzwurm G., Mellis, W., Schockert, S. (1997): Qualitätssoftware durch Kundenorientierung. Die Methode Quality Function Deployment (QFD). Grundlagen, Praxisleitfaden, SAP R/3 Fallbeispiel.

[8] Jensen, RW, Putnam, LH, Roetzheim, W, Software Estimating Models: Three View-points, in Crosstalk, The Journal of Defense Software Engineering, Feb. 2006. Web: http://www.stsc.hill.af.mil/crosstalk/2006/02/0602JensenPutnamRoetzheim.html

[9] Paulk, M.C., Curtis, B., Chrissis, M.B., and Weber, Ch. V. (1993), Capability Maturity Model for Software, Version 1.1, Software Engineering Institute, CMU/SEI-93-TR-24, DTIC Number ADA263403, Carnegie-Mellon University, Pittsburg, PA.

[10] Saaty, Th. (1999), „Fundamentals of the Analytic Network Process", in: ISAHP 1999, Kobe, Japan.

[11] Santillo, L., "Error Propagation in Software Measurement and Estimation", IWSM/MetriKon 2006 conference proceedings, Shaker Verlag, Aachen, Germany, 2006.

[12] Taylor, J.R., An Introduction to Error Analysis, The Study of Uncertainties in Physical Measurements, University Science Books, 1982.

A prototype tool to measure the data quality in Web portals

Angélica Caro, Juan Enríquez de Salamanca, Coral Calero, Mario Piattini

Abstract

The Internet is now firmly established as an environment for data administration, exchange and publication. To support this, a great variety of Web applications have appeared. Web portals are among these, and are an important means of accessing information. Numerous users worldwide make use of Web portals to obtain information for different purposes. For example, this information is used to work, make decisions, do business, study, for entertainment, etc. These users, or data consumers, need to ensure that this information is suitable for the use to which they wish to put it. This paper introduces a PDQA tool, based on a data quality model for Web portals (PDQM), which assesses data quality in Web portals.

1. Introduction

A Web portal is a site that aggregates information from multiple sources on the Web and organisees this material in an easy user-friendly manner [6]. Over the past decade the number of organiseations that provide Web portals has grown dramatically. These organiseations provide portals that complement, substitute or extend existing services to their client base [7]. Numerous users worldwide make use of Web portals to obtain information for their work and to help with decision making. These users, or data consumers, need to ensure that the data obtained are appropriate for the use to which they need to be put. Likewise, the organiseations that provide Web portals need to offer data that meet user requirements and help these users to achieve their goals. Therefore data quality represents a common interest between data consumers and portal providers.

Data Quality (DQ) is often defined as "fitness for use", i.e., the ability of a collection of data to meet user requirements [1][5]. Moreover, the terms "data" and "information" are often used as synonyms. In this work we shall also treat them as being synonymous.

In recent years, several research projects have been conducted on the topic of Web Data Quality. However, there is still a lack of specific proposals for the data quality of Web portals which consider the data consumer's point of view. In this work we introduce the PDQA tool, which assesses the DQ in Web portals. This tool is based on a data quality model for Web portals (PDQM) created in our previous work [2]. This model is centred on the point of view of data consumers and uses a probabilistic approach (based on Bayesian networks) for data quality evaluation. The tool at this moment is only a prototype which is working but is not available in the Web. This because we are refining both the model implemented by the tool and the indicators calculated by PDQA tool in order to eliminate some factors that can introduce errors in the results (such as outliers, dead pages, etc.).

The PDQA tool was built using a 3-tiered architecture to separate the presentation, application (business), and storage components, using Visual Basic .NET technology. The main functions of PDQA are to calculate the level of DQ for a given Web portal and to calculate the data quality ranking for a given Web portal domain.

This paper is structured as follows. Section 2 briefly describes the PDQM, the data quality model that is supported by PDQA. Section 3 explains the main characteristics of the PDQA. The architecture of the tool is described in Section 4. The method used to calculate the DQ is discussed in Section 5. Finally, Section 6 shows our conclusions.

2. A Portal Data Quality Model (PDQM)

PDQM is a data quality model for Web portals focused on the data consumer perspective. Its definition is based on three key aspects: (1) **The Data consumer perspective,** according to the DQ definition which suggests that DQ cannot be assessed independently of the people who use data [5]; (2) **Web data quality attributes,** proposes in literature for different types of Web applications; and (3) **Web portal functionalities,** which characterise and distinguish portals from other Web applications.

To produce the PDQM, we defined a process divided into two parts (Figure 1). In the first part we defined a theoretical model composed of 33 DQ attributes (Table 1). This set of DQ attributes was validated by means of a survey of a group of Web portal data consumers [2].

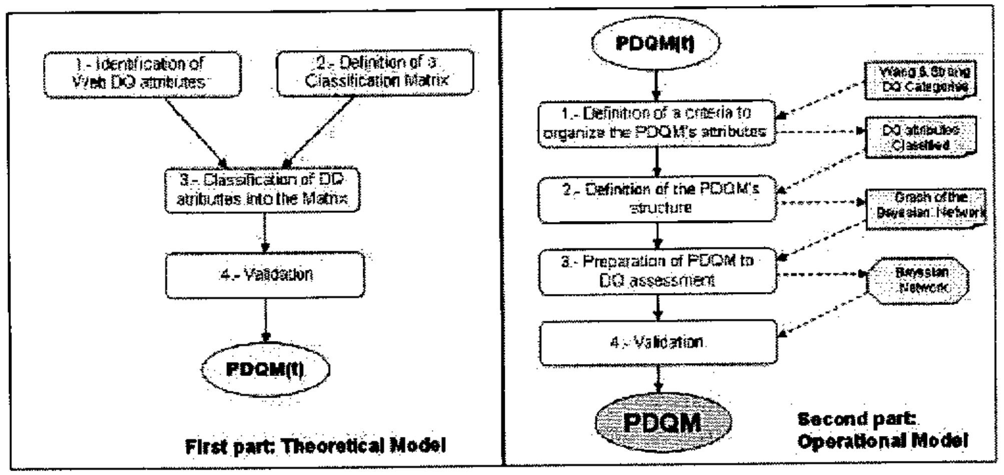

Figure 1: The development process of PDQM

Table 1: DQ Attributes of PDQM

Attractiveness	Documentation	Customer Support
Accessibility	Duplicates	Reliability
Accuracy	Ease of Operation	Reputation
Amount of Data	Expiration	Response Time
Applicability	Flexibility	Security
Availability	Interactivity	Specialization
Believability	Interpretability	Timeliness
Completeness	Novelty	Traceability
Concise Representation	Objectivity	Understandability
Consistent Representation	Organiseation	Validity
Currency	Relevancy	Value added

In the second part, our aim was to convert this theoretical model into an operative one. In simple terms, this conversion consisted of the definition of a structure with which to organisee DQ attributes, along with their association of measures and criteria. Taking the intrinsic subjectivity of the data consumer's perspective and the uncertainty inherent to quality perception into account [3], we decided to use a probabilistic approach based on Bayesian networks. This decision was made by taking into account a set of properties/requirements that our final model had to satisfy.

The most important are the following:

- *Generic.* The PDQM must be applicable to any Web portal.
- *Adequacy.* The PDQM is oriented towards the data consumer's point of view. It must support the subjectivity and uncertainty associated with DQ evaluation.
- *Flexibility.* It must be applicable to different situations. For example, in different Web portal domains, in processes where the model can be used in a partial or complete way or in processes where different kinds of data consumers can be considered. To do this, the structure must support the assignation of different weights to the attributes.
- *Completeness.* The structure must allow the representation of all the relationships between the attributes, e.g., an attribute can simultaneously affect several other attributes. In hierarchical models for example, attributes from the same level cannot be related and an attribute cannot affect more than one of the attributes in the upper level.

A Bayesian network (BN) is a directed acyclic graph, whose nodes represent variables, whose arcs signify the existence of direct causal influences between the linked variables, and the strengths of these influences are expressed by forward conditional probabilities [4]. BNs provide a graphical and intuitive method to capture the relationships between attributes in a task or domain. Arcs, nodes and probabilities can be elicited from experts and/or empirical data, and probabilities are conveyed by using Node probability tables which are associated to nodes.

In the operational definition of PDQM we have organiseed its 33 DQ attributes into four DQ categories:

- *DQ Intrinsic*, which denotes that data have quality in their own right.
- *DQ Operational*, which emphasises the importance of the role of systems. That is, the system must be accessible, secure and allow personalization and collaboration, among other aspects.
- *DQ Contextual*, which highlights the requirement which states that DQ must be considered in the context of the task in hand.
- *DQ Representational*, which denotes that the system must present data in such a way as to be interpretable and easy to understand, as well as concisely and consistently represented.

So the BN that represents PDQM and that organisees its 33 DQ attributes is composed of four sub-networks, one for each DQ category. Each DQ attribute is represented as a node in the BN.

For each sub-network we need to define the measures and the node probability tables necessary to evaluate the DQ. At this moment we have completed the definition of the DQ Representational sub-network, and the first version of the PDQA, shown in this paper, supports the sub-network of DQ Representational.

Figure 2 shows the BN generated for this sub-network. How this was achieved is mentioned in the previous paragraph; probability tables were defined for each node in the sub-network and quantifiable variables which measure the DQ attributes that they represent were defined for each input node (marked zone).

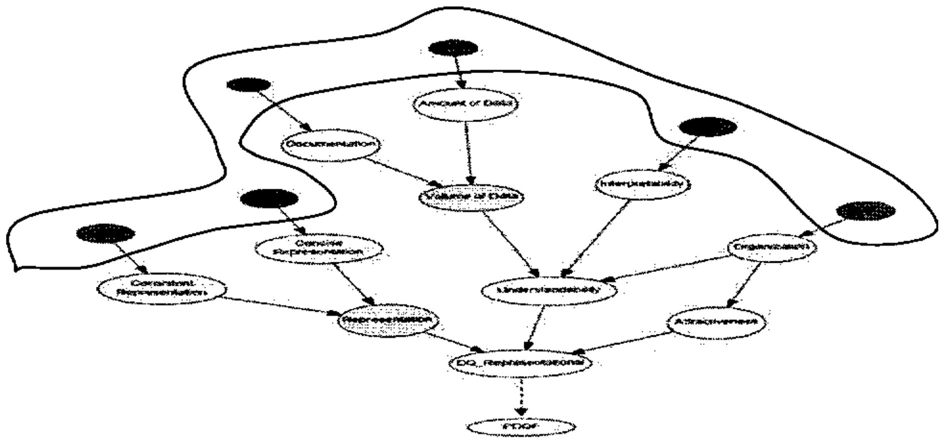

Figure 2: The BN that represents the sub-network of DQ Representational

In the following sections we will describe the main characteristics and how the PDQA Tool works.

3. Characterising the PDQA Tool

The objective of the PDQA tool is to give the user information about the data quality level in a given Web portal (at the moment this will only be for the DQ Representational). This process could not take place in real time because it is necessary to download and analyze all the pages of the Web portal, in order to calculate the defined measures. The tool calculates the measures using the public information in Web portals.

A Web portal can be analyzed several times. The application stores the results of each evaluation, including several evaluations for the same portal. Thus, the user can check the data quality evolution for a given Web portal.

The tool considers different Web portal domains. In this way, data quality can be evaluated depending on the domain to which the Web portal belongs. Also, this characteristic allows the user to check the data quality ranking for Web portals in a given Web portal domain.

Finally, as well as giving information on data quality, the application will suggest some activities that could be applied to improve that web portal data quality.

The main function of PDQA is, then, to allow users to introduce the URL of a Web portal together with its domain and, after a period of time (one or two days) the tool generates an e-mail for the user to inform him/her that the evaluation is finished and that the results can be obtained on the PDQA website. An additional functionality, oriented towards developers/designers, will be the possibility of obtaining a list of corrective actions to improve the data quality if necessary.

4. The PDQA Tool architecture

The tool was built using a 3-tiered architecture to separate the presentation, application, and storage components (Figure 3), using Visual Basic .NET technology.

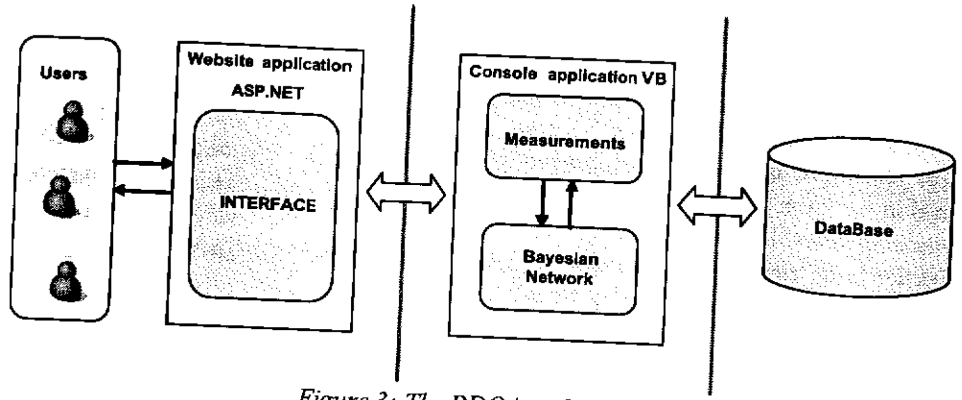

Figure 3: The PDQA architecture

By means of the presentation tier the tool provides an interface for the user that allows them to basically carry out two tasks. Users can start an evaluation process and seek information about the previous evaluations. All tasks are offered by means of menu options.

When the user decides to start an evaluation process s/he must provide the URL of a Web portal, the Web portal domain, which DQ category s/he wishes to evaluate, and their e-mail address (see Figure 4). When the data are verified, the process is initiated. If the DQ category to be evaluated includes subjective measures, then a set of questions will be formulated for the user. Once the calculations are performed the user is contacted (via e-mail) inviting him/her to visit the PDQA tool website again in order to recover the results.

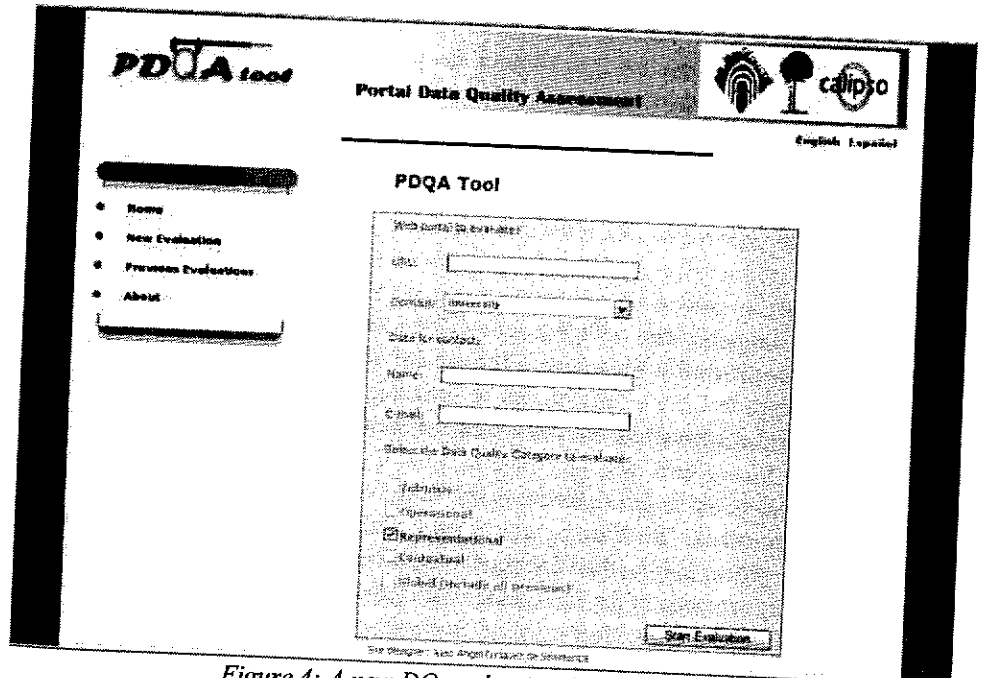

Figure 4: A new DQ evaluation for a Web portal

If the user decides to use the PDQA to ask about previous evaluations s/he can obtain two types of information: (1) the results of evaluations asked for by him/her, (2) the results of the previous evaluations of a given Web portal sorted chronologically (asked for by any user) and (3) the ranking of the Web portals belonging to a given domain.

The application tier is composed of two sub-applications. The first calculates the measures defined in the given portal, stores the results in the database, generates the inputs for the second sub-application and notifies the user when the evaluation process is finished. The second sub-application loads the appropriate BN (corresponding to the Web portal domain) and sends the final results to the first sub-application to be stored.

Finally, the data tier corresponds to the data base where the results of different evaluations are stored.

4.1. The database

In the database of PDQA, the information, both about the Web portals, domains and evaluations, is stored. The most important entities in the database are:

- *Web Portals*. For the storage of the information about the Web portal evaluated.
- *Users*. For the storage of the information of the PDQA users (e-mail, name...). A particular user can evaluate several Web portals and the same Web portal can be evaluated by several users.
- *Domains*. For the storage of the Web portal domains. These domains are used to select the BN corresponding with the Web portal that will be evaluated. A particular Web portal can belong to only one domain.
- *Evaluations*. For the storage of the measures calculated for each web portal requested and the final DQ evaluation. Each evaluation of a Web portal has an associated state value: activated or evaluated. Activate means that the evaluation of the portal is being performed and evaluated means that the evaluation has finished and the results are available. The same portal can be evaluated many times.
- *Recommendations*. For the storage of the recommendations to improve the DQ in a Web portal. Depending on the results obtained and the Web portal's domain, the tool delivers a list of recommendation to improve the DQ, if the user asks for it.

4.2. PDQA users

The PDQA tool is a public tool with free access that uses public data. Any user can use it to request the DQ evaluation of a Web portal. The results of the different evaluations are public information. This means that any evaluation can be consulted by any user. Users can see both the evaluation that they have ordered and also that which has been ordered by all other users.

The results will be stored in the database. If the same Web portal is newly evaluated the new evaluation will also be stored. This allows a user to ask for historical data about the evaluations and to check whether the data quality in the Web portals has being improved. In this way, the user can check the data quality evolution of the Web portal with regard to several evaluations. In addition, if the user asks for it, the tool can deliver a list of recommendations to improve the DQ. Figure 5 shows a use case diagram which graphically explains the interactions of the users with the tool.

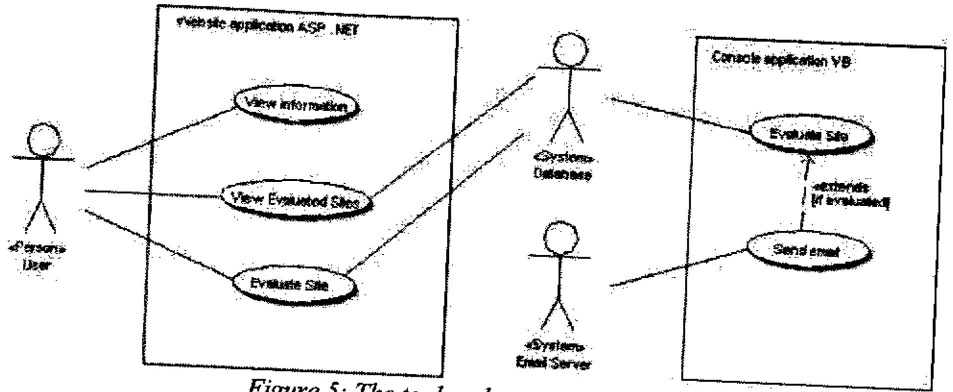

Figure 5: The tool and user interactions

5. Calculating the DQ in a Web portal

At this moment, the method proposed to calculate the DQ in a Web portal is applied through the DQ Representational category. In the DQ Representational category, most of the measures can be measured in an objective way, but some of them must be calculated using a questionnaire for the user. Then, as shown in the marked zone in Figure 1, the PDQA will perform measurements for the following indicators or variables:

- *Level of Consistent Representation (LCsR)*. The Consistent Representation attribute is defined as: *The extent to which data are always presented in the same format, are compatible with previous data and are consistent with other sources*. The measures selected for this attribute are centred on the consistency of the format and on the compatibility with the pages in the portal. For this indicator we have defined measures based on the use of Style on the pages of the Web portal and on the correspondence between a source page and the destination pages.
- *Level of Concise Representation (LCcR)*. The Concise Representation attribute is defined as: *The extent to which data are compactly represented without superfluous or non-related elements*. To define an objective measure for this attribute we have considered measures associated with the amount and size of paragraphs and the use of tables to represent data in a compact form.
- *Level of Documentation (LD)*. The Documentation attribute is defined as: *Quantity and utility of the documents with metadata*. The measures selected to evaluate this attribute are related to the basic documentation that a Web portal presents to data consumers. To calculate this indicator we considered the simple documentation associated with the hyperlinks and images on the pages of the Web portal.
- *Level of Amount of Data (LAD)*. The Amount of Data attribute is defined as: *The extent to which the quantity or volume of data delivered by the Web portal is appropriate*. We understand that from the data consumer's perspective the amount of data is concerned with the distribution of data throughout the pages in the portal. It is for this reason that we have considered the data in text form (words), in hyperlink form (links) and in visual form (images) when measuring the amount of data in a Web portal.
- *Level of Interpretability (LI)*. The Interpretability attribute is defined as: *The extent to which data are expressed in language and units appropriate for the consumer's capability*. We have considered that the evaluation of this attribute is too subjective, so we have decided to use a check list for its measurement. Each item in the check list will be valuated with a number from 1 to 10; subsequently these values need to be transformed into a value input for the BN.

- *Level of Organiseation (LO).* The Organiseation attribute is defined as: *The organiseation, visual settings or typographical features (colour, text, font, images, etc.) and the consistent combinations of these various components.* Based on this definition, we have used measures that verify the existence of data group (tables, frames, etc.), the use of colours, titles and different fonts, etc, as a form to establish the level of organiseation of the data in the portal.

So, for a given Web portal the PDQA will calculate the measures associated with the indicators: LCsR, LCcR, LD, LAD, LI, LO. Each indicator will take a value of between 0 and 1. This value will be transformed into a set of probabilities for the corresponding labels. Each of these values will be the input for the corresponding input node (for example, in Figure 6, the value of indicator LD is the input for the *Documentation* node). With this value, and using its probability table, each node generates a result that is propagated, via a causal link, to the child nodes for the whole network until the level of the DQ Representational is obtained. Figure 6 explains this method graphically.

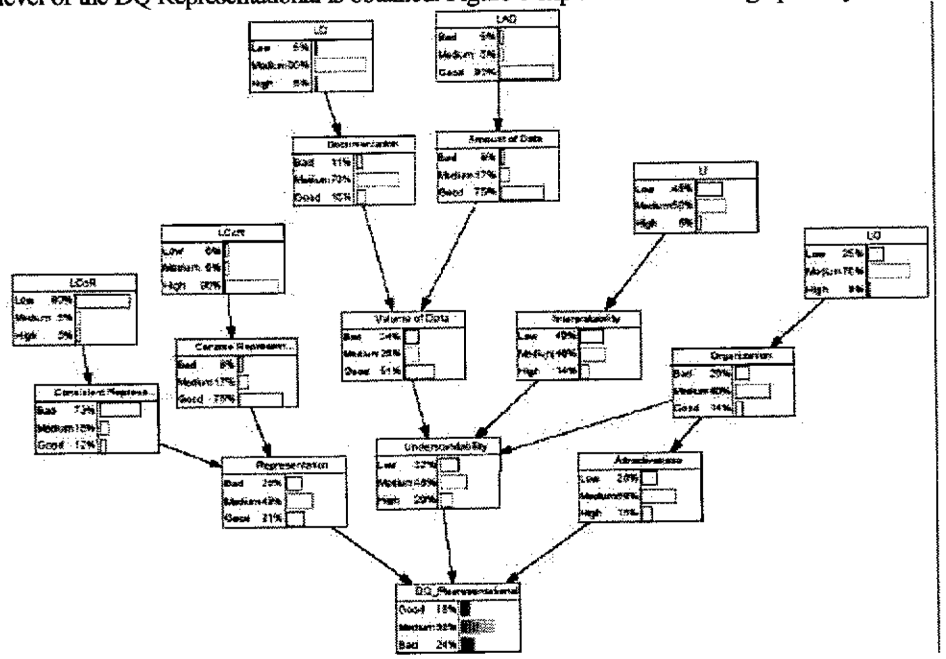

Figure 6: The tool and user interactions

5.1. Rankings calculation

For a specific Web portal domain it will be possible to calculate a ranking of the Web portals evaluated. This ranking will be calculated in a simply form, considering the last evaluation made for each portal.

As was explained in Section 2, in the underlying DQ model of PDQA the DQ can be divided into four categories. Consequently the PDQA tool will offer the users the possibility of deciding whether the evaluation will be made for the global DQ or for a DQ category. So, the DQ ranking shows the position of each Web portal in each category and in the DQ global.

The Web portals will be presented in the ranking sorted by the value obtained at its evaluation. See Figure 7.

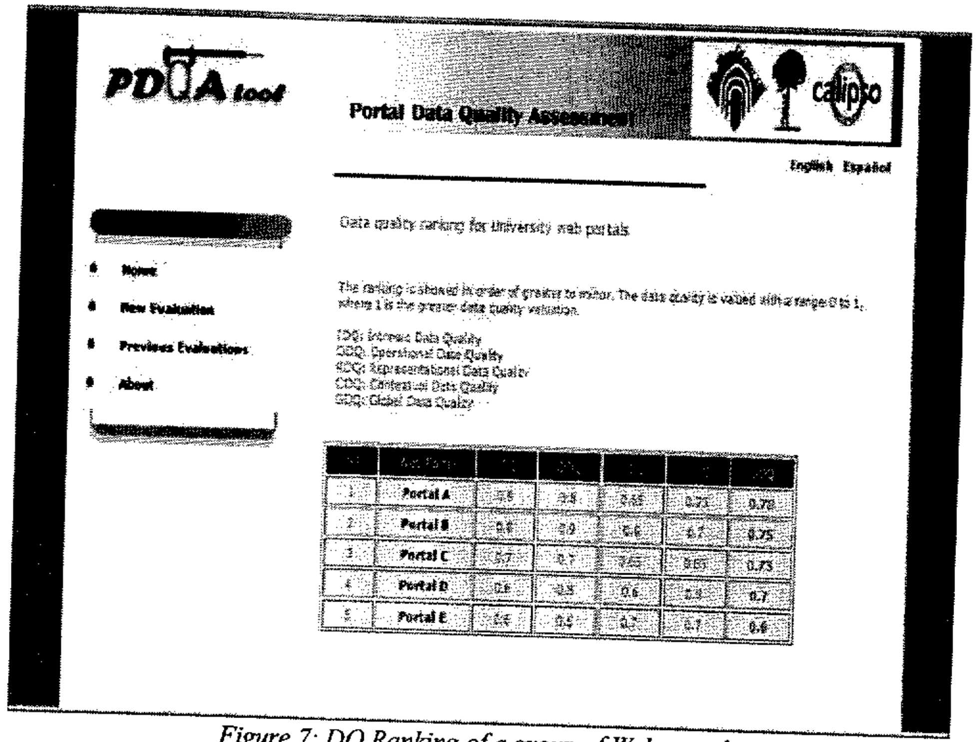

Figure 7: DQ Ranking of a group of Web portals

6. Conclusions

Nowadays, numerous users worldwide make use of Web portals to seek information for their work and to help with decision making. These users, or data consumers, need to ensure that the data obtained are appropriate to their needs. In recent years, several research projects have been conducted on the topic of Web Data Quality. However, there is still a lack of specific proposals for the data quality of Web portals and that which considers the data consumer's point of view. In this work we introduced the PDQA tool which assesses the DQ in Web portals based on a data quality model called PDQM.

PDQM is a data quality model for Web portals composed of 33 DQ attributes grouped into four DQ categories. The method defined to evaluate the DQ is based on the use of a Bayesian network. This BN allows us to adjust the DQ model according to the Web portal domain. The model can also be applied to the assessment of the DQ global in a Web portal or can simply be used to assess the DQ in a specific DQ category.

Together with the BN, the method is accompanied by various measures that are used to calculate a set of indicators that generate input values for the BN. To develop this automatic DQ assessment we have built the PDQA. The first version of the PDQA implements the DQ evaluation for the DQ Representational category. As we mentioned previously we are still working on the refinement of the model and on the depuration of the values obtained for the indicators. So, at this moment PDQA is a prototype but as soon as it will be ready we plan to make it public in www.webportalquality.com.

The main functionalities of the PDQA are: for a given Web portal the level of DQ representational is calculated and for a specific Web portal domain it shows the data quality ranking for the Web portals evaluated.

Our future work is to extent the tool to the whole PDQM. That is, we will implement the measures for the rest of the DQ categories in the model. As a consequence of this, the tool will offer the users all the categories for evaluation or for the evaluation of the global DQ. Another task for the future is the adaptation of the BN to other Web portal domains, with the aim of developing evaluations which are better suited to specific domains.

7. Acknowledgments

This research is part of the following projects: ESFINGE (TIC2006-15175-C05-05) granted by the Dirección General de Investigación del Ministerio de Ciencia y Tecnología (Spain), CALIPSO (TIN20005-24055-E) supported by the Ministerio de Educación y Ciencia (Spain), DIMENSIONS (PBC-05-012-1) supported by FEDER and by the "Consejería de Educación y Ciencia, Junta de Comunidades de Castilla-La Mancha" (Spain) and COMPETISOFT (506PI0287) financed by CYTED.

8. References

[1] C. Cappiello, C. Francalanci, and B. Pernici. Data quality assessment from the user's perspective. in International Workshop on Information Quality in Information Systems, (IQIS2004). 2004. Paris, Francia: ACM.

[2] A. Caro, C. Calero, I. Caballero, and M. Piattini, A Theoretical Model for Portal Data Quality Data Consumer Oriented. Data & Knowledge Engineering. Sent for publishing., 2007.

[3] M. Eppler, Managing Information Quality: Increasing the Value of Information in Knowledge-intensive Products and Processes. 2003: Springer.

[4] J. Pearl, Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference. 1988: Morgan Kaufmann.

[5] D. Strong, Y. Lee, and R. Wang, Data Quality in Context. Communications of the ACM, 1997. Vol. 40, Nº 5: p. 103 -110.

[6] L. Xiao and S. Dasgupta, User Satisfaction with Web Portals: An empirical Study, in In Web Systems Design and Online Consumer Behavior, Y. Gao, Editor. 2005, Idea Group Publishing, Hershey, PA. p. 193-205.

[7] Z. Yang, S. Cai, Z. Zhou, and N. Zhou, Development and validation of an instrument to measure user perceived service quality of information presenting Web portals. Information and Management. Elsevier Science, 2004. 42: p. 575-589.

A framework for semi-automated measurement of a software factory productivity

Andrea Bei, Fabio Rabini, Giovanni Ricciolio

Abstract

Software development productivity measurement is a classic software engineering topic. In a software factory, the knowledge of the value of productivity plays a main role both for the measurement of the efficiency of the development process and for the cost estimation of new projects.

The practical feasibility of the measurement process is affected by several factors, such as cost and time needed to perform the measurement, and the repeatability of the measurement in different phases of software lifecycle.

For a software project, productivity can be calculated as the ratio of the functional size of the system under construction to the effort spent on it.

For functional size measurement, a rigorous IFPUG approach is suitable but often too expensive in terms of time and cost, and difficult to apply when software is incomplete.

On the other hand, for effort measurement, it is necessary to track and update effort spent on every project. Therefore, it can be very useful to have an inexpensive, frequently repeatable measurement process which is at least partially automated.

In this paper we describe a framework for the semi-automated measurement of productivity. In our framework every project is related to a specific category depending on environmental and project features.

Measuring software size in FP (function point) can be performed by "use case" completed or, in case they are not available or not accurately detailed, by SLOC (Statement Lines of Code). In the latter case FP is evaluated as the ratio of the total number of SLOC to a specific "Gearing Factor". Gearing factors are periodically updated by means of exact IFPUG measurement performed on completed projects which are significant with respect to their categories. In the measurement process, this kind of feedback acts as "accuracy injection", making measurement error smaller than the one typically introduced by SLOC-based method like "backfiring".

From a design point of view, the adoption of a plug-in architecture and the "inversion of control" pattern facilitates reuse and independence from feeding information system: Configuration Management System, Requirements Management System and Project & Portfolio Management System.

From a functional point of view, the framework provides different reports by means of an open source business intelligence system (www.pentaho.org) and effort estimation using linear regression analysis (Effort vs. FP).

This framework has been designed for Enterprise Digital Architects software factory.

1. Introduction

In the last few years IT market has grown very fast, generating increased competition between software service and application providers. Today all the IT departments involved in software