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Business Services as a Modeling Approach for Smart Business Networks

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Business Services as a Modeling Approach for Smart Business Networks

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1. Business Networks, Business Architectures and Business Services

While Web Services and Service-Oriented Architectures (SOA) [1] have provided some important insights on how to design plug-and-play ecosystems of enterprises based on the interaction of information systems, Smart Business Networks [2] require a richer level of abstraction. Realizing the goals of standardization, specialization, modularity and openness in intra and inter-company operations through Smart Business Networks offers a new and very appealing perspective. As it was pointed out in [2], we need a systematic way to characterize Smart Business Networks in the form of suitable concepts and language. This paper introduces the concept of Business Service-based modeling of companies and related ecosystems as an approach for attaining these goals.

Encapsulation and separation of the assembly of services from their actual implementation lie at the realm of SOA. As it is shown in the ongoing Service Component Architecture standardization effort [3], the value of SOA-approaches holds irrespective of the granularity or level of the proposed modeling. Although SOA concepts are not limited to information technology applications, modeling business networks needs to be based on a richer set of business architecture abstractions that go beyond providing service construction and assembly.

A seminal paper by D. McDavid [4] has provided great insight into the main concepts and ontology toward a definition of 'business architecture'. As McDavid has shown, there are several dimensions needed to represent the most common concerns arising in business. For example, one of such dimensions, called "Outcome", and its relationship to "Commitment", "Role Player" and "Purpose" provide an abstract framework to introduce the concept of Business Service, the agreement between its provider and consumer and the goals in an enterprise such a Business Service fulfills. A variation of the original scheme shown in [4] is included in Figure 1 below.

As Figure 1 shows, there are some loops around each of the business architecture dimensions, thus suggesting that each of these entities may have a dependency on one or more entities of the same nature or type. For example, a commitment has other commitments on which it builds; an outcome has other outcomes on which it depends, and so on. Since the 'owner' of different occurrences of the same concept can be in different enterprises, this means that company boundaries may be crossed by these 'recursive loops' depending on the specific dimension at play and the modeling scenario. For example, a commitment may be binding two players in different companies; an outcome may depend on outcomes provided by other companies, etc.

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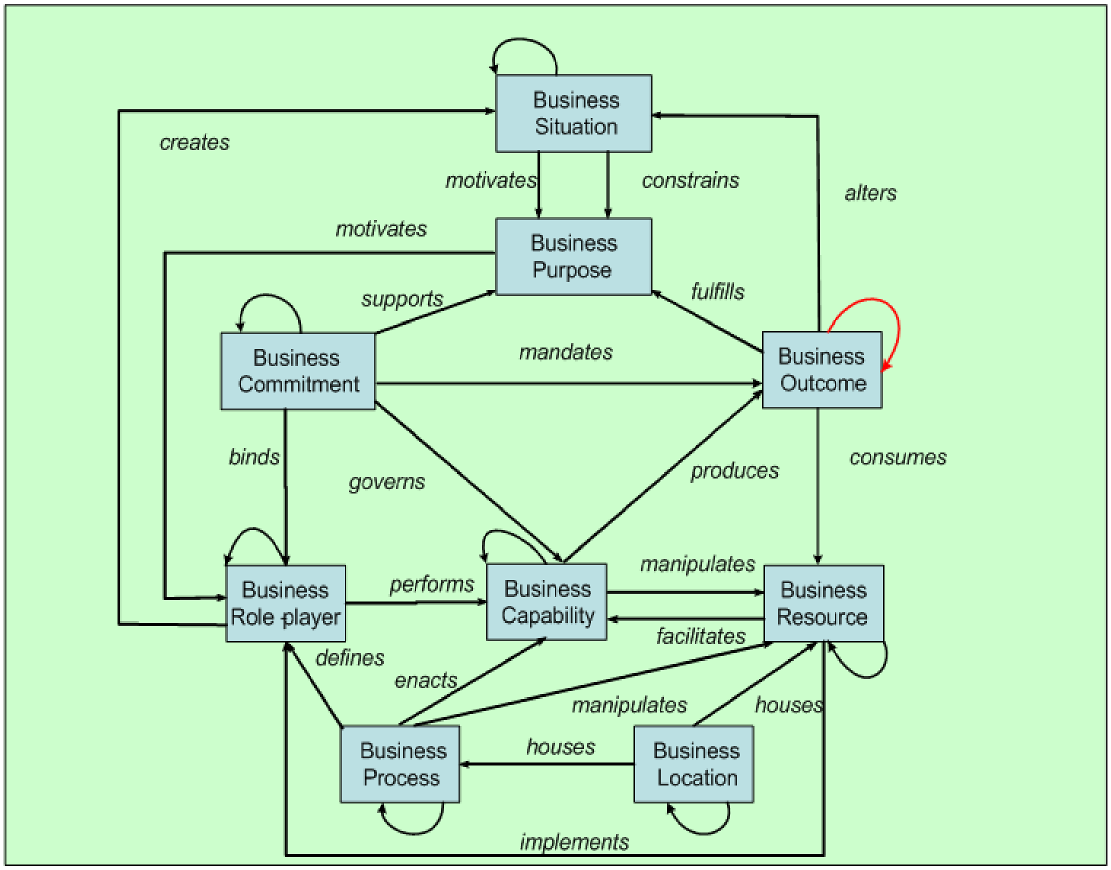

Figure 1. Business Architecture Principles

The generic principles described by the business architecture scheme of Figure 1 clearly are suggest that there are *several relevant business networks inside and across enterprises*, all interconnected by links with verbs that explain the semantics of these connections. In fact, the obtained well-known Social and Organizational Networks could be cast as networks that are defined by linking resources in an extended enterprise[1]. A key question is then which of these multiple networks is the most appropriate one. Undoubtedly, while the answer will ultimately depend on the goal of the model, the requirements posed by a Smart Business Network lead to Business Services as the most suitable architectural choice.

On the other hand, Business Processes have governed intra and inter-enterprise operational modeling for several decades [5], [6], [7], [8] and have also provided the basis for many business transformation efforts. Business Processes have become an early form of standardization for intra-company and inter-company business operations. In fact, the maturity of certain classes of Business Processes has given rise to significant outsourcing and supply-chain implementation markets that have helped companies produce substantial savings and foster innovation.

[1] In particular, the above remarks show that the architecture of Figure 1 is not limited to a 'company-centric' view of business but it also encompasses an ecosystem perspective.

However, there is a clear need for new ways of modeling inter and intra-enterprise operations that exploit deeper levels of industry-specific commonalities across companies, thus realizing further economies of scale while yielding more cost savings, deeper innovation and enhanced resilience. Some recent approaches to modeling inter-company collaboration have been presented in [9], [10]. The ecosystem view of a network of enterprises used by Iansiti et al. [9] is definitely one of the ways a Smart Business Network can be modeled. However, the lack of a deeper model to render such Smart Business Networks models more operational still remains as an open problem. Another important approach based on the concept of componentized enterprises as introduced in [11] and [12] brings an opportunity to build the needed concepts and language enabling Smart Business Networks.

As we have stated earlier, the concept of "services" is not new. Service Oriented Architecture (SOA), related Web Services and other service standardization efforts are already well-known [1]. Furthermore, their potential use to enable Smart Business Networks has been also shown [13]. Since an increasingly large part of the world's GDP is based on services-based industries and related economic activities [14], the term "service" has become quite overloaded and thus, unfortunate confusions have been created, the most common one being the assumption that all Business Services of 'interest' can be subjected to IT Services-based implementations[2]. Software tools for modeling processes by implementing SOA concepts also exist today and are available from different providers [15].

In spite of these multidimensional trends in the "services" world, known formal services operation models and their interaction in a network of enterprises have been primarily used in integration of IT systems motivated by modularity and interoperability. Thus, "services" have been used as an implementation mechanism for the realization of intra and inter-enterprise business processes [1]. These IT service models, which are targeted towards solution implementers, do not adequately address the needs of higher level, business-oriented modeling.

On the business side, companies are beginning to recognize the importance of service orientation as a pre-requisite to becoming competitive. For on demand interaction with their customers, suppliers, partners, and employees, companies are beginning to explore actively what Business Services to provide and how to develop them rapidly in order to be responsive, innovative and grow margins. Hence, there is a need for proper operational modeling constructs and corresponding SW tools that support design, representation, and analysis of services that are required by service-oriented businesses. Business Services provide a very useful paradigm for extended business-level standardization, modularity, and specialization.

Modeling a Smart Business Network with Business Services is all about choosing the right architectural entities for designing a business, an industry segment and the involved ecosystem at the right level of granularity. These are some of the key elements that make standardization feasible. On the other hand, the SOA concept per-se cannot generate the same type of industry-wide convergence toward a common business framework because most of the 'service content' generated has been mostly related to the IT level.

Recently, Business Services have been introduced through a rigorous Unified Services Metamodel (USM) that captures and extends the capabilities needed to model a componentized enterprise ecosystem [15]. Actually, IBM has studied an innovative way to represent entire industries by using Business Services, dubbed Component Business Modeling (CBM), thus

[2] In some cases, IT Services are considered to be the only services that matter.

suggesting a very significant opportunity to foster unprecedented levels of standardization and modularity at a business-level [11], [12].

Consequently, the design of Smart Business Networks based on Business Services becomes an appealing approach since it offers an opportunity for unleashing the value of "network of enterprises" to an operational level while simultaneously deepening the degree of standardization for individual industries, industry segments, and appropriate cross-industry levels.

2. Smart Business Networks Modeling through Business Services

As we said in Section 1, enabling Smart Business Networks calls for the right level of granularity of the model of a company intervening in such a network and also requires the selection of the correct business architecture entities to be used as the primary elements of the model. A too fine granularity leads to excessive detail, as in the case of Web Services. In this situation, the desirable characteristics of a Smart Business Network [2] such as its agile ability to carry out business decisions to connect-disconnect, the possibility to effectively manage the network and finally, the capability of reasoning about matters of strategic business nature are hindered by the intricate nature of the chosen representation.

In our approach we have selected "Outcome", or Business Service, as the main dimension to model our Smart Business Network because of several practical and fundamental reasons. First, this business architecture dimension represents exactly the main concept that exists to fulfill the business goals of an organization, business units and finer-grain operational entities. Second, a network of such architecture concept also captures the main intra-company and inter-company operational dependencies that these entities have, expressed in the form of Business Services offered to and used from the ecosystem. Finally, provisioning-based design of operations is at the core of the cost structure governing company performance and economic models of industry deconstruction. Thus, for all practical purposes, a Business Service Network is not only a generalization of the 'supply-chain' model but it also captures the behavior inherent to the ecosystem, as it will be shown later in the paper.

On the other hand, the choice of alternative business architecture entities could also become an insurmountable hurdle for the goals of a Smart Business Network. If purely behavioral entities are selected, such as Business Processes, the issue of lack of modularity comes to play since the main processes in an operation usually span many activities located across large sections of the resulting network. Finally, if only business rules[3] are chosen as the business architecture element dictating the definition of the network, then a rich understanding of the commitments governing the interaction of the nodes will be obtained but simultaneously, the operational capabilities of each individual role player bounded by such rules will be absent from the representation.

In our approach, the representation of every enterprise participating in the Smart Business Network is given by a set of Business Services (nodes), while a directed link in the graph joining two Business Services represents the existence of a dependency of the source Business Service node on the Business Service represented by the target node (see Figure 2).

[3] Business Rule is a particular case of "Commitment" in the business architecture approach discussed in Section 1.

Intuitively, a Business Service is the business architecture entity that represents the outcome of a significantly large "chunk of operation" in a company. As it will be shown below, a Business Service includes specific functional forms under which it is made "visible" to the ecosystem, a

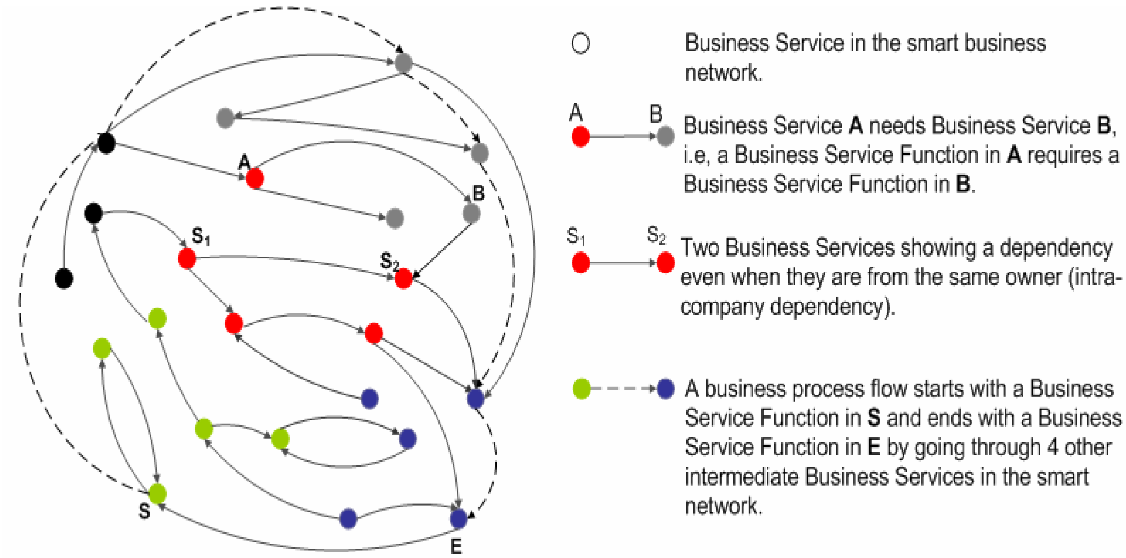

Figure 2. A Smart Business Network based on Business Services modeling

high-level description of the operations it carries out[4] and that include the behavior rendered by other Business Services on which it depends, and a service agreement that captures the commitments made to other network participants.

Thus, a Smart Business Network is depicted as a rich graph of Business Services representing the outcomes that each main organizational unit of a company offers to and needs from the network as well as the commitments that govern every interaction involving a Business Service in the network. As a byproduct of the above ideas, the ability to build multiple Smart Business Networks, support intelligent connect-disconnect, and analyze economic and strategy value provided by such a network will be facilitated by a repository in which all available Business Services can be found. This repository would also be searched through when seeking for Business Services candidates that "match" against a given Business Service specification.

It is clear that every Business Service has a single "owner", for example, the company or business unit responsible for furnishing it to the ecosystem. We call this role-player Business Service Provider. In Figure 2, we have painted the nodes of the Smart Business Network by assigning the same color to Business Services with the same owner. Notice, in particular, that there are links connecting nodes with the same color. This characteristic is the direct consequence

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[4] The fact that a Business Service involves 'Behavior' as a part of its internal architecture is well-aligned with the inherently recursive 'fractal' nature of business architecture description presented in [4].

of the fact that inter-dependencies among Business Services also model service provisioning needs inside the same enterprise.

Any business operation needing to resort to a Business Service plays the role of Business Service Consumer. The conditions governing the relationship between Provider and Consumer are described by a Business Service Agreement. These role players and the agreement binding them are described in the lower part of Figure 3. As it can be seen, a specific part of the agreement, called Interaction, includes the way "coordination" between the Provider and Consumer will be achieved, i.e. the interaction model explains the joint behavior between a Business Service Consumer and the Business Service Provider.

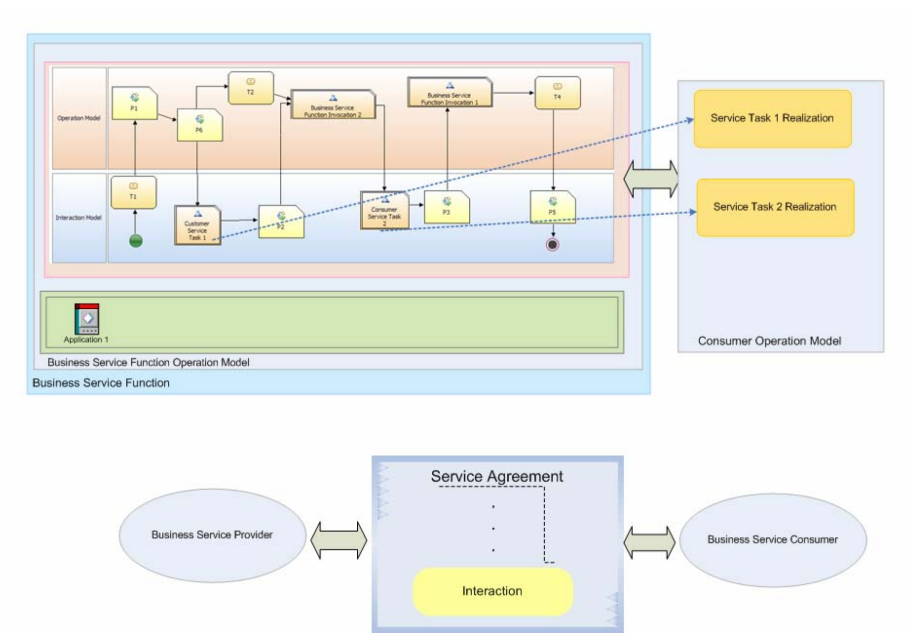

Figure 3. Some business architecture entities involved in the definition of Business Service

Consequently, the "boundaries" of an enterprise are blurred in favor of a flexible provisioning of needed operations through available Business Services in the Smart Business Network. In particular, the desirable plug-and-play and connect-disconnect properties of the network are made evident by the fact that the same "owner" of two Business Services, S1 and S2, with S1 depending on S2 as shown in Figure 2, may decide to stop using S2 and switch over to another one from a different Business Service Provider if the desired specification is found in the ecosystem and the corresponding Business Service Agreement that is acceptable to the owner of S1.

The subject of 'ownership' of a Business Service is a very interesting and important subject. In order to simplify our presentation, Business Services were introduced as the outcomes produced by significantly large 'chunks of operations' in a company but we have not defined any specific 'owners' for such individual operations. Inside a given enterprise all Business Services ultimately belong to the same company and thus, they may all be considered to belong to the same 'owner'. This explains why all Business Services within the same enterprise were given the same color on Figure 2. However, this high-level ownership does not characterize the obvious differences that may exist for two distinct 'chunks of operations' in the enterprise, for example, in terms of accountability. In other words, the internal Business Services of an enterprise need a finer-level concept of ownership within the boundaries of the organization. The way this problem is approached is intimately related to the criteria with which the involved 'large chunks of business operations' are selected. If two companies belonging to the same segment of the same industry were to follow different criteria to make such a selection of the pieces of their operations to be modularized into Business Services, they would end up with different sets of Business Services and therefore, the standardization sought for that industry segment would likely be lost.

Leading companies in several industries have recognized that in order to benefit from economies of scale in the provisioning of their common needs from external sources and to foster more effective collaboration, they would need to modularize their business operations by following common and agreed principles. While this need may not hold true for all operations of a company, it is definitely the case for those specific operations that do not offer significant competitive advantage and are high candidates for externalization. For example, in the telecommunications industry, many large companies have agreed on a standard called Enhanced Telecom Operations Map (ETOM). A simplified and partial example of the ETOM framework is shown in Figure 4 for illustration purposes. The main operations have been modularized and organized according to a design principle dictated by the name given to the main rows and columns in the diagram.

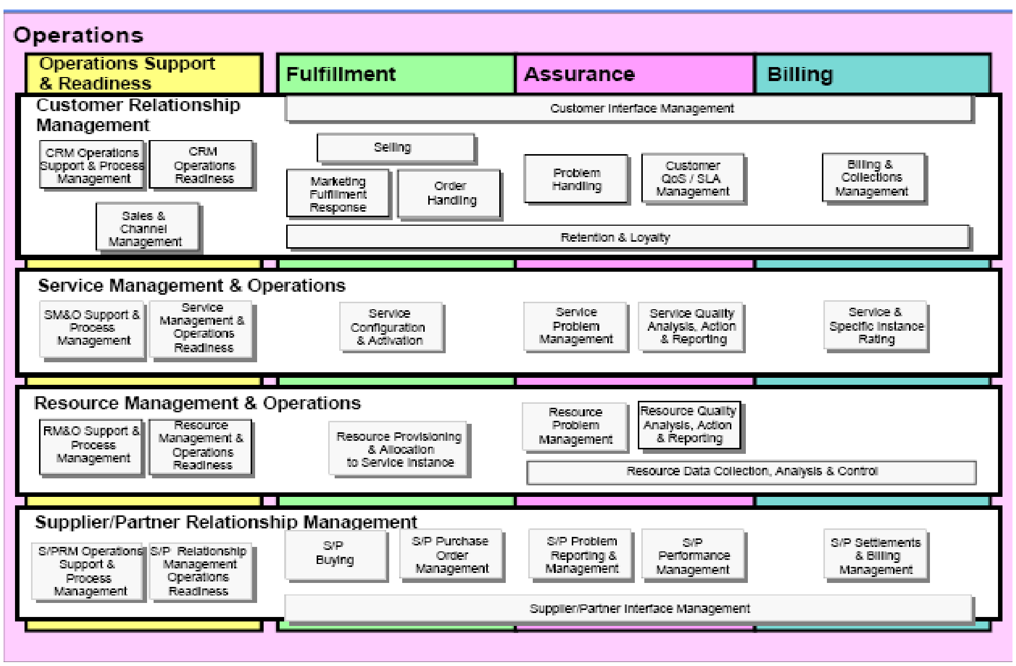

Figure 4. A partial view of the Enhanced Telecom Operations Map (ETOM) created by the Telemanagement Forum

In [11], the concept of aggregating large chunks of company activities according to a number of well-identified capabilities in the enterprise and three levels of accountability involved in the business operations was presented. In this framework, called Component Business Modeling or CBM, business components are identified and proposed as a standard for individual segments of the most common industries. The design principles followed to define such business components in each industry segment is not the objective of this paper. With a CBM view of the business at hand, individual Business Services have a natural owner, i.e., the individual business component whose main operations are encapsulated under one or more Business Services. As an example, Figure 5 shows a CBM view of an enterprise with the Business Services of Figure 2 overlaid onto the business component map. Thus, each component becomes the natural owner of the Business Services it provides to the rest of the ecosystem, both internally and externally to the company.

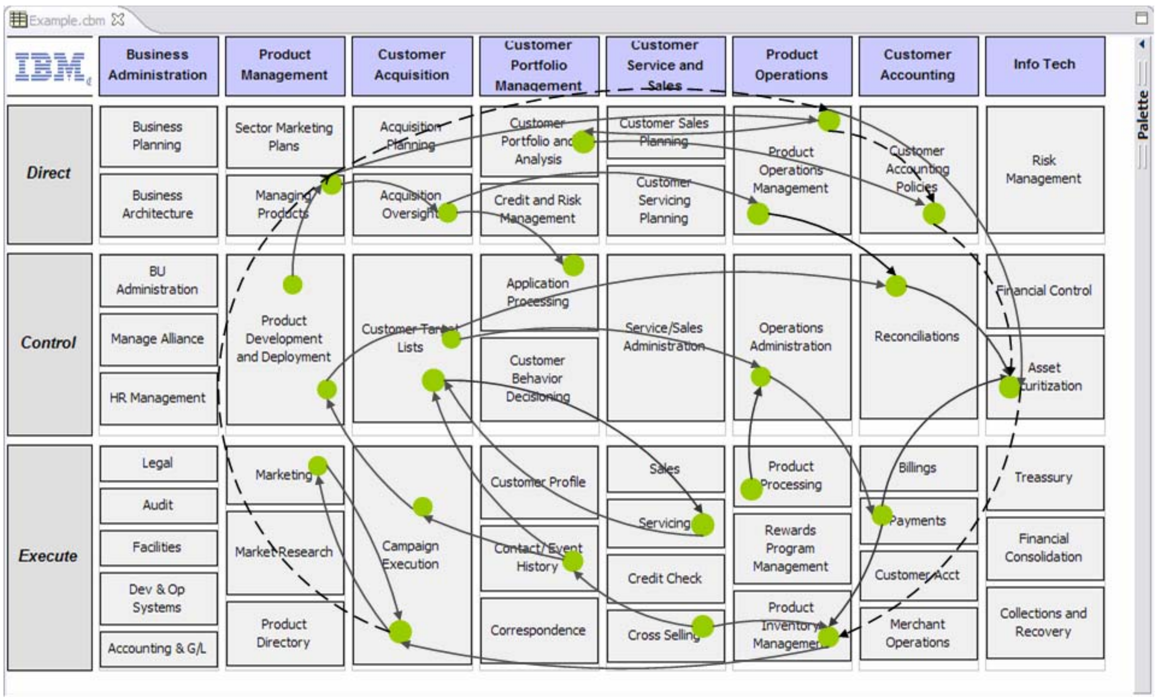

Figure 5. Component Business Modeling (CBM) framework

For the sake of allowing effective collaboration, a Business Service is made "available" or usable to the rest of the Smart Business Network through a set of Business Service Functions. Figure 3 above shows one Business Service Function for the given Business Service. Figure 6 offers a more complete description of these concepts, and includes several Business Service Functions as part of the Business Service Specification. Each of these Business Service Functions has an Operation Model as well as some specific behavior that governs its interaction with the rest of the ecosystem, i.e., the Interaction Model, which is derived from the Business Service Agreement. The Interaction Model is **fixed** for each Business Service Function and part of its behavior will be materialized through specific actions performed by **any** Business Services Consumer requiring the service, which are dubbed "Consumer Service Tasks" or "Service Tasks" for short.

In Figure 3 and Figure 6, the Interaction Model is represented with a set of Business Processes, thus stating that the interaction between Business Service Provider and Business Service Consumer is purely behavioral in nature. These processes obviously must interact with the Operation Model of the Business Service Function and they do so in more or less complex forms depending on the particular case at hand. The important lesson to be learned is that in business-level modeling accomplished by the proposed Smart Business Network, naïve artifact-passing communication (input-output parameters) does not hold as in the case of lower-level IT-oriented implementations through Web Services[5]. It is obvious that since a Business Service encapsulates a substantially large size of company operations under each of its Business Service Functions, the Interaction Model that describes the joint behavior between a Business Service Function and the Business Consumer is much richer than a simple Web Service interface. This should be no surprise as any business-level interaction has a higher degree of complexity than just passing input and output artifacts between the involved role-players.

On the other hand, the maximum possible level of standardization and simplification sought in the Interaction Model will ensure that interoperability and effectiveness of a Smart Business Network are met by a Business Service-based model.

An Interaction Model is the public way a Business Service says explicitly to the Smart Business Network how joint collaboration will be realized. In fact, it should be noticed that the definition of the Interaction Model of Figure 6 includes some activities that are owned by the Business Service Function while others are performed by the role of the Business Service Consumer. As said above, the latter activities are represented as Service Tasks whose operational details are of the exclusive incumbency of the Business Service Consumer because the Business Service Provider does not need nor cares to know about their realization.

A Business Service Agreement includes other business rules that bind and commit the two role players while setting performance, financial understanding, and other terms and conditions. The details of this Agreement and the relationship with rules go beyond the scope of this paper.

Intuitively, the business logic encapsulated by a Business Service is thus divided into a set of Business Services Functions that shared substantial pieces of common operations among themselves. Some common processes that are used in different Business Service Functions are shown in Figure 6 as P1, P2, P3 and P4. Each of these Business Services Functions is also equipped with an Interaction Model which is the piece of the operation that rules the collaboration with the rest of the Smart Business Network, and thus, is made public to the ecosystem of Business Services. This division of business logic promotes the right balance between all those chunks of operations that are kept internal to the Business Service and thus, to the exclusive knowledge of the Business Service Provider and those operations which the rest of the ecosystem needs to know about the Business Service to be able to use it.

As an important detail to be noticed from Figure 6, the Operational Model facilitates the reuse of large "chunks" of business operations across Business Service Functions of the same Business Service. As it is shown, some of the activities (processes or simple tasks) used in the Operational Model are local to a Business Service Function while others come from a shared pool in the Business Service Operation Model. Some of the supporting enterprise applications (for example, a Customer Relationship Management solution or a SAP financial package) are also shown as part of a typical Business Service Operation Model and consequently, they are also reused in the Business Service Function Operation Model.

[5] In fact, the Service Component Architecture standard includes a 'conversational mode' for assembling services that resembles the Interaction Model.

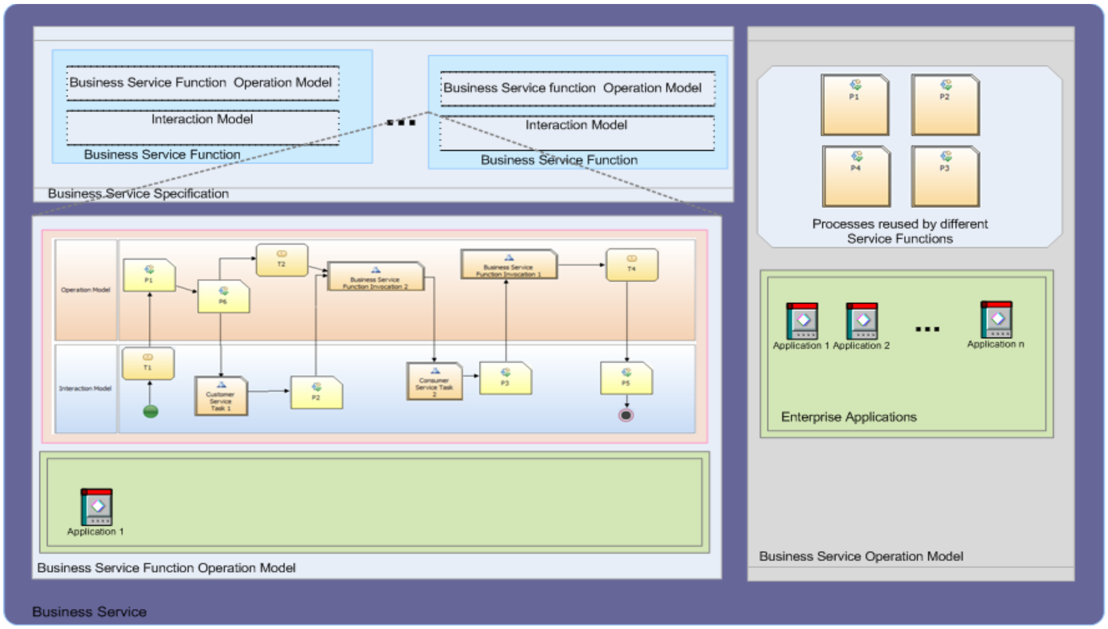

Figure 6. A simplified business architecture definition of a Business Service.

The proposed representation of a Smart Business Network through Business Service Modeling also encapsulates all potential and complex forms of joint behavior across the network. More precisely, this Business Service-based representation of a Smart Business Network supports all business processes needed in the operations. Indeed, the design of any business process taking place across the ecosystem can be realized as a choreography of selected nodes which are chosen to attain the sought collective behavior. Thus, we are in a position to claim that a Business Services representation of a Smart Business Network encapsulates "Potential Energy", as any ecosystem behavior can be described by resorting to the defined business architecture of the network.

As an example, given a Smart Business Network of the telecommunication industry as represented by its Business Services, an end-to-end "Ordering Process" can be obtained as shown in Figure 7 below. In this example, the intervening Business Services are conveniently swinlaned for ease of visualization, and in each lane several different Business Service Functions of the same Business Service are used in due turn to create the telecommunications industry "Ordering Process".

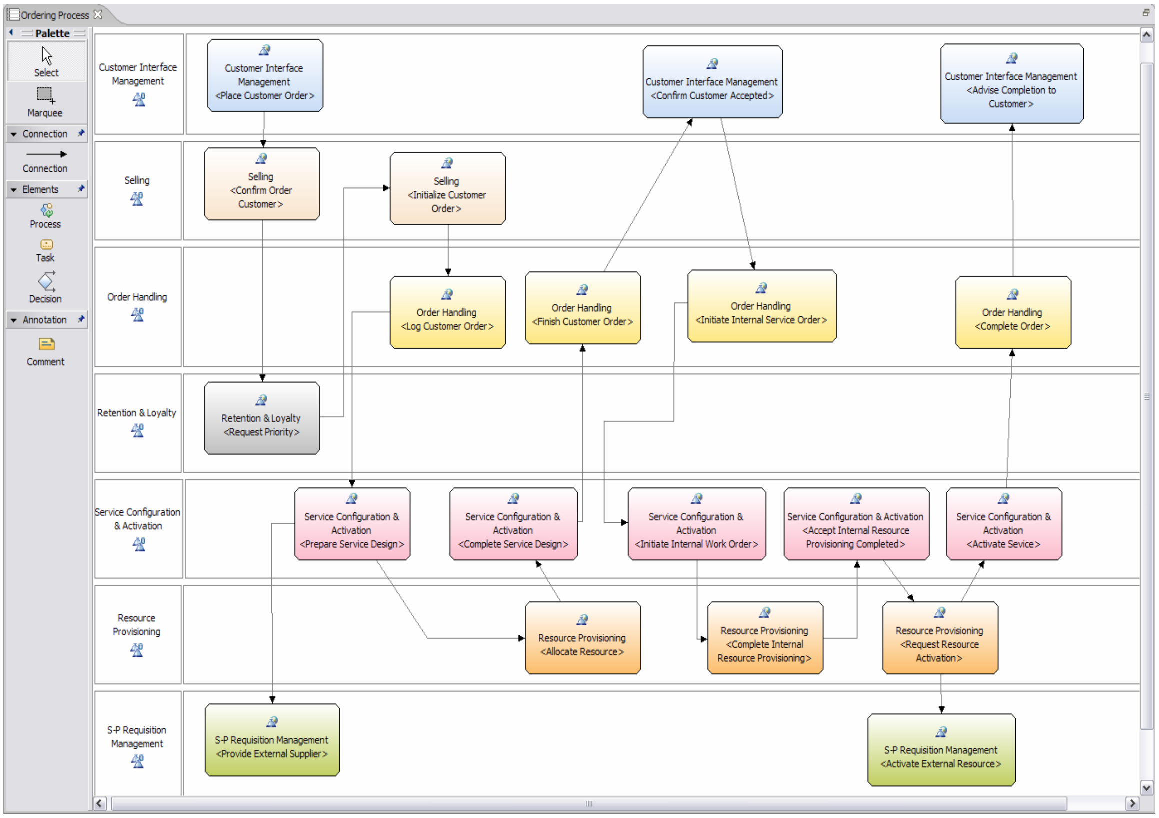

Figure 7. The "Potential Energy" contained into a Smart Business Network. An Ordering Process generated from individual Business Services in the Telecommunications Industry.

3. Conclusions and Further Research Activities

In this paper, the concept of modeling business ecosystems through Business Services has been proposed as an approach to Smart Business Networks. Business services provide the right architecture dimension and the appropriate level of abstraction for obtaining the desired characteristics of standardization, specialization, modularity and openness. Business services offered and provided by enterprises and their interdependencies offer an opportunity to reach a level of unprecedented industry-level business standardization. The Smart Business Network concepts presented enable some of the desired properties of such networks, including its ability to carry out business decisions to connect-disconnect and the capability of reasoning about matters of strategic business nature.

Dividing the behavior of Business Services into intrinsic work performed by the service and an Interaction Model that governs the joint work to be performed with its potential consumers, and exposing such Interaction Model in a public form furthers the openness about the way different ecosystem participants collaborate in the network.

On the other hand, a metamodel giving a formal foundational model to the Smart Business Network has been designed and a companion software tool to define, search and use Business

Services in the Smart Business Network has also been built. This software capability includes the definition of business processes as choreographed Business Services. In Figure 8, a preliminary screenshot of the actual software tool being built for defining, searching and managing the Smart Business Network is shown. This tool also has the capability to define Business Processes sustained by the Smart Business Network.

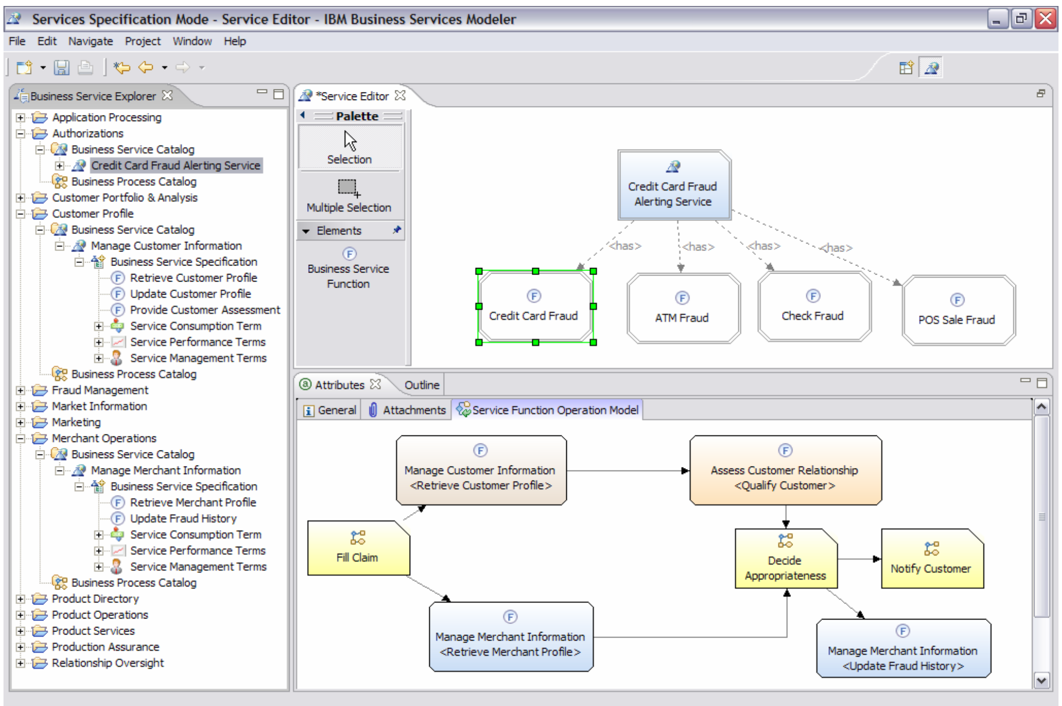

Figure 8. A preliminary view of the Eclipse environment tool for defining the Smart Business Network through modeling with Business Services

In addition, successive decomposition of a Business Service by further refinement of the operations that its Business Service Functions comprise gives raise to finer grain of detail. Although this further refinement goes beyond the scope of the Smart Business Network definition, the approach shown in this paper can be repeated in a hierarchical form downstream. This progressive refining yields a hierarchy of Business Service ecosystems. In those cases where it makes sense, this decomposition method leads ultimately to fine-grain SOA-oriented service realizations at the IT level. Since the bridge between business and IT has always been a prevalent subject of concern, it seems that the suggested Business Services modeling and its decomposition sheds new light on this important problem for practitioners. This topic will be fully addressed in a companion paper.

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