A Framework for Customer-Oriented Solution Applied to the Tourism Sector

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Abstract. Tourism is a very sensitive economic sector and depends heavily on the stability of market variables such as the political and social conditions of regions, as well as terrorism threats, natural disasters, nuclear or industrial risks (pollution) and epidemics or pandemics. In times of great uncertainty and volatility in the market, when the customer quickly demands new services or products, it is essential that tourism operators use information platforms that enable and agile these new responses to the market. New models of cross-organizational business collaborations have emerged to allow the integration of companies in a consortium to rapidly seize market opportunities. Service-Oriented Computing and Cross-organizational Business Processes provide the means to create and execute dynamic business environments, meeting constantly evolving customer requirements and support for current challenges in a turbulent market. This paper describes the basis of a conceptual adaptive framework that supports a method of service selection and ranking applied to Tourism sector relying on a set of services that satisfies the customer specific requests. The framework will provide the means to engage a collaborative network of tourism partners, taking into consideration mechanisms to deal with business process constraints and the dynamic environment. In a future work, a prototype oriented to Tourism sector will be developed and implemented.

Keywords: Service-Oriented Computing · Cross-organizational Business Processes · Tourism customer-oriented solution · Tourism risks and threats

1 Introduction

The global business environment is constantly changing and has become increasingly complex. These changes are reflected in the way companies interact with customers, how business services and products are conceived, and how companies are organized and managed, according to variables and market conditions. It is assumed for all that the Tourism sector is a very sensible sector, that is highly vulnerable to the impact of the global or local threats and risks. The recent Covid-19 pandemic outbreak, natural disasters and/or terrorism attacks have posed an unprecedented threat to the global Tourism sector. Concerning the Covid-19 pandemic and according to UNWTO1,
Tourism is among the most affected industries with an overwhelming impact on the economy as well as on the social aspect, with million direct tourism jobs at risk. The current high level of uncertainty in the markets derived from all the circumstances that are occurring, the volatility of information and the speed with which the phenomena occur and the complexity of their management, oblige companies to look for flexible and agile organizational structures that can quickly respond to these challenges. In addition, tourism operators are constantly under pressure to reduce operational costs, facing increasingly shorter margins, while are committed to promote new and innovative customer-oriented solutions according to their criteria and preferences.

The new circumstances triggered by the Covid-19 forced companies to rethink the strategy and the offer of new services adapted to the new reality. Customer’s needs and requirements change quickly, according to the market offer that is widely diversified and enables the customer to choose alternatives in one click, which leads the business to adopt constant efforts to competitively improve services. Such market volatility requires business to rapidly adapt to survive, and organizations must enable the businesses’ abilities to adapt. These facts strongly emphasize the added value of the implementation of collaborative business models [1]. The spread of Information and Communication Technologies (ICT) leverages this global process and provides support for an economy format in which business tends to adopt practices for enhanced collaboration as response to new challenges. New models of cross-organizational collaborations [1, 2] have emerged in different industry sectors and allows the integration of companies in a consortium to rapidly seize market opportunities. Market products and services are nowadays composed of several nested parts [12] that may be obtained from collaborating enterprises across multiple supply-chain tiers that are geographically distributed [13]. This implies a decentralization of the business activities of an organization [14]. The product or service developing business process is distributed by the company’s consortium that share responsibilities, knowledge, skills and resources, costs and risks, and contribute with their specialist know-how by carrying out the part of the process for which they are responsible. Collaborative Network (CN) environments [3] involving a consortium of companies (partners) are suitable to effectively achieve common strategic objectives, with an expected high level of quality standards and service provision [4] in a dynamic context, with all the synergistic effects and advantages of its implementation [5]. Cross-organizational Business Processes model (CBPs) [6] cover the full scope of activities regarding a business goal. A CBP is characterized by different parts of a business process are performed by different organizations. This means that different organizations can outsource certain processes enabling those organizations to focus on their core business [7]. Strict monitoring and assessment [8] of each part of a CBP is of the utmost importance to monitor and assess the quality and performance of the service provided by each of the partners involved in the collaboration.

Despite the benefits of a CN, the challenge for partners involved in the consortium is high as they need to maintain high levels of performance within the partnership to remain part of the collaborative network and must promote innovative and complex customer-oriented solutions in dynamic services environments aligned by a common collaborative strategy. In a highly competitive market, innovative solutions are dimensioned according to customer expectations and profiles to ensure that they have
the custom functionality, the global quality, in time- and cost- effective manner, to satisfy the customer’s business service request which can range from Transportation, Accommodation, Food and Beverage to Entertainment services. To ensure these conditions for the customer, the partnership needs to agree on the alignment of a set of dashing metrics for monitoring and assessment so that the distributed business process is reliable and highly revealing of the performance behavior of each partner in the subprocess that it is responsible for. Having prior information on the performance of specific collaborative service networks, considering the customer’s criteria and preferences, allows companies to dynamically create the partners network in the most appropriate conditions to provide customers with personalized service for their specific request. This leads to a constant redefinition of the partnership schemes which implies the addition, replacement, or elimination of partners from the partnership. This approach allows the CN to offer tools to customers that allow them to customize the requested service, and to allow an accurate estimate of the results based on their expectations (e.g.: service cost and quality level estimates), which is, nowadays, of great importance to face and differentiate from the competition.

The ICT evolution allowed, in parallel, the evolution of business developing architectures that aim at responding to these new market challenges [15]. To overcome restrictions in a CN imposed by the heterogeneity, interoperability and permanent volatility of the requirements, computational architectures contemplate platforms for the construction of weakly coupled services, transparent location, and protocol-independent [14]. Service-Oriented Computing (SOC) [9–11] and CBPs provide the means to create and execute dynamic business environments, meeting constantly evolving customer requirements and support for current needs and challenges of business in this context [16, 17]. Service computing acts as a linker between CBPs and Information Technologies (IT) so that business processes can be automated using software services [18].

This paper proposes a conceptual adaptive framework that supports a method of service selection and ranking [19, 20, 24] applied to the Tourism sector relying on a set of services that satisfies the customer specific requests, considering business process constraints and the execution environment. Based on this framework, it is possible to provide customized solutions to customers to purchase services or tourism products, and to respond quickly to market variations, immediately dynamizing new offers grounded on new or different partners of the collaborative network. The rest of this paper is organized as follows. The proposed framework for Customer-oriented solutions is presented next. Related work is briefly analyzed in Sect. 3. The paper ends addressing conclusions and future work.

2 Framework Description

The proposed framework architecture is based on several components that include responses to the needs of the Tourism sector, in order to quickly manage changes in market variables such as political and social crises, terrorism attacks, natural disasters, nuclear or chemical risks, pollution, epidemics or pandemics [22]. Whenever these variables become unstable or change, it is necessary to quickly transform and/or
recreate new services or products if the information system of the tourism operator is adequate to provide these responses. The framework of this research work constitutes an approach oriented to the offer of services centered on the customer in which, the tourism product he or she intends to purchase is completely customized by the customer, guaranteeing that everything that was acquired from that collaborative network (created specifically for that request) represents the offer that best suits the request profile in the market (at that time).

2.1 Basic Framework Components

The description of the most relevant components of this framework are listed below:

- A set of four software modules to cover the following main functionalities:
  
  - Parameterization of the service or tourism product request in which the customer selects the criteria and preference levels he or she wants to obtain, which may be at the best price (defining a range of values, higher, lowest or negligible), on the appropriate date (defining a range of dates: check-in and check-out, or, in case of no availability, the framework may propose a range of dates that may suit the request profile), and with the required quality levels (depending of a scale from high to normal level quality). Multiple services or products can be part of the customer’s request so that they are interdependent (considering the service or product dependent sub-criteria). This module acts as a powerful and flexible data front-end that is continuously refined for the tourist product or service profile (according to the customer user-experience). (Basic Application Setup module).
  
  - The selection of partners that provide the services or tourist products identified by the customer, their ranking (identifying the ranking positions based on scoring algorithms with specific rules and weights assigned in the customer’s request), and the final proposal/offer to the customer, are functionalities resulting from the Core module. This module receives the customer’s request and determines the inclusion/exclusion of services from candidate partners (to form the collaborative network for the provision of the service). Each customer requests obliges to trigger a new collaborative network with the best positioned partners in terms of the ranking of the service they offer. The definition of this collaborative network is carried out in this module. The list of metrics (and respective levels of measurement) is identified and associated with each software service (so that its behavior can be measured, not only in relation to functional as well as to non-functional requirements). This module (Core) also deals with the SLAs (rights and duties of all parts) between the tourism operator and each partner in accordance with the procedures of the established contracts (electronic contracting) [23].
  
  - The Metrics Monitoring and Assessment module must evaluate the behavior of the collaborative network, partially (service to service) and globally (at the level of the whole of the collaborative network). The metrics system is defined by a structure based on a tree of dimensions and scopes (Fig. 3), and the levels at which they can be measured. This system identifies the types of metrics dealt with at each level. The data collected by the monitoring system is stored and used for future customer
requests assessments influencing the position of each service in the ranking. The Core module will use these data to process the positions of the most appropriate software services for the customer’s request enabling the application of evaluation rules (sometimes benefiting, if behavior was above expectations, sometimes penalizing, if behavior was below expectations).

- The last software module is related to the setup and instantiation of the collaborative network with the various partners responsible for the selected services, being in a higher position in the rank to respond to the specific request from the customer (Choreography Engine Setup module). The business process design is mounted with the new set of software services in a choreographic instance, where each of these services know what to do, when to do and with whom to interact [21].

- Data repository will ensure the storage of system activity with different objectives:
- Production repository (Datalog, Operational and Configurations and Setups repositories): stores all the data that allows the daily management of whole system. The data resulting from the system’s operations such as new customer requests (criteria and preferences); design and identification of partners and services that support the new instance of the business process; mapping metrics for each customer request; and the results of the services’ metrics assessments are stored in this repository.
- Knowledge repository: represents a collector of historical data that offers an analytical approach to provide knowledge of the behavior of the entire framework and thereby promote adjustments to that behavior.

2.2 Operational Flow

The sequential flow is determined by Fig. 1 and is composed by the following steps:

1. The pre-selection step (of software services) is responsible to prepare the setup of the whole system to work. Structures of meta-data based on the inter-dependencies of services or products are available for customer choice. The entire offer of tourism services and products, made available by the tourism operator, is available for personal choice and parameterization by the customer.

2. The second step is related with the identification and selection of the software services set that is going to be involved in the business process of the collaborative network. A service ranking method [24] runs over the pools where services of the same nature rely to elect the final list of the services. Based on the ranking method, these service pools support all the rules for competition between services defined by the customer’s specific request.

3. Simultaneously, the setting up of the collaborative network begins with the previous definition of generic services (still without the definitive services that are being determined in step 2) in order to align the metrics that will be the target of analysis motivated by the specific request (SLA service levels that need to be guaranteed, etc.). All the preparation for execution is conceived in this step.
4. The execution step is responsible for the global service requested by the customer is executed: the choreography of services is assembled and run, and the monitoring and assessment system is instantiated and run over the collaborative network (collecting performance data).

5. The post-execution step is related with final activities of the run. This step is responsible of the collection and analysis of data resulting from the evaluation of metrics so they can be confronted to SLA contracts done with each business partner involved in the process. A learning process starts which is fundamental to enrich the system for future interactions, based on closed life-cycles of information.

2.3 Autonomy and Control Structures

The proposal for a framework of this level has very complex outlines. Given the multiplicity of market variables in the Tourism sector, as well as the speed with which they change, forces the tourism operator to create rules to control the autonomy and performance of the system and to improve learning processes.

Regarding a complex adaptive system, to achieve and maintain a certain level of system autonomy and performance, when parameters dynamically change, an approach of adaptive control must be considered [25]. Controls such as rules and regulations allow to reduce the complexity and help the system to behave more predictably.

A closed-loop control system is used to analyse the output information as a return back to the input to level performance. The closed-loop system used is a control system in which its control action is being dependent on the output of the system. Through this system the tourism operator can adjust the behaviour of the entire framework, enabling the selection of services more or less competitive, for instance.

To allow the framework to respond continuously, improving the quality of the response to future requests, a learning process allows to influence a hierarchical structure in which the elements of the software components are addressed. These elements are divided into three levels: strategic and tactical (composed by elements that allow decisions to be defined and have the capacity to influence the behaviour of all or part of the system), and operational (software elements that are dedicated to the instantiation of the collaborative network or monitoring system, for example).

Figure 2 presents the schema that supports the learning process. There are two main blocks of elements: Decisional and Operational elements. All elements that represents strategical and tactical decisions are stored in the first block, while all the execution instance elements are stored in the second block. Continuous life-cycle systems allow feeding, adjusting, and improving the system’s behaviour, in which the tourism operator can define adjustment levels. Flows A and B represent the data that is important to improve the performance of a block of elements, and C represents the data that is important to share between blocks. In case of C - in the way of the 1st to 2nd block, Operational elements receive decisional orientations of how to instantiate the collaborative network and the monitoring system. In case of the way of the 2nd to 1st block, the feedback of the behavior of each service and of the whole instance is shared between the decisional elements for further decision analysis.
2.4 Metrics Tree Model

The metrics model definition (Fig. 3) is based on dimensions (measurement scopes) and layers (levels of the architecture) in which the respective types of metrics are addressed. The model structure is flexible, and the tourism operator may address more dimensions to be measured (e.g.: Customer; Product or Service; Technological infrastructure; Partners; etc.). The schema top defines aspects to be measured related to the business process. At an intermediate layer, the composition of services gives answers when invoked by the business process. At a lower level, metrics are applied to measure the technological infrastructure quality that supports the services composition.
Different types of measure may be addressed at each layer: Key Performance Indicators (KPI) to measure levels of the global service at business layer; Process Performance Metrics (PPM) to measure the business process in a service composition engagement; and Quality of Service (QoS) metrics to measure technical aspects related with the technological infrastructure. This flexible model proposes a 360º overview of the measurement needs of the collaborative network.

3 Related Work

One of the most important software components of this framework is the Metrics Monitoring and Assessment module, as it is this mechanism that guides the behavior of all other components with the data it collects. There are several research chains based on service monitoring and assessment in a cross-organizational setting where this research work collected groundings: Service Choreographies Monitoring [26, 27] and Service Orchestrations Monitoring [28]. Several authors are concerned about predicting, adaptation and correction of service level violations [29] which is one important issue to be consider in future work (changing a service which the potential performance may be below expectation for the next best ranked service). At this time, considering this research work, the collected data is used to measure the service performance and thereby to adapt the whole system. Other research chains are concerned with the identification of erroneous situations after they occur [30] (which is the present research case), and early detection of faults [31] (which will be useful for future work improvements).
4 Conclusions and Future Work

The dynamic environment of the globalized Tourism market, where market constraints are changing recurrently, forces tourism operators to redesign business models to better adapt to these challenges. Collaborative Networks environments provide a basis for competitiveness, world excellence, and agility in turbulent market conditions. New solutions are required according to the customer’s expectations to ensure that they have the means to satisfy tailored customer’s business service requests. This research work advances a solution in this area that allows customers to choose a tourism service or product and the level of service tailored to their criteria and preferences. The proposed conceptual framework supports a control mechanism based on closed life cycles that feed a learning process and enables a great level of customization. The definition of the metrics tree structure, as the model to be implemented by the monitoring and assessment system, identifies the dimensions or scopes of the metrics and the layers at which metrics can be addressed, enabling a 360° coverage of the whole measurement needs. The method for services selection and ranking aims to evaluate and solve a problem related to a decision making based on multiple criteria and preferences. It proposes to offer the best set of services (obtained from a competition between partners) for a given customer request to form the collaborative network.

Future work will address the development of a prototype specifically oriented to the Tourism sector to prove the concept presented in this paper. To support this prototype, the collaborative network will consist of a small number of partners but will allow to validate the main features of the framework. After the prototype is completed, the monitoring and assessment system will enable mechanisms to anticipate an imminent performance failure of a service and create an on-the-running service replacement solution. One of the future objectives is to collect the customer experiences of multi-channel (e.g.: social networks) and integrate this aspect into the framework to enrich the responses to the market. Finally, other of the next approaches is to extrapolate data generated by the system to provide analytical support to the framework.

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