

# PTSM: A PORTLET SELECTION MODEL

M<sup>a</sup> Ángeles Moraga, Coral Calero and Mario Piattini

*Alarcos Research Group. UCLM-SOLUZIONA Research and Development Institute  
University of Castilla-La Mancha, Paseo de la Universidad,4 Ciudad Real, Spain*

Oscar Díaz

*ONEKIN Research Group, University of the Basque Country, San Sebastián, Spain*

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**Abstract:** The use of Web portals continues to rise, showing their importance in the current information society. The success of a portal depends on customers using and returning to it. Nowadays, it is very easy for users to change from one portal to another, so improving/assessing portal quality is a must. Hence, appropriate quality model should be available to measure and drive portal development. Specifically, this work focuses on portlet-based portals. Portlets are web components, and they can be thought as COTS but in a Web setting. This paper presents a portlet selection model that guides the portal developer in choosing the best portlet, among a set of portlets with similar functions for specified tasks and user objectives, in accordance to five quality measures, namely, functionality, reliability, usability, efficiency and reusability, and other three characteristics not related to the quality but important to carry out the selection.

## 1 INTRODUCTION

A portal provides a solution for aggregating content and application from various systems for presentation to the end user. Users do not need to know how the content or functionality is provided (Linwood and Minter, 2004).

Due to this complexity, vendors of portal frameworks strive to bring component-based development to the Web: the portlets. Portlets are used by portals as pluggable user interface components (Java Community Process, 2003). In such a way, a portlet can be seen as a mixture of software components and web applications.

So far however, portlets could not be reused by different portals since they did not use the same API; and the lack of a common model prevents portlet interoperability. However, the delivery of the Web Services for Remote Portlets (WSRP) specification overcomes this problem, and opens the possibility of a COST-like market for portlets (OASIS, 2005).

This raises the need for quality models that guide the user to ascertain the appropriate portlet. Therefore, if we want a “good” portal (with a good level of quality), we must select the most appropriated portlets for constructing it. In spite of

the existence of different quality models for software web and components, a specific model for portlets has not been developed yet.

The objective of this paper is to present a portlet selection model (PtSM) which is composed by a set of characteristics that must be taken into account when selecting a portlet. In concrete, PtSM is composed of two different kinds of characteristics. On the one hand those characteristics based on the quality of a portlet (considered as a software product that combines characteristics of software components and characteristics of web applications), which are unified under a quality model, namely PtQM (Portlet Quality Model). On the other hand, PtSM will use other characteristics not related to the portlet quality as such but are fundamental in order to select the best portlet.

This paper is structured as follows. Section 2 specifies the portlets characteristics. Section 3 explains how to use the selection model of a portlet (PtSM). Section 4 shows some related works. Section 5 identifies the quality characteristics for portlets whereas section 6 identifies the other portlets characteristics used for the selection of portlets. Finally, last section summarizes this paper and outlines the main areas of future work.

## 2 PORTLET CHARACTERISTICS

First generation portals tended to present a monolithic software architecture that compromised portal development and management, but second-generation portals let users create one or more personal pages composed of personalizable portlets - interactive Web mini-applications, local or remote to the portal that render markup fragments (news, weather, sports, and so on) that the portal can aggregate into a page (Bellás, 2004).

Until recently, the main problem related to portlets was the lack of a common model which hindered portlet interoperability. Nevertheless, WSRP (OASIS, 2005) overcomes this deficiency by defining a common interface. The main goal of this standard is to enable an application designer or administrator to pick from a rich choice of compliant remote content and application providers, and integrate them with just a few mouse clicks and no programming effort (OASIS, 2005).

Therefore, portlets are independent and reusable Web components which offer a specific functionality and provide markup fragments ready to be rendered. An example of a portlet can be a mini-application whose objective is to provide the cheapest books of the market. The portlet is aggregated into the portal web page where the rendering space available depends on the so-called window state. In particular, WSRP standard identifies five window states: *normal* indicates the portlet probably shares the portal page with more portlets; *minimized* the portlet should not render any visible markup although can include non-visible data; *maximized* indicates the portlet is probably the only one that is being rendered or that this portlet has more space; *solo* indicates that the portal page only has this portlet; *custom* is useful for consumers because they can declare custom window states.

In addition, portlets render different content depending on its mode. WSRP defines five modes: *the view* mode renders markup reflecting the current state of the portlet; *the edit* mode provides content and logic that let a user customize the behavior of the portlet; *the help* mode provides help screens that explains the portlet and its expected usage; *the preview* mode provides a rendering of its standard view mode content, as a visual sample of how this portlet will appear on the end-user's page with the current configuration; *the custom* mode provides a field for consumers to declare additional custom modes (OASIS, 2005).

Next items summarize the main portlet features for the purpose of this paper.

*Portlets provide functionality:* they are individual components that provide content for a portal (Linwood and Minter, 2004).

*Portlets are reusable:* they are portal components that can be shared and exchanged by various portlet containers to provide enhanced functionality (Novotny et al., 2004).

*Portlets must be usable components:* they can be subject by composition by third parties, so they need clear interfaces and configurability (Diaz and Rodriguez, 2004).

*The portlet efficiency must be acceptable:* they have to provide an acceptable efficiency in order to be aggregated to the portal page.

*Portlets must be reliable:* they must be capable to manage the different faults that can arise during its operation.

## 3 PORTLET SELECTION MODEL - PTSM

We aim at providing a portlet selection model (PtSM) based on both a portlet quality model and a set of characteristics not related to the portlet quality as such. The use of the selection model is outlined in figure 1. Specifically, the PtSM must be used in order to carry out the assessment of a set of portlets which have similar functions for specified tasks and user objectives. As a result, the values of the different characteristics that make up the model must be estimated for each portlet. Then, taking into account the users' needs, the best portlet among the evaluated is chosen. As a final result, the best portlet for each case is obtained.

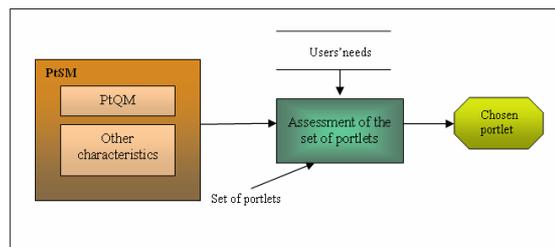


Figure 1: Use of the Portlet Selection Model (PtSM).

The beneficiaries of the portlet selection model, are portal administrators – the ones who must choose the most appropriate portlet for building the portal.

The characteristics of PtSM, can be split into quality characteristics (these characteristics constitute PtQM) and other characteristics.

## 4 RELATED WORK

Portlets sit in between Web applications and Software Components and then PtQM is built upon three main sources: the ISO/IEC 9126 standard, quality models for components and quality models for Web applications. Figure 2 describes the major influences.

The ISO/IEC 9126 standard has come into existence by the necessity of developing or selecting high quality software products. This standard seeks to define a quality model which specifies and evaluates software product quality from different perspectives: developers, acquirers, quality assurance staff and independent evaluator.

Specifically, the model for software product quality identifies six quality characteristics for internal and external quality (functionality, reliability, usability, efficiency, maintainability and portability) which are decomposed into other sub-characteristics.

There are other proposals which can be used as basis to develop our portlet quality model.

Some examples of quality models proposed for components are the following.

(Botella et al., 2003) propose a quality model for the selection of Enterprise Resource Planning (ERP) Systems. (Bertoa and Vallecillo, 2002) present a quality model for commercial off-the-shelf (COTS) components. (Simão and Belchior, 2003) identify the quality characteristics and sub-characteristics most relevant for software components. (Franch and Carvalho, 2003) propose a methodology for building structured quality models based on ISO/IEC 9126.

An example of a quality model proposed for web applications is the web quality model, namely WQM and developed by (Calero et al., 2004). Also, (Offutt, 2002) identifies different quality attributes for web software applications.

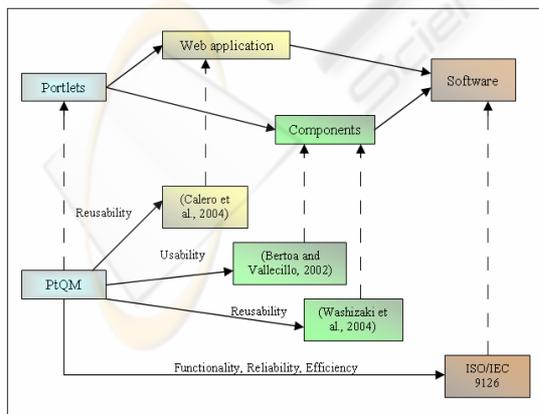


Figure 2: Portlet Quality Model: major influences.

## 5 QUALITY CHARACTERISTICS FOR PORTLETS

In concrete, the quality characteristics have been split up into three groups: the first one is made up of the quality characteristics that have been adapted from ISO/IEC 9126 standard, the second is composed of the quality characteristics that have been adapted from quality models for components, and finally, the last group is made up of characteristics that have been considered from quality models for web applications. It may be worth emphasizing that each quality characteristic, which has been considered for portlets, is directly related to some of the portlet characteristics identified in section two.

We must realize that there are some characteristics from ISO/IEC 9126 standard that do not make sense for portlets due to the own nature of them. Concretely:

- Maintainability quality characteristic has not been considered because the tasks related to the maintenance of software must not be done by the portal developer.
- Portability quality characteristic has not been considered as a characteristic on its own but a sub-characteristic of reusability. The rationales are twofold. First portlet reusability implies to understand what the portlet is about. And second, the portlet must be liable of being transferred from one environment to another (i.e. must be portable).

Furthermore, the reusability quality characteristic has been included because it is fundamental that portlets can be reused from one environment to another without problems.

In table 1 the definition of each characteristic of PtQM is presented.

Table 1: Quality characteristics definitions for portlet context.

| Characteristic | Definition  |
|----------------|---|
| Functionality  | Capability of the portlet to provide functions which meet stated and implied needs when the software is used under specified conditions |
| Reliability    | Capability of the portlet to maintain a specified level of performance when used under specified conditions                             |
| Usability      | Ability of the portlet to be used by the portal developer when constructing a portal with it.   |
| Efficiency     | Capability of the portlet to provide appropriate performance, relative to the amount of resources used, under stated conditions.        |
| Reusability    | Capability of the portlet to be reused in different portals by several developers   |

## 5.1 Quality Subcharacteristics

This sub-section is concerned with obtaining the sub-characteristics that affect each one of the quality

characteristics previously identified. Table 2 outlines these sub-characteristics, and their sources (i.e. the work from which the sub-characteristic has been adapted). More information about the reusability characteristics can be found in (Moraga et al., 2005).

Table 2: Quality characteristics definitions for portlet context.

| Characteristic | Sub-characteristic   | Definition for portlet context  | Original source  |              |
|----------------|----------------------|---|--|--------------|
| Functionality  | Accuracy             | Capability of the portlet to provide the right or agreed results or effects with the degree of precision accorded.  | ISO/IEC 9126   |              |
|                | Interoperability     | Interoperability with the portal  | Capability of the portlet to interact with one or more portals | ISO/IEC 9126 |
|                |                      | Interoperability with other portlets  | Capability of the portlet to interact with other portlets      |              |
|                | Security             | Ability of the portlet to prevent unauthorized access, whether accidental or deliberate, to information and data.   | (Calero et al., 2004)  |              |
|                | Self-Containment     | Capability of the portlet to accomplish by itself alone the function that it is expected to perform   | (Simão and Belchior, 2003)                                     |              |
|                | Functional-Cohesion  | Capability of the portlet to make use of all its elements in performing its services.   | (Simão and Belchior, 2003)                                     |              |
|                | Compliance           | Capability of the portlet to adhere to standards, conventions or regulations in laws and prescriptions relating to functionality.   | ISO/IEC 9126   |              |
| Reliability    | Maturity             | Capability of the portlet to avoid failure as a result of faults.   | ISO/IEC 9126   |              |
|                | Fault tolerance      | Capability of the portlet to maintain a specified level of performance in cases of software faults or of infringement of its specified interface.                                       | ISO/IEC 9126   |              |
|                | Recoverability       | Capability of the portlet to recover itself from unexpected failures.   | (Bertoa, Vallecillo, 2002)                                     |              |
|                | Degradability        | Effort needed to re-establish the essential functionality of the portlet after a breakdown.   | (Calero et al., 2004)  |              |
|                | Evaluability         | Capability of the portlet to enable the portal developers to evaluate its form and/or its content   | (Simão and Belchior, 2003)                                     |              |
|                | Availability         | Capability of the portlet to be operational every day of the year   | (Offut, 2002)  |              |
|                | Compliance           | Capability of the portlet to adhere to standards, conventions or regulations in laws and prescriptions relating to reliability.   | ISO/IEC 9126   |              |
| Usability      | Understandability    | Capability of the portlet to enable the portal administrator to understand what the portlet is about  | ISO/IEC 9126   |              |
|                | Learnability         | Capability of the portlet to enable the user to learn how the portlet achieves its aim  | ISO/IEC 9126   |              |
|                | Customizability      | It refers to the attributes of portlet that enable the portlet to be customized by the user, to reduce the effort required to use it and also to increase satisfaction with the portlet | (Calero et al., 2004)  |              |
|                | Compliance           | Capability of the portlet to adhere to standards, conventions or regulations in laws and similar prescriptions relating to usability.   | ISO/IEC 9126   |              |
| Efficiency     | Time behaviour       | Capability of the portlet to provide appropriate response and processing times when performing its function, under stated conditions.   | ISO/IEC 9126   |              |
|                | Resource utilisation | Capability of the portlet to use appropriate amounts and types of resources when the portlet performs its function under stated conditions.   | ISO/IEC 9126   |              |
|                | Compliance           | Capability of the portlet to adhere to standards, conventions or regulations in laws and similar prescriptions relating to efficiency.  | ISO/IEC 9126   |              |
| Reusability    | Understandability    | Capability of the portlet to enable the user to understand what the portlet is about  | (Calero et al., 2004)  |              |
|                | Portability          | Capability of the portlet to be transferred from one environment to another.  | (Washizaki et al. 2004)  |              |

## 6 OTHER CHARACTERISTICS FOR PORTLET SELECTION

In addition to the quality characteristics previously identified we think that exist other set of characteristics which affect when selecting a portlet. For example, we must consider the characteristics that affect a portlet as a product that must be bought and aggregated to our software and the reputation or profile of the provider.

Specifically, in order to determine the set of characteristics and sub-characteristics, not directly related to quality, several standards exist. These standards can be split up into two groups: standards targeted at components and standards targeted at software product. In figure 3, the influence of these standards is shown.

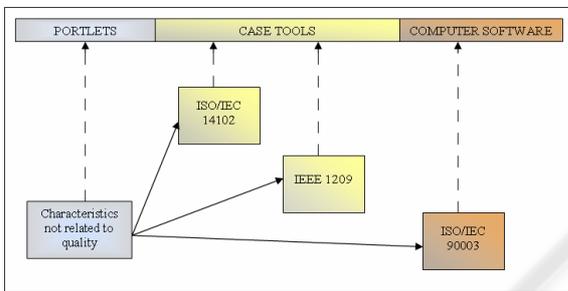


Figure 3: Standards analyzed to obtain characteristics and sub-characteristics not directly related to quality.

ISO/IEC 14102 and IEEE 1209 are a guideline for evaluation and selection of CASE tools while ISO/IEC 90003 is a guideline for the application of ISO 9001 to computer software.

These standards enumerate different characteristics which must be considered when a tool is chosen. These characteristics have been adapted to the portlet context and gathered in three main characteristics which are composed of other sub-characteristics (see Table 3).

Table 3: Other characteristics for portlet selection.

| Characteristic        | Sub-characteristic                                   |
|-----------------------|--|
| Acquisition           | Cost   |
|                       | Licensing policies                                   |
|                       | Surveys to user groups                               |
| Indicators of support | Portlet vendor profile                               |
|                       | Portlet profile                                      |
|                       | Information related to the installation              |
|                       | Portlet vendor support                               |
| Compliance            | Feedback of the client to deal with their complaints |
|                       | Portlet vendor certification                         |

The **acquisition** characteristic accounts for purchase and usage, and includes the following sub-characteristics.

*Cost*: the cost can be derived from the portlet purchasing or renting.

*Licensing policies*: it refers to the available license options, the right to copy (media and documentation), and any restrictions and/or fees for secondary usage (because of the fact that portlets can use other elements to carry out its functionality).

*Surveys to user groups*: the opinion that portlet's users have about it can be a good or bad influence on the decision to choose the portlet or not.

The **indicator of support** characteristic is related to the support that the portlet vendor provides, as well as, the profile of both the portlet vendor and the portlet itself. This characteristic is composed of the following subcharacteristics.

*Portlet vendor profile*: it is a general indication of the portlet vendor's overall capability. This profile might include the portlet vendor's size, number of years in business, a financial statement, a listing of any complementary products, identification of relevant business relationships (for example, other tool suppliers), and the company's planned direction for future development.

*Portlet profile*: general information about the portlet including portlet age, number of paid installations, existence, size and level of activity of a user's group, formal problem reporting system, portlet development program, body of applications, freedom from error, and availability (i.e. commercial, government public domain, in-house, or under development).

*Information related to the installation*: documentation related to the portlet installation. This information is useful if the portlet is locally run.

*Feedback of the client to deal with their complaints*: the portlet vendor provides some mechanism to help users to process their complaints.

*Portlet vendor support*: availability, responsiveness, and quality of services provided by the vendor to portlet users. Such support services might include telephone support, local technical support and on-site support.

Finally, the **compliance** characteristic alludes to the certifications that the portlet vendor owns. This characteristic includes the sub-characteristic *Portlet vendor certification*: certification from a professionally recognized software engineering evaluation organization (for example, the Software Engineering Institute, the ISO) that shows that the software engineering practices of the portlet vendor meet some minimum level, or are at some defined level. Certification may be informal, for example by reviewing vendor-supplied quality/defect data.

## 7 CONCLUSIONS AND FUTURE WORK

We have presented a portlet selection model, namely PtSM, to be used to choose the “most appropriate” portlet among a set of portlets with similar functions for specified tasks and user objectives. This model uses a quality model (PtQM) which integrates and adapts to the portlet case, models proposed for Web applications, Software components and Software products. The outcome is shown in figure 4.

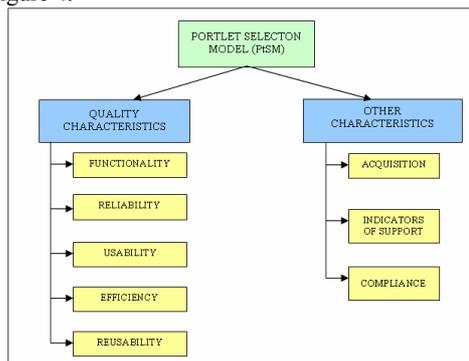


Figure 4: Portlet Selection Model.

The next step will be to identify measures for each one of the characteristics and sub-characteristics. To date, we have identified the measures which affect reusability characteristic (Moraga et al., 2005). A similar reasoning should be used to obtain the measures that affect the rest of characteristics.

Future work also includes the validation of the model characteristics through surveys. Thereby, the PtSM for portlets will be finished.

The final goal is to have a well-defined model that facilitates portlet selection as well as identify possible improvements in the characteristics based on the values of the measures of a given portlet in order to assure that it will be selected when compared with others.

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