Business service network design: from business model to an integrated multi-partner business transaction.

Bertrand Grégoire, Michael Schmitt,
Centre for IT Innovation (CITI),
Public Research Centre Henri Tudor,
29 Avenue John F. Kennedy
L-1885 Luxembourg-Kirchberg,
{bertrand.gregoire, michael.schmitt}@tudor.lu

Abstract

This article presents a framework to design a business service network (BSN) in-line with a given business model. Particular emphasis is on the use of industry specific standards, existing business process components and best practices. Based on a sample business model for a brokerage service in the tourism sector, a multi-partner business transaction is designed. At each stage, the various factors that guide the decision-making are discussed.

1. Introduction & motivation

Service network design refers to those activities that coordinate the flow of goods, financial resources, information and services among a network of business partners to create value for their customers. A main objective in supply chain management research is to maximize value creation and efficiency while minimizing costs. The latter involves cost-effective integration of each party's business activities, which relies on information sharing, common coordination and planning processes.

Challenges must be addressed to enable electronic business collaboration: On a conceptual level, the common planning and coordination of business activities presupposes that all parties involved have the same understanding of the business model.

On an operational level, the business processes of each partner in the supply chain must be aligned with those of its suppliers, intermediaries and customers.

While the first (conceptual) level of collaboration focuses on whether what we do is the right thing and that every actor involved understands and buys into the business idea, the second challenge is about doing things right, that is, to structure and organize the business activities of each actor in a way that we achieve our common goals.

Finding the right business process or transaction for a given business model, raises some questions as to know what are the factors that guide decision-making to prefer one to the other and which elements of the business model refer to which parts of the business process.

These questions will be discussed in section 6, based upon a sample business case introduced in section 3. The notions of business model and process model are defined respectively in the sections 2 and 4, as they build the fundament for the discussion about pattern (section 5). The use of patterns in BSN design is discussed in section 7. An algorithm for composing a service transaction based on a given business model elements is detailed in section 8.

2. Business models and risk management

To understand the business model of a BSN, or what every business partner brings in into the collaboration and expects in return. Gordijn [4] proposes in his e3-value framework an intuitive graphical representation of what he refers to as Value Objects (VO). He provides an actor-centered interpretation that details the profits one earns from one’s participation in a service network, as a first approximation, insisting on the need for reciprocal exchanges. Other approaches, as Pigneur’s Business Model Ontology (BMO, [5]), focus upon one actor and explore his own products and infrastructure requirements for meeting a particular market demand.
We should note that a business model “represents an ideal state of affairs in which actors make money by engaging in certain business transactions.”[4]. In a real world BSN, like ad-hoc and virtual service networks where the firms do not know each other well, an organization may deliver a product that does not match the requirements, or it may deliver too late or not at all.

With regards to such unfavorable outcomes, a firm or organization needs to ponder its profit goals with such considerations as risk exposure and financing. We identified in [6] a set of common business risks and propose a framework for managing them, which then leads to an ideal design for a new business transaction.

3. A tourism broker business model

The MIT process repository [1] defines a broker as follows: “a Broker facilitates sales by matching potential buyers and sellers. (He) does not take ownership of the product being sold (but) receives a fee from the buyer, the seller, or both.” This section draws up the business model of a Brokerage service in Tourism. The Tourism sector ([2]) is characterized by

- Information fragmentation. No web site has all the information necessary. Customers must in consequence browse through a large number of sites to get the full picture.
- Diverse agents. Many specialized agents exist, which makes information research a non-trivial task.
- Price diversity. Price comparison is almost impossible, unless for the big players.

A Tourism Broker may, in consequence, provide valuable services to consumers by aggregating and offering transparent and comparable travel-related information, as illustrated in Figure 1 using a simplified form of e3-value model.

There are three parties involved. The Customer contacts the Broker who matches its requirements with the service offerings of various tourism Service Providers. He receives the payment from the Customer on behalf of the Service Providers and takes care of the financial settlement. The Service Providers transfer the Broker the right to book their products and services and pay the Broker a commission (awareness fee) for the mediation of their services. Finally, the Service Provider delivers the products and services bought by the medium of the Broker to the Customer.

4. Process models

Designing integrated multi-partner business transactions in-line with the needs and goals of a series of independent business actors is becoming more and more important. The need of flexibility in today’s economy, to be able to respond to a complex customer demand in regrouping different business actors and integrating their value creation, is a key asset for business success and sustainability. In understanding the mode of operation of a BSN (the “how”) and helping business service to set up business transactions, a lot of effort has been on approaches that develop industry specific standards. Some examples are RosettaNet [10] or the more recent ISO 20022 [9]; as well as cross-industry initiatives (OAG, ebXML or UBL).

Other approaches provide methodologies rather than message templates, as the ISO Open-EDI process model, which considers a business transaction to be the whole process of order plus fulfillment [7]. They propose different stages of business collaborations such as the Planning, Identification (of suitable partners), Negotiation (of the commitments), Actualization (fulfillment), and Post-Actualization (returns, warranty service or post-sales support if applicable) phases. The first three of these are concerned with the preparation of the business activities; they end up with the conclusion of a commercial agreement. The Actualization and Post-Actualization phases refer to the operational aspects of doing business between the business partners. The transaction is not complete until all commitments are fulfilled and all claims are settled.

The UN/CEFACT conceives, in the Unified Modeling Methodology (UMM, [3]), a business collaboration as a sequence of smaller business transactions, each one of which involves exactly two parties. They identify a set of basic business transactions as communication flows and propose to combine them to build-up more complex multi-party choreographies. The “transaction” concept used in this paper refers directly to the “choreography” concept of UMM, and our work integrates the UMM communication patterns (binary collaboration) as reusable patterns. In this article, we build on these former works to provide an integrated view of the business transaction.
5. The role of patterns in BSN design

5.1. Definition of process patterns

UMM [3] defines patterns as “off-the-shelf”, ready-made business process components that can be used to implement a more high-level value-creation activity. Business process patterns simplify and prescribe reusable components in an electronic business collaboration activity; they can be used to standardize and speed up electronic business development.

5.2. The meaning of process patterns for service network design

As described in section 1, the design of a BSN covers those activities that coordinate the flow of goods, services, financial resources and information among a network of business partners to create value for the customer. Each organization contributes to the common value creation by delivering a product or service in exchange for a compensation. The value chain of the BSN can be seen as the ordering of the various bilateral value exchanges that realize the conditions of the business model [2].

A firm or organization generally needs to ponder its profit goals with such considerations as risk exposure and financing we somehow described in [6]. When trading for the first time with a new business partner, it may want to secure the transaction, for example by asking for the payment in advance of the delivery or by utilizing the services of a trusted intermediary, usually of a bank. For each type of value exchange, there are a series of alternative scenarios depending on the preferences and business goals of the firms concerned.

Each of these alternative scenarios for conducting business can be considered as a business process or pattern own its own. The overall value chain of the business service network is then made up of a sequence of patterns; it sets the order and the rules that combine the basic patterns for bilateral value exchange into the overall value creation process.

5.3. Classification of process patterns

Process patterns can be classified according to two main criteria:

- The phase of the business collaboration, as defined by the ISO Open-EDI model ([7]).
- The type of value object subject of the value exchange between two business partners.

For each business activities comprised in the Open-EDI phases of a business (see section 4), there are a number of typical process patterns that realize the activities concerned.

The Identification of a suitable business partner supplying a particular product or service, for instance, may be implemented by a Call for Tender process or would be to ask potential product suppliers for a product catalogue and a price list, and to establish a short-list based on the information given.

In the Actualization phase of the business collaboration, that is, when the business transaction is executed, we can distinguish patterns according to the type of value object that is subject of the transaction:

- Physical objects must be made available to the buyer. We can differentiate between the delivery of the object and the transfer of title, that is, the property rights on the object.
- Financial objects (money, obligations or funds) must be transferred from the buyer to the seller.
- Information objects, sales information for example, throw up questions with regards to the authenticity and disclosure of the type of information given.

Each of these object types is associated with some typical market risks. Table 1 list up the most important risks for each value object category.

<table>
<thead>
<tr>
<th>Value object type</th>
<th>Associated risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial objects</td>
<td>Risk of non payment, collection risk, insolvency, poor liquidity, currency fluctuation</td>
</tr>
<tr>
<td>Physical objects</td>
<td>Transport risk, damage, non acceptance, delivery risk, non-conformance with standards, product liability, lost, decay, rotting</td>
</tr>
<tr>
<td>Information object</td>
<td>Authenticity, non-disclosure, wrong information</td>
</tr>
</tbody>
</table>

In addition, there are some business or trading-partner related risks that are independent of the type of value object (like the political stability of the country of destination of the goods, confiscation, corruption or administrative difficulties).

For each of these risks, there are typical risk mitigation instruments. These may be more or less standardized, depending on the market segment and the industry sector concerned. Each of these instruments defines the application context and the rules that govern its application. Often, standardized forms and procedures are prescribed for the use of the instrument as well as the roles & responsibilities for its use are well defined. In principle, all of the patterns shown in Table 2 can be seen
as process components that may be used for BSN transaction development.

While some of these instruments concern a single value object transfer, others span a set of value exchanges. Lagging, payment in advance and factoring illustrate the former type, whereas a letter of credit applies to both the delivery of the physical object and the financial compensation.

5.4. Composition of process patterns

While the pattern types discussed in section 5.3 can lead to quite complex process structures, which can be transactions on their own, their internal composition follows some rules. The UN/CEFACT Unified Modeling Methodology ([3]) presents a set of basic (or atomic) transaction design patterns that consists of:

<table>
<thead>
<tr>
<th>Table 2: market instruments for risk mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk</strong></td>
</tr>
<tr>
<td>Risk of non payment</td>
</tr>
<tr>
<td>Risk of currency fluctuation</td>
</tr>
<tr>
<td>Country risk, confiscation etc.</td>
</tr>
<tr>
<td>Transport risk, damage of the goods</td>
</tr>
<tr>
<td>Non-acceptance</td>
</tr>
<tr>
<td>Non-conformance with requirements</td>
</tr>
</tbody>
</table>

\(^1\) The INCOTERMS (International Commercial Terms, see [8]) are standard trade terms that are most commonly used in international contracts. They allocate costs and risks for international transport between buyer and seller. Insurance responsibilities and customs formalities are also included in the Incoterms.

Figure 2 illustrates the design pattern for a commercial transaction. The basic design patterns can be used to develop new higher-level process components. With such an inventory of basic design patterns, pattern development can be much quicker as well as the new transaction pattern follow the same design principles and become more standardized. New higher level process components can be developed when the standard collaboration processes do not match the needs of the business partners, or to design a new, innovative type of business collaboration that bears an economic advantage compared to the standard patterns. Such a pattern must be defined independently from the application context, for the sake of reusability.

6. Patterns characteristics

As discussed in 5.3, a process pattern can be described by its functional characteristics: the collaboration phases it applies to, the type of business risks it can mitigate and the value object types it is best to be used with. The final choice in favor of one pattern over others, which bear the same functional characteristics, depends on non-functional aspects such as the cost and effort involved with its use as well as the contractual obligation associated.

It is the importance that the trading partners attribute to the characteristics of a pattern that impact on the decision-making. However, the relative market power of the firms and hence their capability to impose a trading pattern must not be neglected too. The next sections take a closer view on the non-functional characteristics of...
process patterns and what they mean from a business perspective.

6.1. Contractual obligations

At the contractual level, business partners decide about obligations, risk allocation, time frames for delivery and contractual penalties for failure to comply with the terms and conditions:

- **Risk level and risk allocation.** Some risks are specific to a VO type (e.g.: good damage or information disclosure, see [6]), some are not (e.g.: liability). The type of risk is to be mitigated by the selection of a trading pattern, and risk allocation to the trading partners is to be agreed upon.

- **Cost level and cost allocation.** The overall cost of using a particular pattern is of great importance. As with other risk mitigation instruments, the use of a specific process pattern entails a certain cost structure. While some mechanisms are inherently cheap (cash payment), others may be quite expensive (e.g. letter of credit as a payment term).

- **Questions related to the environment.** Concerns related to external factors that govern the trade must be taken into account: country specific rules and obligations, needs and preferences of the trading partners, quality concerns, the legal and socio-economic business context as well as the feasibility of using a risk-mitigation instrument in the actual business situation.

6.2. Practical concerns

Other factors that influence the choice of trade pattern are practical considerations as to the efficiency and the ease of use of the pattern (administrative complexity, as in the case of a letter of credit), the experience that the trading partners may have with a specific pattern, the level of trust that holds between the business partners and the technical complexity involved in configuring and setting up the ERP and application systems for the use of the pattern.

7. Pattern composing elements

This paragraph deals with the internal composition of (business) process patterns, that is, the elements that make up a pattern and that we may use to define new patterns. We shall illustrate how elements of existing process patterns may be reused and chained up to form a new end-to-end business transaction.

While the latter is explained in some detail at the end of this article, the following illustrations deal with the internal structure of patterns. As we shall see, the main challenge is to describe pattern components in a way that they may be easily reused while not overloading the requirements of their description with details so as to ease the development of new ones.

7.1. Illustration pattern: smooth negotiation

Our tourism brokerage business model could be configured with respect to different business settings with the use of process patterns: Let us assume that the customer would like to negotiate the features of the travel products that the broker makes available to him instead of just accepting or non-accepting the package he receives. Such a negotiation phase may serve to clarify the needs of the customer, both in terms of preferences regarding hotels and flights and in terms of his economic requirements. There are different business process patterns for negotiation. The one we choose here is called **smooth negotiation**; it states two roles, a Demander role who compiles a wish list including all of his needs and preferences, and a Responder who selects a set of products that meet these requirements. This pattern is typically employed when both business partners are willing to make an agreement and both of them have a similar economic power.

7.2. Business domain (static pattern elements)

The business meaning of a pattern is associated with its economic function. However, the use of a particular pattern prescribes a well-defined chain of business activities each of the business parties involved must comply with. Typically a pattern describes a set of value exchanges. The value objects (VO) exchanged may be physical objects, goods that is, services, money or information. The availability of these VO in the BSN is a prerequisite to the execution of the transaction. In order to visualize and facilitate the understanding about **who needs to deliver what in a business transaction and what he receives in return**, we model the VO in a UML Class Diagram.

More and more, industry standardization groups use UML to document business transactions as these graphical representations can be easily understood both by business experts and IT specialists. Examples are the ISO 20022 in the domain of Finance [9] and the UN/CEFACT standards for Trade and Electronic Business [11]. The somewhat simplified business domain of our Smooth Negotiation pattern (see section 7.1) is given in Figure 3.

![Figure 3: business domain of Smooth Negotiation pattern as a UML class diagram](image-url)
7.3. Formal parameters

In order to support maximal pattern reusability, patterns must be applicable in quite different business contexts. That is, the same pattern that allows a customer and a broker to negotiate hotel and flight features in a tourism business model should be applicable - with no modification to the pattern definition - to the context of an office manager who negotiates office furniture with an office supply distributor. We use the notion of a formal parameter, as used in the domain of Software Engineering, to achieve the required flexibility. A formal parameter can be understood as placeholder for a real parameter, which in turn could in real-world business case refer to a hotel room, a flight reservation or a piece of office furniture.

This solution is based on the hypothesis that the nature of the value that is object subject of a pattern has no implication to the pattern itself, in that each pattern may be parameterized for each type of VO. The business domain diagram for our Smooth Negotiation pattern (Figure 4) the wishes expressed by the Demander will be instantiated with regards to a yet unknown object, something that may be a hotel room or any other travel related subject.

![Figure 4: complete business domain of Smooth Negotiation with a formal parameter](image)

7.4. Abstract Roles

As with the formal parameters for the representation of the value objects exchanged in a business transaction, the roles of the respective business partners must be stated independent from the application domain. That is why we prefer the more general role names “Requester” and “Responser” over more specific instantiations such as “Customer and Seller”, which would limit the reusability of the pattern.

7.5. Dynamic pattern elements

The pattern description must specify in addition to the value objects exchanged and their characteristics the process orchestration in terms of the nature and sequence of the business activities as well as the information exchanged (business documents) between the actors concerned. As with the static elements of patterns (see 7.2) we use a UML notation to define its dynamic aspects.

7.6. Messages

An activity or a sequence of activities in a BSN that does not involve an exchange (value object, communication) between one or more business actors and that does not bring about a change in the state of a value object can be considered as being not relevant with regards to the scope of the business process pattern. This includes such activities that are of purely internal nature to a business partner and that do not require communication. What are described in a pattern are those activities that refer to an exchange of a value object between the actors concerned. A pattern specifies which value object is exchanged at what moment in the course of the business process. An UML class diagram can capture the characteristics of the value objects that are relevant to a process pattern.

7.7. Others

Other elements such as suitable business document templates, technical details, cost allocation and technical details could also be included in the description of the pattern, depending on the business context.

A further element that may be included in the description of a pattern are the business logic. This may help to ensure that the business motivation that has led to the choice of a particular pattern are preserved in its execution. Such business logic can be expressed in UML as business rules [12].

8. Chaining

8.1. Validation of our approach

This section describes an algorithm that develops an end-to-end business transaction, which implements a given business model. For validation purposes, the transaction must fulfill a series of conditions:

- Is the transaction functional (i.e., does it fulfill its business purpose)?
- Is the transaction satisfactory (mainly from a non-functional point of view)?
- Is it coherent and sound?

Let us assume we state the purpose of a transaction in terms of the set of value object exchanges required to deliver value to the final customer. When we further consider the transaction as a sequence of smaller business processes (i.e. a chain of process patterns), each having a well-defined functional purpose, we may then evaluate the adequacy of the transaction in a given business scenario by comparing the sum of the individual results of the application of process patterns to the intended business purpose.
As regards the *satisfaction* of non-functional characteristics (risk and cost allocation, contractual obligations intended...) we propose to consider the union of the non-functional characteristics of each of the patterns included and to ask the business parties whether they are satisfied with the result. While this may sound straightforward, this method has some fallbacks. Firstly, the satisfaction criteria of the business partners may be contradictory, where one partner could prefer a high level of security while his counterpart may turn his attention to the efficiency and cost allocation achieved. Also, even if all business partners would put their priority on transaction efficiency, the chain of a dozen highly efficient patterns must not necessarily result in the most efficient transaction. Traditional Requirements Engineering techniques, such as goal modeling, may be needed to further deepen the investigation.

The transaction *coherence* expresses the homogeneity of the selected patterns, either from a semantic, a legal or technical point of view. We believe that some of the pattern characteristics given in 7 can be utilized to answer this question, however, this is subject of another article and cannot be dealt with here.

### 8.2. Designing a transaction for the Tourism Brokerage business model

The main value objects, which the business parties exchange in the Tourism brokerage business model, have been discussed in section 3. They are summarized in the business domain (as explained in 7.2) model of our case study. Figure 5 regroups these value objects according to the role that *supplies* them, however we could have used a different criterion to group them. A first and preliminary step to design a business process that implements our business model consists in the agreement upon a partial order for the flows of VO, whether that is triggered by historical, technical or business reasons. For example, the lack of trust between business partners be a reason to agree on a partial order where the payment precedes the good’s delivery.

The reasoning that leads to the ordering constraints for the main VO exchanges has been discussed in [13]. For the purpose of this article, we assume that such a preliminary ordering has already been established.

The scope of the business process is to implement all of the value exchanged given in the model. Each exchange can be business critical for one or both roles concerned, and it may be subject of a commercial agreement. We model the various phases of the life cycle of a business collaboration referring to the Open-EDI process model introduced in section 4. Indeed, one of the first questions we must answer is to determine which of the collaboration *phases of the Open-EDI model are required to enable the VO exchange*. While most value object exchanges require an actualization phase, where the business activities are actually carried out, in some cases suitable VO suppliers must be identified first (Open-EDI identification phase). Also, a planning phase must be necessary to prepare the exchange of the value object, and we may have to deal with returns due to poor product quality (*post-actualization* phase).

Table 3 gives an exemplary scenario for the collaboration phases concerning some of the value exchanges of our business case. The next step consists in asking the business parties to *select collaboratively one pattern* for each VO exchange they participate in, based upon the pattern characteristics already introduced.

<table>
<thead>
<tr>
<th>VO exchange</th>
<th>Phase</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settlement</td>
<td>Plan</td>
<td>Notification</td>
</tr>
<tr>
<td>(Brok. to Cust.)</td>
<td>Negotiate</td>
<td>Smooth Negotiation</td>
</tr>
<tr>
<td>Tourist Service</td>
<td>Actualize</td>
<td>Deliver-Acknowledge</td>
</tr>
<tr>
<td>(Prov. To Cust.)</td>
<td>Identify</td>
<td>Query-Response</td>
</tr>
<tr>
<td>Booking right</td>
<td>Actualize</td>
<td>Deliver-Acknowledge</td>
</tr>
<tr>
<td>(Prov. to Brok.)</td>
<td>Plan</td>
<td>Commercial Transaction</td>
</tr>
<tr>
<td>Actualize</td>
<td>Actualize</td>
<td></td>
</tr>
</tbody>
</table>

Each pattern will be *put into the context of the overall transaction*, by instantiating the abstract (formal) pattern characteristics with the real business concepts of our case. It is at this stage that the value objects of our business domain are mapped onto the abstract placeholders of the pattern definitions (roles or formal parameter of the business domain). Table 4 exemplifies the instantiation of parameters for the Smooth Negotiation pattern at the Negotiation phase of the VO exchange between the Broker and the Customer. Note that not all roles of the pattern must be assigned to actors.
of the business model. It may well be that the pattern defines an additional to facilitate the execution of business activities.

The resulting business process transaction can be manually adapted to incorporate any additional non value-adding activities, e.g. information flows that ease the communication among business partners.

Table 4: mapping for one use of a pattern

<table>
<thead>
<tr>
<th>Smooth Negotiation for Settlement exchange from Broker to Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth Negotiation</td>
</tr>
<tr>
<td>Requester (role)</td>
</tr>
<tr>
<td>Responder (role)</td>
</tr>
<tr>
<td>Something (VO)</td>
</tr>
</tbody>
</table>

8.3. Hypotheses

The chaining algorithm discussed in this article and its applicability to business service network design is based upon a set of hypotheses. A first hypothesis is that the business partners that engage in a BSN are honest and want the common value creation to be a success to the whole BSN.

Another hypothesis we rely on is the fact that existing ways of doing business (processes, standards, patterns) can be combined and integrated to create new innovative service networks. A lot has already been standardized whereas the framework discussed in this article applies to situations where these standards are not sufficient or not adequate. In this case, new patterns may be developed or existing patterns combined in an innovative manner, as sketched in 5.4.

8.4. Current and further work

At the current stage, an expert system is being designed to facilitate the choice of business pattern. This tool shall be integrated into the Efficient toolset for transaction development2. A lot of work still needs to be done with regards to the various pattern characteristics and their applicability and compatibility in different business contexts (e.g. finance, telecommunications).

Also, the current library of patterns is based on best practices and standards in electronic business and electronic commerce. We shall work on an extension in scope to go beyond the domain of electronic business.

9. Conclusion

This article presents a method and an algorithm that helps and guides business experts with the task to design of a business service transaction, based on a given business model.

Starting with a description of the general business case, we have shown how step-by-step an operational service transaction can be designed that implements the business model. We have put special emphasis on the use of process patterns, which can be understood as ready-made process components that fulfill specific business purposes (risk mitigation, cost allocation). The use of pattern does not only make transparent the business decisions and motives that have shaped a business transaction in a particular way, but patterns do also reduce the time to market for the development of new transactions.

We believe that approach depicted can be easily applied to different business contexts.

10. References


---

2 More on the Efficient toolset can be found at http://efficient.ciri.tudor.lu