

THE SERVICE-ORIENTED ENTERPRISE

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Abstract

Today's organizations are changing with respect to both structure and internal working processes. As a consequence of trends such as globalization, deregulation and highly volatile markets, corporations are forced to increase their responsiveness to temporary requirements or business opportunities. Most existing organizational theories do not apply to the emerging sort of enterprise which incorporates principles such as structural decentralization, loose coupling of autonomously acting business units as well as complexity hiding on the basis of uniform interfaces. This work briefly elaborates on the concept of Service-Oriented Architecture (SOA) in the field of information technology and proposes a first approach to mapping its major underlying principles to upcoming forms of organizations. We present a model of the Service-Oriented Enterprise (SOE) and leverage use cases of existing companies as well as recent theoretical approaches to demonstrate the analogy between state-of-the-art paradigms in the fields of both technology and organizational theory.

Keywords

service-oriented architecture, networked enterprise, service-oriented enterprise, transaction cost theory, institutional economics

INTRODUCTION

Today's organizations are changing with respect to both structure and working processes. The corporation Li & Fung (www.lifung.com) for example, concentrates on performing mere business process management for its clients and has given up traditional research, development or production tasks which they pursued before. Instead, the firm provides sourcing solutions to customers worldwide by composing and coordinating different suppliers which are specialists in their respective domains. Increasing specialization and structural decentralization are only two of numerous characteristics that emerging organizations expose. As argued in the following chapters, both the significant decrease of transaction costs due to modern information and communication technologies and the change of institutional frameworks can be quoted as enablers of this recent development.

According to (Scherer, 2002), organizational theories enable to explain and understand the

emergence, the existence and the functionality of organizations. Therefore they either implicitly or explicitly serve the improvement of organizational practice. Most existing organizational theories do not apply to the above described emerging sort of enterprise which incorporates principles such as structural decentralization, loose coupling of autonomously acting business units as well as complexity hiding on the basis of uniform interfaces. For this reason, it is necessary to consider developing a new perspective on the organizational phenomenon.

The hypothesis underlying this work is that certain principles stemming from the field of information technology can be leveraged for analyzing upcoming forms of organizations. Especially Service-Oriented Architectures (SOAs) promise to be an adequate groundwork for explaining and understanding the emergence, existence and functionality of such organizations. To have a solid basis for the examination of this hypothesis available, the first step is to define Service-Oriented Architectures

as well as its key principles. Subsequently, a brief historical overview of existing organizational theories is provided to investigate their varying scope, granularity and fundamental assumptions. We then present a novel perspective on organizations that incorporates SOA key principles. We thereby leverage real-world use cases of existing companies as well as recent theoretical approaches to demonstrate the analogy between state-of-the-art paradigms in the fields of both technology and organizational theory. Organizational decentralization, operational agility through loose coupling and composition and coordination of reusable building blocks are the three central dimensions of this analysis.

Since the late 1990s, many definitions of SOA have been published (Frost, 1998; Alonso et. al., 2004). The normative OASIS Reference Model for SOA (MacKenzie, 2007) defines SOA as "...a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations". According to this model, the major components of a basic SOA and their possible interactions are: a service provider publishes his service interface via a service registry where a service requester can find the service and subsequently may bind to the service provider.

The SOA Reference Model assumes the existence of services which provide access to capabilities by well-defined interfaces to be exercised following a service contract with constraints and policies. This enables a loose coupling of services (thereby minimizing mutual dependencies) and complies with some of the probably most-known principles in software-engineering, information-hiding and modularization (Parnas, 1972). Services are provided by entities, the service provider, and are to be used by others, the service consumers. Services may be composed on the basis of other, existing services, thereby adhering to the principle of reuse. They are autonomous (solely control the logic they encapsulate) and are uniformly described and

publicly retrievable via certain discovery mechanisms.

Coordination refers to the definition of a certain sequence of service calls between two or more distant services. Service-Oriented also adheres to the principle of collaboration. Whole cross-organizational business processes can be setup on the basis of SOAs. Technical agility is achieved as a result of the loose coupling of different services. SOAs are explicitly designed for change and enable its users to build or modify applications in a fraction of the time required when using traditional concepts of software design. Last, decentralized ownership and control is central to the SOA philosophy. The encapsulation of applications with the help of uniform interfaces allows owners of the different services to change internal operations according to their hearts' desire while avoiding any interference with the consumers' implementations.

The remainder of this work is structured as follows: Chapter two briefly presents some of the most widely known early organizational theories and also motivates the need for a new perspective on human organizations. Chapter three leverages the key principles underlying the SOA philosophy and demonstrates their analogy to the characteristics of emerging organizations. Chapter four closes this work with a brief summary and an outlook on current trends.

TRADITIONAL ORGANIZATIONAL THEORIES AND THE NEED FOR A NEW SERVICE-ORIENTED PERSPECTIVE

Before elaborating on a novel, service-oriented paradigm for organizations, we briefly present the early evolution of organizational theories. Figure 1 provides an overview of this evolution which starts with Weber's (Weber, 1922) bureaucracy model and leads to the scientific management era, with Taylor's Scientific Management (Taylor, 1911) as the peak of this movement. Representatives of this strictly rational approach believed organizations could be optimized and productivity increased solely on the basis of changes in workflows or compensation systems.



Figure 1: Early Evolution of Organizational Theories

Weber promoted a rational-legal understanding of authority, clear definition of tasks and scope of authority as well as clear career paths and competence-based promotion of individual members of an organization. Taylor's approach ("Scientific Management") mainly aims at increasing operational efficiency and proposes to organize human tasks similar to the ones of machines. Fayol's Administrative Management (Fayol, 1917) approach is related as it assumes that general rational principles exist which can be used to improve efficiency in all different companies.

Subsequently, socio-psychological reasoning was introduced as a consequence of the Hawthorne studies. This Human Relations Management movement (Mayo, 1933; Roethlisberger and Dickson, 1939) focused more on individual motivation and the fulfillment of the goals of participants of an organization. Barnard's Acceptance Theory of Management (Barnard, 1938) also considered the individuals' attitudes important for organizations to function properly and regarded efficiency as the degree to which individual needs are met. According to Barnard, authority requires acceptance of subordinates. Simon finally promoted the Administrative Behavior Theory (Simon, 1947) which provides an analysis of human decision-making processes. According to Simon, individual actions and decisions underlie two main principles, the "Bounded Rationality" and "Satisficing". He states that mostly individuals are only partly rational and are subject to manifold emotional influences with respect to a significant part of their decisions.

After World War II and the work of Simon, the focus of organizational theories shifted again as the interest in rational and quantitative methods in management sciences increased and System Theory (von Bertalanffy, 1950) emerged. Scott

(Scott, 1961) was one of the first to apply System Theory to the organizational phenomenon. He regarded a system as an organized, unitary whole composed of two or more inter-dependent parts, components, or subsystems and delineated by identifiable boundaries from its environmental supra-system. Scientists investigated the interrelationships of organizational components and also classified organizations as either open (interact with and depend on their environments) or closed (exist independently from the environment). The Contingency Theory was developed in the 1960s and assumed that organizations were heavily impacted by external "Contingency Factors" (Burns and Stalker, 1961; Lawrence et. al., 1967). The Theory of Institutions (North, 1990) represents a more recent approach and tries to explain how institutions and institutional change affect the performance of organizations. The reason for institutions to exist, North argues, is the uncertainties involved in human interaction; they act as constraints and framework to structure that interaction and make it more reliable. According to North, the proper establishment and application of informal constraints, formal rules and enforcement are adequate to lower transactions costs and boost organizational performance. Population Ecology (Aldrich, 1979) and Resource Dependence (Pfeffer and Salancik, 1978) represent further existing theories, but are not described in detail due to space constraints.

None of the above presented theories comprehensively accounts for organizational structures and individual interaction as they can be observed in emerging forms of organizations. Many of them consider organizations to be unitary wholes that expose stable and hierarchical structures and communication paths. In most cases, they also rely on specific

perspectives that only tackle part of the organizational phenomenon. The bureaucracy theory, for example, focuses on structural issues, while the Human Relations Movement concentrates on individual interaction and motivation as driver of an organization. The following chapter is devoted to leveraging the key principles underlying the SOA philosophy and demonstrates their analogy to the characteristics of novel organizations. We thereby leverage the above mentioned set of SOA-principles to thoroughly describe a new and generally applicable model of the Service-Oriented Enterprise.

THE SERVICE-ORIENTED ENTERPRISE

This chapter elaborates on the analogy between the key principles that underlie service-orientation in the fields of information technology and human organizations. We thereby focus on decentralization, agility as well as composition and coordination of building blocks as major characteristics of our first model describing the Service-Oriented Enterprise.

Decentralization

Decentralized ownership and control are central to the SOA philosophy. Instead of establishing a central control instance, SOAs comprise a number of decentrally organized services that may collaborate according to previously negotiated service contracts but still run autonomously.

Hagel and Singer investigate the decentralization of organizational structures in their article "Unbundling the Corporation" (Hagel and Singer, 1999). They first of all consider companies as consisting of three major businesses: a customer relationship business (CRM), a product innovation business and an infrastructure business. Traditional theories argue that the coordination of customers, innovation, and infrastructure must be combined within on single company. "If those activities were dispersed to separate companies, the thinking goes, the interaction costs required to coordinate them would be too great" (Hagel and Singer, 1999). The large vertically oriented organizations that emerged during the 1970s were compliant to this assumption. Three facts are quoted as reasons for the recent trend to rethink this theory and consider unbundling the three core functions:

First, globalization has increased the number of small and extremely flexible competitors, thus forcing large organizations to identify ways for increasing their responsiveness to changing business needs.

Second, state-of-the-art technologies have lowered general transaction costs in a way that the efficient coordination of decentral business units has become reality.

Third, the three core functions naturally follow different goals and may even impede each other. A study of a Regional Bell Operating Company (RBOC) is provided to demonstrate the disadvantage of integrating the three core functions in one enterprise. To avoid endangering the revenues of its CRM business, the infrastructure-related units were not allowed to serve external customers and thus were detained from growing their individual business. The authors thus recommend the incorporation of SOA-principles and to foster the unbundling of business units. By concentrating on their core activities and by acting without being required to know and to take into account the need of related other units, these business units are supposed to perform better.

In the field of information technology, especially company-internal SOAs often comprise a central integration layer which is often referred to as Enterprise Service Bus (ESB). The introduction of an ESB avoids the emergence of an uncontrollable mesh of point-to-point connections, with custom-built application interfaces at both ends. In a SOA, all services are plugged into this intermediary that acts as an information highway for exchanged messages. This support layer for decentral coordination of autonomously acting services can also be mapped to the organizational context. Bieberstein et al. (Bieberstein et. al., 2005) propose the introduction of a Human Service Bus (HSB) that may perform tasks analogous to those executed by the ESB. Activities of single employees are structured as either team services, departmental services, business unit services, divisional services or group services which can be differentiated with respect to scope and strategy. Similar to the ESB in the technical domain, the HSB supports the collaboration of decentral and autonomous services by providing an integration layer. The Bus provides the infrastructure to formally advertise team services and offers workflow tools to support and plan

joint activities and coordination across services (and teams) and also allows for early crisis detection.

In terms of the individuals' interaction, another important dimension of organizational science, decentralization and thus the movement away from central authority as driver of individual behavior has been identified as one of the major consequences of organizational decentralization (Galbraith, 2000). Employees are expected to focus on and interact with the customer rather than align with the corporate hierarchy.

Performance benchmarking with other units is considered as important part of the decentralization strategy as well. Each unit can be assigned a certain profit-and loss measure and also has competitors with which it can be compared. This change in human interaction may represent a challenge for the individual employee who needs to incorporate a completely new thinking. He or she is no more part of a large static hierarchy with clear task assignment but rather owns the business and takes over more responsibility. Along with the responsibility may also come more stress and pressure to continuously adapt the behavior to new requirements and continue learning. Galbraith also identifies a different sense of social reality for the individual members of heavily decentralized organizations as humans are more influenced by their peers and horizontal communication is fostered, thus leading to an intense sense of community and social connectedness to the organization.

In his article "Making the Decision to Decentralize" (Malone, 2007), Malone presents the so-called decentralization continuum that spans from centralized organizations over loose hierarchies and democracies to markets. This continuum differentiates between four specific forms of decentralization. He also elaborates on the advantages and drawbacks of each of them and presents a framework for managers supporting them in the decision on which form of organization to adopt. All concepts are also compared with regard to the criteria communication costs, individualization, potential for conflict resolution and autonomy, creativity and motivation. The four differently decentralized forms of organizations vary in particular with respect to the decision-making processes they incorporate. In centralized organizations, important decisions are made by

few central individuals. In case of a loose hierarchy, decision power is delegated further down in the hierarchy and more individuals take over more responsibility. Democracies expose an even higher degree of decentralization as employees are envisioned to either directly vote in case decisions have to be made or vote for a manager to make a decision on behalf of them. Markets finally reduce decision making to a simple and fast process that is performed only between two parties – a buyer and a seller. Organizations that are structured according to this approach represent the most decentralized forms thinkable. Single stakeholders are not bound to any decision they didn't agree with beforehand but are also self-dependent and responsible for what they do as any central instance is absent. Malone stresses the importance of legal frameworks and rules to allow for such organizational forms to work: Markets need legal frameworks to resolve disputes between buyers and sellers, and they need regulatory systems to prevent activities (like pollution, price fixing, misleading accounting, or deceptive advertising) that make the whole market less efficient.

Agility Through Loose Coupling

Besides decentralization, one more principle that stems from the SOA-concept can be observed at numerous emerging forms of organizations. The hiding of complexity and information via uniform interfaces with the goal to achieve high operational agility represents a key characteristic especially in the field of inter-organizational supply chains. Customers tend to negotiate with their various suppliers only certain performance parameters such as the time of delivery, amount as well as characteristics of the desired part of a product. The exact means used for fulfilling Service-Level Agreements (SLAs) established beforehand are not relevant from the customer's perspective. Rather than trying to micromanage production processes and to monitor every detail, firms are enabled to only take care of the relevant parameters and thus leave space for individuality and specialization of their various suppliers. With the help of complexity-hiding through uniform interfaces, operational agility can also be significantly improved within corporate boundaries.

In the article "Beyond the Business Unit" (Eisenstat et. al., 2001), Eisenstat, Foote, Galbraith and Miller propose to treat organizations as a portfolio of reusable

resources and opportunities rather than a static composite of business units. The complexity and peculiarities of single resources are thereby encapsulated with the help of unified interfaces. The goal of such architecture is to bring the most useful resources to bear on the most promising opportunities.

The authors envision managers to “discover opportunities in key global accounts, tightly defined market segments, or tailored product solutions. To exploit such opportunities, these entrepreneurs, regardless of their positions in the corporation, are authorized to mobilize whatever resources they need, such as product experts to create an integrated solution or functional and industry specialists, from a variety of countries, to serve a key global account” (Eisenstat et. al., 2001). In this way, the responsiveness of organizations to changing environmental requirements can be heavily increased “without sacrificing the advantages of scale and scope.” This setup strides along with certain implications on the individuals’ way of working and interacting with each other. Careers, accountability, and decision-making processes are no more subject to static and formal structures but rather evolve dynamically and can be significantly influenced by individuals. Summing up, the authors envision organizations as markets of resources and opportunities where leaders are required to negotiate with owners of resources but also compete for resources with other projects and units, thus leading to a high degree of responsibility assigned to the single employee.

Composition and Coordination of Reusable Building Blocks

Besides decentralization and operational agility through loose coupling, the composition and coordination of reusable building blocks represents another major dimension of our model. The above mentioned, Hong Kong-based trading company Li & Fung can be cited as an excellent example for an organization that has incorporated this principle already. The firm imposes a choreography on the tasks necessary for the production of goods and thereby relies on a huge global network of highly focused providers to arrange for manufacturing, primarily on behalf of US and European clothiers. The firm has a vast global network of supplier companies available and can negotiate with each of them to deliver a certain part of the overall end product at a given point in time. The

knowledge about the individual capabilities of single suppliers and about the way to ensure their efficient and seamless collaboration represents Li & Fung’s key value proposition.

Operational agility is enabled by a broad and easily interchangeable spectrum of suppliers that allows for quickly modifying a whole supply chain. The company focuses on managing the interface between each specialist’s activities, monitors each single player’s performance and may substitute one specialist in case he does not comply with the agreements made beforehand. In this way, Li & Fung imposes a choreography on the numerous supplier services in order to make them assemble harmonic end-products. In other words, the business process management is the firm’s actual product. The company doesn’t create any tangible product but composes and coordinates dispersed production resources. To allow for this agile setup and modification of a whole supply chain, the single players must also incorporate the principle of information and complexity hiding as introduced above.

THE SERVICE-ORIENTED ENTERPRISE MODEL

Figure 2 on the next page summarizes these characteristics and depicts a first model of the envisioned Service-Oriented Enterprise (SOE): As an analogue to the above mentioned ESB, the Human Service Bus (Bieberstein et. al., 2005) allows for advertising human services within an enterprise and provides a means for workflow monitoring, early crisis detection and harmonized inter-service communications. Corporate structure and processes do not follow static hierarchies anymore, but consist of loosely coupled and flexibly composable services that interact according to a predefined service choreography. This setup allows for continuous change and adaptation to current business requirements. The gray boxes on the lowest level of this layer represent basic team services which can be composed to higher level departmental or even group services. These, in turn, follow a pre-defined but highly agile choreography to realize overall business processes. As a central prerequisite for operational agility, all services must be encapsulated by uniform interfaces. An additional business process management layer accounts for governance and control tasks: It

first of all allows managers to retrieve existing services and employees which can be assigned to service teams. It also enables to compose services and to define a service choreography

(service call sequence) on different service levels.

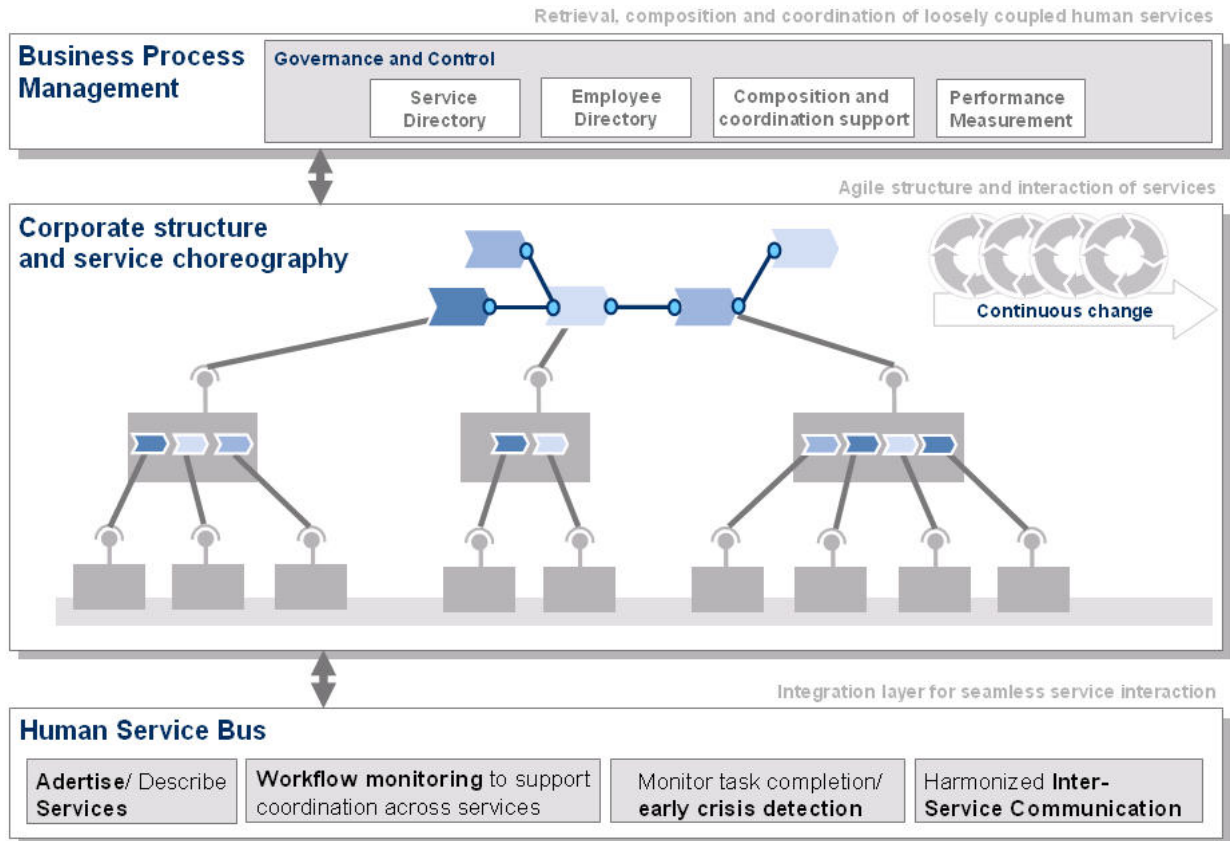


Figure 2. The Service-Oriented Enterprise

CONCLUSION

In this article, we have briefly elaborated on already existing organizational models and theories to motivate the need for a new perspective on recently emerging forms of human organizations. The three core SOA characteristics identified during the analysis of existing companies such as Li & Fung as well as cases described in research papers comprise organizational decentralization, agility through loose coupling and composition/ coordination of reusable building blocks. Finally, a model of the Service-Oriented Enterprise was presented.

Future work will be devoted to analyzing to which degree the application of this SOE model on organizations improves the alignment with

SOA-based IT landscapes that support human work.

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