A Non-functional Framework for Assessing Organizations in Collaborative Networks

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Abstract The French project OpenPaaS aims to support collaborative process by first deducing the process from the collaboration objectives and then orchestrating it. In order to design the process, a functional matching is established in order to find which sets of organizations are able to fulfil the objectives. Then a non-functional selection has to be executed in order to find the "best" process, with the most adapted partners. This paper presents a framework that has been settled for evaluating the organizations through non-functional criteria. Based on various cases of partner selection, this framework is intended to be the most exhaustive possible: it should allow the system to evaluate organization as a human would do in the case of a request for proposal. A structure of framework is first proposed, that fits with the OpenPaaS utilization. Then, non-functional criteria are classified according to it.

Keywords Non-functional criteria · Quality · Collaborative process · Partner selection

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1 Introduction

The OpenPaaS project aims to support collaborative relationships between organizations. When an organization proposes a new collaboration opportunity the system proposes a set of partners and corresponding processes, which means that it can deduce the sequence of activities to execute in order to fulfil the objectives and the actor of each activity. Then the platform orchestrates the process and continues to support the collaboration during the run time.

In order to select partners among the organizations, there are two global steps: (i) which organizations have the required capacities, (ii) which organizations to select in order to obtain the 'best' process. This second question implies the assessment of the processes based on non-functional criteria.

The partner selection in virtual enterprise environments has been widely discussed in the literature and cost, delivery time and quality are the most often used criteria in such a problematic. However this triptych is neither adapted to specific collaborative contexts nor representative of the human reasoning when it comes to choose the ideal partner.

Based on a literature review this article proposes a new referential of non-functional factors that allows a broker to better specify its expectations concerning the collaborative context and the quality of the final service or product. Concretely these factors will appear on each organization profile that will help to characterize its business and will be visible by any other organization.

2 Proposal of a Three Dimensional Framework

2.1 Three Ways to Inform the Non-functional Criteria

The first thing to care about is how the criteria should be informed. It is indeed important for the broker to know measurable criteria values as costs or delivery time, but the fuzzy term of quality is a subjective judgement that is rather informed by the customers of an organization. Three ways to attribute values to non-functional factors are finally highlighted:

- (a in Fig. 1): The organization gives the criteria value on its own profile.
- (b in Fig. 1): An actual or former partner shares its working experience with the organization and therefore gives value to the criteria.
- (c in Fig. 1): The system automatically measures or calculates values and displays them on the organization profile (considering the fact that it supports the collaboration in design time, i.e. when the process is deduced, as well as in run time, i.e. when the process is orchestrated).

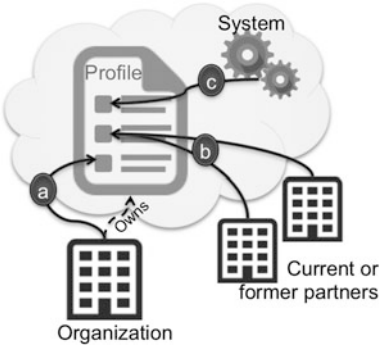

Fig. 1 Three ways to inform non-functional criteria

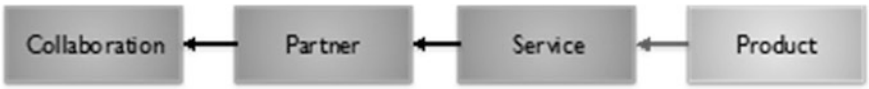

Fig. 2 Inheritance levels

2.2 Inheritance Levels

The criteria can be defined on four levels: the collaboration, a partner, a service or a product. As the OpenPaaS platform aims to support collaborations, it is important that partners share the same collaborative constraints that are frequently provided by an agreement. Thus an inheritance of the non-functional criteria is established. On each level, each individual partner inherits from the previous level which means that if a criteria is required for the collaboration, it is a fortiori for each partner too. Then, partners provide either a service or a product, but a product obviously comes with a linked service (for example the payment or the delivery). Consequently the eventual product level inherits from the service level which inherits from the partner (Fig. 2).

2.3 Non Functional Categories

The literature provides frameworks that aim to assess the quality of any work provided by an organization to a customer i.e. either a service or a product.

The service oriented SERVQUAL referential [1] is based on data gathered from enterprises and defines the service quality through five dimensions established on subjective trust from the customer as well as on technical skills reliability: Tangibles, Reliability, Responsiveness, Assurance, Empathy.

Garvin [2] tries to answer to the question: "what is quality for a product?" As product quality can be seen through a high cost, it can also be seen just through its characteristics and attributes or it can be a correlation between the performance of the product and an acceptable cost. Garvin's objective is to aggregate all the different definitions of quality in order to establish a global framework for better understanding the main element of quality. The author has based the framework on eight dimensions: Performance, Features, Reliability, Conformance, Durability, Serviceability, Aesthetics, Perceived quality.

To these 13 axes of study about quality, Hansen and Bush [3] add one more dimension: cooperativeness.

Table 1 brings a summary of all these dimensions and a definition of them. A correlation between some of them seems to be intuitively done, that is why they appear to be gathered in the table. Note that the term of reliability has been taken from the SERVQUAL framework and the definition of this term given by Garvin has rather been used for a criteria definition (cf. Fig. 4).

The six emerging categories that are expressed as I to VI in the remainder of the article are the categories we chose to classify the non-functional criteria.

3 Classification of Relevant Criteria for the Openpaas Project According to the Proposed Framework

3.1 Six Ways to Select Partners Based on Non-functional Criteria

In order to define non-functional criteria, the literature review has been oriented towards the usual factors for selecting partners in various contexts.

3.1.1 OASIS Standard

OASIS (Organization for the Advancement of Structured Information Standards) is a worldwide consortium whose role is to work on the standardization of formats. The WSQF (Web Services Quality Factors) Standard [4] aims to establish the functional and non-functional factors that define the quality of a web service. This standard is particularly relevant since it is commonly used in the selection of web services when orchestrating a process, for example [5].

The Fig. 3 illustrates the structure of the quality factors. As the web service can be considered as a very technical level of the collaboration, the factors are not oriented towards a "business" level as it is the case in this paper. However two groups seem to be relevant in the OpenPaaS case: the Business Quality Group and the Variant Quality Group. Most of the criteria of these groups have been kept and redefined to fit a "business" level.

Table 1 Definition of Garvin, Parasuraman et al. and Hansen and Bush dimensions

	Criterion	Parasuraman et al. [1]	Garvin [2]	Hansen and Bush [3]
I	Tangibles	"Physical facilities, equipment, and appearance of personnel"		
II	1. Reliability	(SERVQUAL)	1. "Ability to perform the promised service dependably and accurately"	
2.		Assurance	2. "Knowledge and courtesy of employees and their ability to inspire trust and confidence"	
III	1.	Responsiveness	1. "Willingness to help customers and provide prompt service"	3. "Speed, courtesy, and competence of repair"
		2. Empathy	2. "Caring, individualized attention the firm provides its customers"	
3.		Serviceability		
IV	1. Performance		1. "Primary operating characteristics of a product"	
	2.		Characteristics	
2.	"Secondary	characteristics that supplement the procust's basic functioning"		
V	1. Aesthetics		1. "How a product looks, feels, sounds, tastes, or smells"	
	2. Conformance		2. "Degree to which a products' design and operating characteristics match pre-established standards"	
	3. Perceived quality		3. "evaluation of the product depending on its image, advertising, or brand name"	
VI	Cooperativeness			Services or special efforts that a supplier could concede to a customer

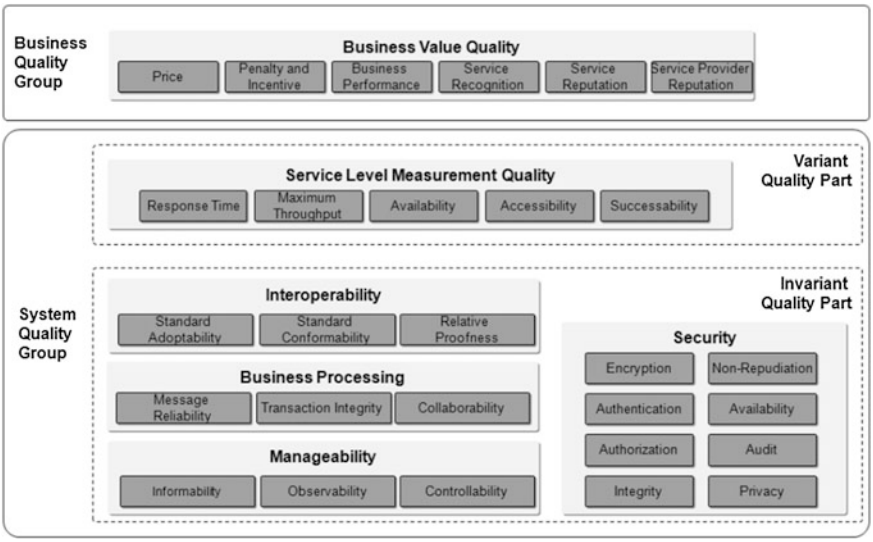

Fig. 3 Structure of web services quality factors, [4]

3.1.2 Web Service Selection Through Non-functional Features

Badr et al. [6] proposes a classification for an ontology that aims to allow web service selection through non-functional properties. It is divided into two parts corresponding to the properties of the context and of the Quality of Service (QoS). Most of the criteria are the same as the OASIS previous standard, but some are new: the *location*, the *payment method* and a last concept of *organization agreements* which allows to detect preferences of partnerships for the organization—based on the current and previous collaborations.

3.1.3 NFR (Non-functional Requirements) in the Software Engineering

In Roman and Boehm et al. research [7, 8] the authors have worked on NFR frameworks applied to the software engineering problematics. Among many others, the following criteria can be found: *performance requirements*, *economic requirements*, *functionality*, *usability* or *efficiency*. However, these NFR are rather oriented towards their specific application. Following the example of the OASIS Standard, the definitions of the NFR can not be used as they are, but must be adapted to the more generic context of OpenPaaS.

	I	II	III	IV	V	VI
Collaboration						
Own profile		*Penalty/ incentive *Confidentiality				
Partner						
Own profile			*Quick on short notice delivery			*Shipping arrangements *Just in time delivery offered *Credit terms offered *Long term price agreements *Payment methods
Partner profile		*On time delivery *Accuracy of system billing	*Reputation *Contact *Rapidly responding & solving the problem *Eagerness to meet the needs			*Ability to understand special orders
Automatically						*Organizations agreements
Service						
Own profile	*Equipment			*Price *Total costs *Delivery lead time		*Authorization *Location
Partner profile			*Knowledge/ expertise assessment		*Reliability (Garvin)	*Agility
Product						
Own profile		*Large/ small orders capacity		*Product technical characteristics *Cost of ownership *Guaranteed life		*Product availability
Partner profile					*Expected quality *Real cost of ownership *Expected life	

Fig. 4 Classification of the selected non functional criteria

3.1.4 Supplier Selection Criteria

Davidrajuh and Deng [9] propose three criteria to constitute the basis when selecting suppliers:

- *Agility*: ability of the organization to react quickly and efficiently to the unexpected.
- *Quality*: the partner should be at least ISO certified and with the possibility to make audits.
- *Leanness*: set of the effective costs of the supplier.

3.1.5 Multiple Criteria Method to Evaluate Suppliers

Xia and Wu propose [10] a way to select suppliers using both qualitative and quantitative criteria. The authors divide the supplier evaluation into three parts, which eventually contain sub-criteria:

- *Price.*
- *Quality*: the *technical* quality of the products, their *defects* and their *reliability.*
- *Service*: the services the supplier is able to provide concerning its products, e.g. *on-time delivery*, *supply capacity*, *repair turnround time* and *warranty period*.

3.1.6 Use Case of a Supplier Selection in the Industry of Wood

Hansen and Bush [3] base their research on a survey they conducted among organizations of the industrial area. They finally obtain a set of 80 criteria classified according to the SERVQUAL and Garvin's dimensions. As the use-case is oriented towards wood purchasing, the framework is rather product-oriented. However it can easily be adapted to our three dimensional framework previously proposed since it does not only take into account the product but also its acquisition and the customer/supplier relationships. *Most of the criteria that are not specific to the field of the use-case have been kept*.

3.2 Selection of Non functional Criteria

Based on all these six ways to select partners, a set of the most relevant has been established and then classified according to the three dimensional framework proposed in the 1.2 part. The Fig. 4 finally summarize the entire paper by illustrating the set of criteria on the framework.

1. Collaboration
   - *Penalty/Incentive*: Financial penalty or incentives to be contractualized and measured on run time.
   - *Confidentiality*: Each partner signs a confidentiality agreement.
2. Partner
   - *Reputation*: Reputation of the service provider.
   - *Payment methods*: Accepted methods of payment.
   - *Organizations agreements*: Preferences and history (ongoing partnerships).
   - *Accuracy of billing system*: Accuracy if the organizations billing system, from the point of view of the partners: was there mistakes? (can lead to serious business issues).
   - *On time delivery*: Has the product or the service been delivered on time?

- *Quick on short notice delivery*: Is the organization efficient enough to deliver on short notice
- *Eagerness to meet the needs*: Eagerness of the organization to understand and answer correctly to the partner's needs.
- *Rapidly responding & solving the problems*: Is the organization able to respond rapidly to partner's problem?
- *Contact*: General assessment of the relationship between the partner and the organization.
- *Ability to understand special orders:* Efficiency of the enterprise to respond to special/exceptional order.
- *Shipping arrangement*: Ability to offer shipping arrangement to the partner.
- *Credit terms offered*: Does the organization accept credit? What are the terms?
- *Long-term price agreements offered*: Being recognized as regular customer. Long term business relationship arrangement.
- *Just in time (JIT) delivery offered*: Capacity/ability/coordination of the organizations to deliver products JIT.

3. Service

- *Price*: Estimated price of the service.
- *Delivery lead time (business performance):* Estimated time to complete the order.
- *Authorization:* Accessibility to the available capacities. (i) Monitoring: Ask for the advancement, anytime. (ii) Observability: subscribe to advancement notifications.
- *Location:* Execution location.
- *Agility:* Ability to react quickly and effectively to a sudden situation.
- *Total cost:* Every effective cost.
- *Equipment:* Equipment used to execute the activity.
- *Knowledge/expertise assessment*: Professionalism of the organization.
- *Reliability:* Does the service conform to the expected and guaranteed accuracy and capacities?

4. Product

- *Large/small orders*: Capacity of the expected: willingness to respond to small orders, capacity to respond to large.
- *Product technical characteristics*.
- *Guaranteed life*: Claimed life.
- *Cost of ownership:* Claimed costs of use.
- *Product availability:* Current availability.
- *Expected Quality*: Does the product conform to the expectations (outwardly & on use)?
- *Expected life*: Does the product conforms to the guaranteed expected life?
- *Real Costs of Ownership:* What does effectively cost the product on use?

4 Conclusion

To conclude, this paper proposes a new non-functional framework for selecting a partner in the case of a request for proposal. This framework aims to be as exhaustive as possible and should be sufficient to describe any organization through the four levels: in a collaboration, as a partner and as an organization that sells service or products. The next step will consist in deducing the "best" processes, according to the expectations of the broker of the collaboration. Thus processes could be ranked for letting the broker organization make its own final choice among them. Then comes naturally a second question: how to make a smart deduction that would avoid to find all the potential processes before assessing them? These two issues will eventually lead to the establishment of a unique algorithm that will explore solutions, assess them and always go to a better one until reaching the most ideal solution.

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