A service classification framework for value co-creation. The case of the Internet of Services

Purpose
The purpose of this study is to propose a classification framework for conceptualizing how value is created through services and suggest a methodology for formally representing the resources that service systems exchange throughout the service lifecycle process. As a promising research field for studying value co-creation activities we propose the vision of the Internet of Services (IoS), where Internet-enabled service ecosystems form the base for customer and provider interaction. Such service infrastructures eventually require new frameworks for formally representing the resources that drive value creation.
Methodology
The study involved the collection and the critical reading of literature surrounding the concepts: service-science, resource-based theory of the firm and service modeling.
Findings
The research revealed that the locus of value creation in these ecosystems is considered to be co-created upon the mutual exchange of operant resources (knowledge and skills) between the various actors engaged in the network. Thereby, existing frameworks are proven inappropriate for conceptualizing how value is created through services, well as to manage the mobilization of resources that maximize value. Finally, the research revealed that a coarse-grained modeling standard is required for leveraging semi-structured information throughout the service lifecycle process, and therefore improve service systems coordination and governance.
Originality/Value
By combining our classification framework of the resources that service systems integrate in value co-creation, with our early experiences from using an industry-neutral service description language, we present our early research findings to support the management of value co-creation throughout the full service lifecycle.
Key words
service systems, value co-creation, service management, service description
Paper type
Research paper

1. Introduction

Over the last decades, leading-edge firms, as well as many business scholars and consultants, have advocated the need for transforming the entire firm orientation from producing primarily manufacturing goods to a concern with service(s). These initiatives can be found in both business-to-business (e.g. IBM, GE, Rolls Royce) and business-to-consumers enterprises (e.g. Lowe's Kodak and Apple) (Vargo and Lusch, 2008a; Ng and Maull, 2009). In essence, enterprises shift from an industry economy toward a service economy and the drivers for this change include globalization, technological change and an increasing demand for services. (Scheithauer *et al*., 2008). Considering this trend it becomes clear that services and the service economy

play an important role in today's and tomorrow's business. In line with this trend service ecosystems (Scheithauer *et al*., 2008) emerge, that form the base for value co-creation exchanges between different legal bodies termed service systems (Poels, 2010).

A common thread surrounding these ecosystems is the notion of value creation, where the locus of value creation, is no longer perceived to reside within enterprises boundaries, but is considered to be co-created upon the mutual exchange of operant resources (knowledge and skills) between the various actors engaged in the network (Nenonen and Storbaka, 2010).

According to this logic, which can be described as Service-Dominant Logic (SDL) (Poels, 2010); customers and involved intermediaries are always co-producers of services and co-creators of value, because they mobilize knowledge and other resources in the service process and this effort influences the success of the value proposition (Ordanini and Pasini, 2008).

Thereby, this new logic of value co-creation which can be interpreted as the focal point of "service science"; necessitates a corresponding change in the concepts, tools and models used to depict value creation (Poels, 2010). Whereas from the technical perspective SOA and Web services leverage the technical value of solutions in the areas of distributed systems and cross-enterprise integration; from a business perspective, there is a need to understand how value is created through services; well as to manage the mobilization of resources that maximize value (Cardoso *et al*., 2009a; 2010).

This challenge motivated this paper, in which we explore the development of a classification framework for the resources that service systems mobilize to engage in value co-creation. The framework presented in this paper is based on existing, well-established theoretical concepts on services, service science and resource-based theory of the firm. In addition, it represents a first version of a design artifact that will be applied in a real-world context to evaluate its utility in further research. The contribution of this work is twofold. Firstly, the proposed framework can support decision making for prioritization of resources into new and existing services. Secondly, by combining our classification framework with an industry – neutral service description language, semi-structured information is provided for translating high level business objectives into service-level objectives (i.e. decision on the proper mix of valuable resources for a given service).

The remainder of the paper has been organized in the following way. First, we briefly elaborate on the underlying concepts that constitute service science. Second, the main perspectives of the resource-based theory of the firm are discussed. Third, both views will be merged into a conceptual framework that represents the resources that service systems mobilize to engage in value co-creation. Fourth we briefly represent how our conceptual framework can be combined with an industry-neutral service description

language to support the management of the full service lifecycle. Finally, conclusions and directions for future research are provided.

2. Brief Review on Service Science

In recent years service-orientation has increasingly been debated both in research and practice. While some researchers advocate a paradigm shift towards services as the basic unit of exchange in economies (Vargo and Lusch, 2004; 2008a), many enterprises struggle to efficiently provide the right business services to their customers. The transition from a goods-based to a service-based economy applies in both business-to-business (e.g. IBM, GE, Rolls Royce) and business-to-consumers enterprises (e.g. Lowe's Kodak and Apple) (Vargo and Lusch, 2008a; Ng and Maull, 2009). In line with this trend, firms can no longer depend only on internal capabilities to meet external needs. Instead they are forced to engage and co-create in a dynamic fashion with everyone, being partner, competitor, educator, government unit and most of all customers (Stathel *et al*., 2008). These constellations, often described as service ecosystems or business value networks (Scheithauer *et al*., 2008), form the base for service co-production and value co-creation as actors involved exchange mutually beneficial resources such as knowledge and skills (Ordanini and Pasini, 2008).

The locus of value creation within these ecosystems has been the focal point of an emerging and interdisciplinary discipline termed "service science" (Poels, 2010). The latter view these networks as dynamic service systems, which work together to achieve mutual benefit (value co-creation). Maglio *et al*., (2009), further elaborate on the notion of service systems by abstracting them as configuration of resources (including people, information, and technology), which are connected to other service systems by value propositions. As the creation of value constitutes the central process of any economic exchange, Vargo *et al*., (2008) view "service" (in the singular) as the fundamental unit of exchange and elucidate it as the application of competences (such as knowledge and skills) by one party for the benefit of another. Eventually then, service science is the study of the utilization of the resources of one service system, for the benefit of another in the context of service-for-service exchange.

In this new logic of marketing theory, described as Service-Dominant Logic (SDL) by Vargo and Lusch, (2004; 2008a), value is fundamentally derived and determined in use; that is the integration and application of mutually beneficial resources for improving the adaptability, survivability and well-being of all the service systems engaged in the value proposition. In essence, this view, stands in contrast with the Goods-Dominant Logic (GDL), in which goods (tangible outputs embedded with value) are the focus of economic exchanges and services are merely seen as an enhancement to goods (Vargo and Lusch, 2008b).

Nevertheless, as a consequence of the increasing interest in services (Bergholtz *et al*., 2010), several attempts aim to define and characterize services by identifying their properties; including intangibility, inseparability, heterogeneity, and perishability

(Zeithaml *et al*., 1985). These properties, collectively referred to as IHIP (Lovelock and Gummesson, 2004), have been criticized by Edvardsson *et al*., (2005) as problematic; since they interpret service as a category of market offering and not as a perspective on value co-creation.

Therefore, it has been suggested by Edvardsson *et al*., (2005) to stop searching for properties and characteristics that uniquely define services, and instead view services as perspectives on the use and offering of resources. In turn, Bergholtz *et al*., (2010) further elaborated this argument and proposed that a service offering, may range from providing access to existing agents' resources, towards providing access to combined resources that form the outcome of a co-creation process.

Summarizing, the focus in service research is shifted from the internal characteristics of services to the context of use and exchange of resources that form the base for value co-creation.

With this overview on service science, we discussed the first requirements and concepts for our conceptual framework. In the next section we will continue this discussion by addressing the literature on resources.

3. Theoretical Background on resources

Taking inspiration from the importance accorded resources in the emergent service-dominant logic, researchers may begin to think of firms and their partners as deploying operand and operant resources both to co-create legitimated market spaces and provide inputs for value creation and delivery within them (Arnould, 2008). These spaces in turn, may range from the Internet to industry clusters, and traditional retail infrastructures (Spohrer, *et al*., 2007). From a marketing perspective, research should focus on the intangible, dynamic resources that form the heart of competitive advantage and performance (Madhavaram and Hunt, 2008).

Several literatures present themselves for developing a resource-centered theory, within the Service-Dominant logic. One source is the resource-based theory of the firm that shares with the S-D perspective an interest in the strategic value of firm's skills knowledge and cultural competencies. This literature suggests that firms can be viewed as combiners of heterogeneous resources distributed across firms, with these distributions to remain relatively stable over time, thereby conveying a superior ability for firms to generate sustainable competitive advantage (Arnould, 2008).

We will briefly discuss the resource-based view literature in the following, after addressing what constitutes a "resource".

Resources have been acknowledged at the heart of the competitive advantage and performance of an entrepreneurial firm in creating new business by managing the firm and its innovations (Seppanen and Makinen, 2010).

Until recently, firm resources were viewed as the factors of production, that is, tangibles such as land, labor and capital (Madhavaram and Hunt 2008). However, as noted by Madhavaram and Hunt (2008), it was not until Penrose's work in 1959 that the resource-based view was formed for business strategy; and consciously, the term "factor of production" was avoided. Penrose's work viewed the firm as a collection of productive and intangible resources and led Barney (1991), three decades later, to define firms resources as "all assets, capabilities, organizational processes, firm attributes, information, skills, knowledge, etc., controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness in some market segment(s) (Barney and Clark, 2007; Madhavaram and Hunt, 2008).

In turn, the resource-advantage theory of the firm combined the heterogeneous demand theory with the resource-based theory of the firm and viewed resources as the heterogeneous imperfectly mobile entities that firms combine in order to fulfill customers' needs, wants and preferences (Seppanen and Makinen, 2010).

We may conclude that resources, in general conception, can be considered as the entities that contribute to the value generating processes of the firm and are more or less directly, under the control of the firm itself; as noted by Madhavaram and Hunt (2008) and Seppanen and Makinen (2010).

Regarding resource categories, Chatterjee (1990) divided resources into physical and intangible resources. According to him, physical resources contain resources such as plants, equipment, land, and distribution channels whereas intangible resources contain resources such as marketing skills, innovating skills and management know-how. Barney (1991), in turn, differentiated resources into physical capital, human capital and organizational capital. The three categories of Barney (1991), were adopted also by Grant (1991), who suggested two additional resource types; financial and technological.

Constantin and Lusch (1994), classified resources as operand and operant resources, in which the former are resources on which an operation or an act is performed to produce an effect, and the latter are employed to act on operand resources and/or other operant resources. As Hunt (2004), notes, while operand resources are typically physical (e.g., raw materials), operant resources are typically human (e.g., the skills and knowledge of individual employees), organizational (e.g., controls, cultures and routines), informational (e.g., knowledge about market segments, competitors, and technology), and relational (e.g., relationships with suppliers and customers).

Finally, Madhavaram and Hunt (2008), extended Barney's work by providing a more finely grained view that categorizes resources as financial (e.g., cash resources and access to financial markets), physical (e.g., plant and equipment), legal (e.g., trademarks and licenses), human (e.g., the skills and knowledge of individual employees), organizational (e.g., competences, controls, policies and culture),

informational (e.g., knowledge from consumer and competitive intelligence), and relational (e.g., relationships with suppliers and customers).

We may conclude that resource categories in general conceptualization can be classified as either operand or operant resources as noted by Madhavaram and Hunt (2008).

Several researchers have suggested that resources can be arranged in a hierarchical fashion, building on the resource-advantage theory's notion of basic resources and higher-order resources (Grant, 1991; Hunt, 2004; Seppanen and Makinen, 2007; Madhavaram and Hunt, 2008; Seppanen and Makinen, 2010). For example, as Seppanen and Makinen (2010) claim; competences or capabilities are higher-order resources because they are bundles of basic resources.

In order to shed light on the hierarchical arrangement of resources and discuss their importance Madhavaram and Hunt (2008) proposed a hierarchy of operant resources. Starting from the seven basic resource categories (financial, physical, legal, human, organizational, informational and relational), they suggest basic, composite and interconnected operant resources as the hierarchy. We will further discuss the proposed hierarchy in the next section, as the latter constitutes a fundamental pillar in our framework.

4. Our Conceptual Framework

Based on the literature discussed above, our research aims on exploring value co-creation in a service system that owns key internal (operand and operant) resources and integrates them with resources of other service systems. The service system in turn acting as provider, may provide access to the co-creation assets through service offerings.

For creating our framework, we use an adapted hierarchy of resources recently proposed by Madhavaram and Hunt (2008), and combine it with the suggestion on viewing services as perspectives of using and offering resources (Edvardsson, *et al.*, 2005; Bergholtz, *et al.*, 2010).

Reasons for selecting these particular starting points is that they essentially include most of the resources identified in the earlier research considering resource-based theory of the firm (e.g. Barney, 1991; Grant, 1991; Constantin and Lusch, 1994; Madhavaram and Hunt, 2008), well as the fundamental resources that constitute a service system (Maglio *et al.*, 2009).

In correspondence with Madhavaram and Hunt (2008), our framework proposes that there exist three classes of resources that service systems may integrate in a value co-creation process: (1) atomic, (2) bundle, and (3) composite class of resources.

Atomic resources refer to building blocks upon which all other categories can be hierarchically classified. The list of atomic resources includes the physical, financial, organizational, relational, human, informational, and legal resources that enable a service system to produce efficiently and/or effectively a service offering that has value for some market segment(s). Therefore, atomic resources may be viewed as the underlying, lower-level, resources that form the "building blocks" of higher-order resources.

It is important to note that a service system may own these basic resources, or it may act as a custody owner of them. In either case these resources are the fundamental resources that a service system mobilizes (either in isolation or collectively) to create a service offering.

Bundle resources refer to the combination of two or more basic resources that are owned by different service systems and experience no functional dependency among each other. In other words these resources are combined to collectively enable a service system to produce efficiently and/or effectively service offerings with greater market value. For example, a car repair shop might offer to exchange windshield wipers (external resource) for free with every premium servicing. Thereby, rendering these resources in isolation will generate the same market value.

Composite resources are similar to bundle resources, but with functional dependency among its constituent basic resources. We define composite resources as a combination of two or more basic resources that are owned by different service systems and manifest functional dependencies among each other. Thereby, composite level resources are higher-order resources and cannot simply be recreated by rendering the individual parts independently. Consider for example an airline that provides air transport services using its own resources, while outsources the cargo handling services to an external partner. Failure of the partner to ensure that the cargo items are correctly manifested and loaded to the right flight will result in failure of the airline service system. Thus, like bundle resources; composite have positive effects for the market value of the service offering. However, the functional dependency among its parts influence and reinforce the value of the service offering.

By proposing a hierarchy for classifying the resources that service systems integrate for value co-creation, we are in position to argue about the strategic importance of these classes. From a resource-based theory (Arnould, 2008) a firms comparative advantage in resources can provide a competitive advantage in the marketplace. Thus, as service systems go up the hierarchy and integrate higher-order resources, there is increased: (1) knowledge creation capability and/or sustainability of competitive advantage, (2) market responsiveness and/or new service development, (3) cost and/or risk of acquisition of resources, (4) cost and/or risk of development of resources, (5) commitment on external service systems resources.

We may now summarize our proposed hierarchy and the corresponding strategic implications in table 1.

Table 1 Hierarchical class and corresponding strategic implications

Hierarchical Class	Interpretation	Strategic Implications
Atomic	The basic building blocks for higher order resources. The list includes operand and operant resources that enable a service system to produce a service offering	Either owned or custodial ownership Mobilized in isolation or collectively to produce a service offering Difficult to sustain competitive advantage
Bundle	A combination of two or more basic resources that collectively enable the service system to produce efficiently and/or effectively a service offering. Resources experience no functional dependency	Resources are combined solely to achieve greater market value Rendering the resources in isolation will achieve the same market value Slightly increased levels to sustain competitive advantage
Composite	A combination of two or more basic resources that collectively enable the service system to produce efficiently and/or effectively a service offering. Resources manifest functional dependency among each other	Resources are combined to achieve greater functional value which results in increased levels of sustainability of competitive advantage Increased market responsiveness Increased knowledge creation capability and/or new service development Increased cost and/or risk from dependency on external resources

As discussed earlier, integration of internal and external resources forms the essence of value co-creation, as expressed in the context of service-for-service exchange. Therefore, we may interpret value co-creation as a function of: (a) the class of resources that service systems integrate in the enhancement of existing services, or the development of new ones; and (b) the type of the co-creation asset that is exposed in the ecosystem through service offerings. These assets may range from current commodity resources (best practices) already owned by the service system, to new

knowledge capability resources (new knowledge) acquired and/or co-produced with other service systems.

Synthesizing the above concepts led to the development of our conceptual framework, called Service Classification Model as shown in Fig. 1.

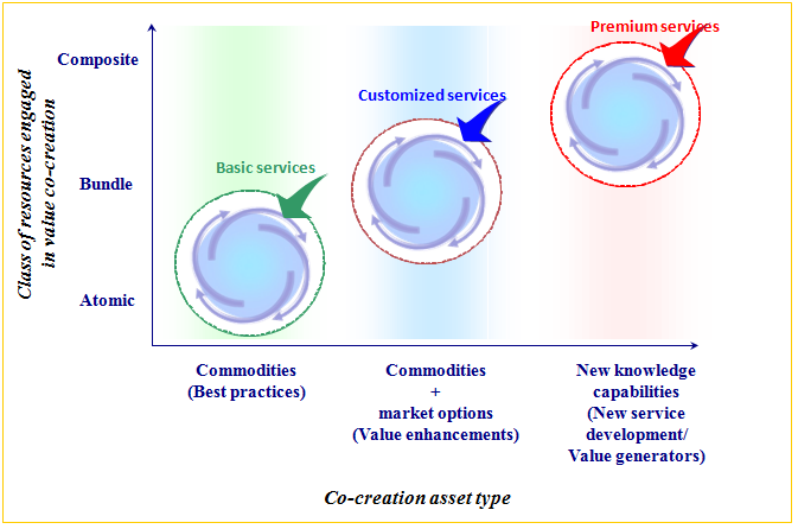

Fig. 1 Our Service Classification Model

This model allows us in turn to create rich value propositions for the chosen type of service system (the provider), by delineating the following levels of service offerings:

i. Basic services – these are standardized services that encapsulate commodity resources (generic – or industry-specific) either owned by the service system, or provided through custodial ownership. External service systems participation is limited and is provided on an ad-hoc basis. Service systems that provide these offerings may experience difficulties to sustain their competitive advantage

ii. Customized services – these are configurable services that provide a wide menu of market options offered by the provider. External service systems participate in the value co-creation process; however no functional dependency is experienced between the integrated resources. The latter are only combined for collectively increasing the market value of the service offering. From a strategic perspective, customized services may increase the ability of a service system to sustain its competitive advantage; well as to enable new syntheses of market options, through different mobilization of resources

iii. Premium services – these are highly customizable and user-driven services. External service systems participate in the value co-creation process and integrated resources manifest functional dependencies among each other.

Services of this level may significantly expand knowledge capabilities and lead to the development of new services. A service system that provides premium services, may in turn exploit the sustainability of its competitive advantage and improve its market responsiveness. However, it must concurrently, mitigate the cost and/or risk on depending on external resources for avoiding failures

Based on these service levels, a service system can decide on the desire mix of innovative (but costly) and commoditized (but easily imitated) services that it will offer. Balancing thereby the proper mix of resources becomes a strategic decision for the profile of any offered service. In essence, a service system may potentially reclassify its service offerings (upwards or downwards), terminating or even develop new services, after anticipating the cost and/or risk of depending on external resources.

5. Managing the Service Lifecycle

Our proposed classification framework highlights the importance of integrating internal and external resources for value co-creation while concurrently provides support for the prioritization of resources into new and existing services. Equally important however, is to understand how the value co-creation process can be managed within a service system.

Spohrer *et al*., (2007) further expand this argument and claim that the ability of a service system to integrate resources and jointly co-create value is constrained by the need for a common form of language or standard encoding of information for enabling coordination and governance. Without some form of standard encoding service systems would find coordination difficult, leading to miss opportunities for innovation or efficiency gains.

As service-oriented Architectures (SOA) and web services leverage the technical value of solutions in the areas of distributed systems and cross-enterprise integration, the emergence of service ecosystems is driving the need to describe services not only from their technical nature, but also from their business nature as the latter leverages the true value of services (Cardoso *et al*., 2009a; 2010). While many Web services externalize business functionalities, existing specification languages, such as WSDL and BPEL, only target the description of technical characteristics of services. Currently, there is neither a unique, nor a sound standard for the precise description of services (Scheithauer *et al*., 2008). Especially for service ecosystems such a formal description will enable to abstract from the multitude of services and provide a tangible artifact that can be compared against other artifacts.

The need for a formalized description has been also highlighted as fundamental by Rosemann *et al*., (2009) when they proposed “Business Service Management” as the business discipline dedicated to the holistic management of services in an

organization to ensure the alignment between the needs of the customer and the objectives of the organization. Kohlborn *et al*., (2009) proposed a service lifecycle management framework that we aim to adopt for the purpose of our research.

Our service lifecycle management framework is depicted in Fig. 2 and constitutes four key phases of service development – from service analysis to service operation.

Fig. 2. Our Service Lifecycle Management Framework

The Service Analysis phase captures all activities required for the identification and contextualization of the service. Service analysis can be driven by market requirements and/or by various internal needs. Hence the proposal for a service development has to be analyzed and decomposed to identify which resources need to be outsourced and insourced from the service ecosystem. Eventually a decision is made on whether to implement the service or not. Service Analysis as a perceptual perspective results in an abstract ontology that will be used to drive the service design phase. In the Service Design phase, the perceptual service design is translated into a more detailed conceptual model of the service that can act as an appropriate specification for the actual development of the service. Hence more detailed resource requirements have to be captured and a blueprint depicting the dependencies between the resources is elaborated. During the Service Instantiation phase, the service is ready to become operational and all activities concerned with the determination of access rights, costs, pricing models and sanctions in case Service Level Agreements are not obeyed are formed under contractual agreements. Finally during the Service Operation phase, the service is in operation, actively consumed and provided.

Depending on their background, skills and mindsets, stakeholders involved in a service lifecycle tend to use different structures to define information. For example, business managers that view services from a perceptual perspective tend to use unstructured data to describe future strategies, such as Porter's Five Forces model, SWOT-analysis, BCG Matrix and others. On the other hand, business architects that view services from a conceptual perspective usually rely on structured information to describe formal models such as UML activity/class diagrams, BPMN, SoaML and others. It is clear that unstructured information drives numerous business processes but often, organizations cannot leverage this information efficiently through all the stages of the service lifecycle. Thereby, organizations may experience inconsistent communications, duplication of effort, poor decision-making and higher costs.

For bridging the perceptual and conceptual perspectives in a service lifecycle, a coarse grained standard for service description is required in order to express a higher-level of information (Bottcher and Fahnrich, 2009). Such a modeling standard

recently emerged from a SAP-led research project on modeling generic business services, by utilizing a common meta-model. The proposed description framework is termed (Unified Service Description Language) – USDL (Cardoso *et al*., 2009b; 2010) and Fig. 3 below depicts the unified meta-model. In this preliminary phase of our research we are exploring the usage of USDL (current version 3.0) as a coarse grained meta-model for describing the resources that service systems integrate in value co-creation. Such a semi-structured information format will enable to reduce the ambiguity and interpretation space that exists when using natural languages for describing resources and subsequently the right form of information will be leveraged in all the phases of the service lifecycle.

It is important to note that we intentionally selected USDL against other business-oriented description frameworks; like those proposed by Scheithauer *et al*., (2008) and Bottcher and Fahnrich (2009) as USDL is currently under standardization process from the W3C consortium as a generic standard for modeling services.

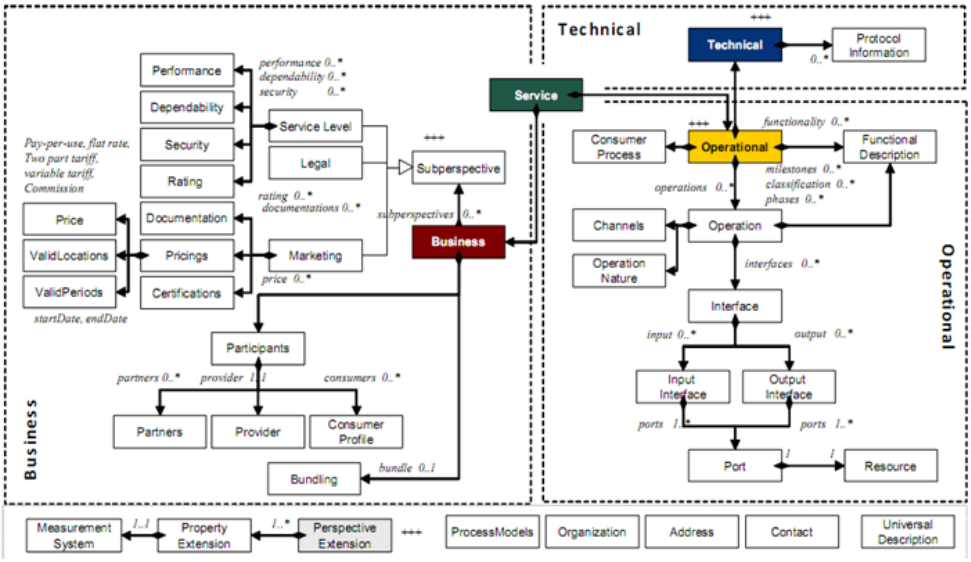

Fig. 3. USDL V3.0 Formal Meta-Model

6. Conclusions and Future Research

In this paper we have argued that the ongoing dissemination of the service-based view in organizations necessitates a corresponding focus on the operand and operant resources that these organizations; termed "service systems", integrate as the essence of value co-creation. Under this logic, services can be viewed as perspectives on using and offering access to these resources. We have proposed a framework for classifying the resources that service systems integrate in various levels of service offerings, and we combined the framework with an industry-neutral service description language for formally representing the resources that service systems integrate in value co-creation. Reasons for doing so were to leverage semi-structured information about embedded resources in all the phases of the service lifecycle, and thus improve coordination and

management of the latter. Our work; even in this preliminary phase supports decision making for prioritization of resources into new and existing services. Additionally, by elaborating on a coarse grained modeling standard, adequate information is provided for the business manager in order to translate high level business objectives into service-level objectives (i.e. decision on the proper mix of valuable resources for a given service).

Based on the characteristics of our conceptual framework presented in this paper, several directions for further research have been identified. Firstly, our framework as a design artifact needs to be embedded in a real-world context to test its utility. Initial discussions with collaborating SMEs for a potential application are encouraging. Secondly, our framework needs to be extended and/or enhanced with a methodology for generating potential business models for each specific service offering. Such a methodology will further support decision making in terms of prioritization of resources into new or existing services. Finally, we aim to combine our framework with modern portfolio theory (MPT) for managing the overall risk of a service system's portfolio of resources. That is to choose a couple of resources with appropriate risk/return ratios for each potential service offering.

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