Simulation for Supporting Business Engineering of Service Networks

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INTRODUCTION

Today, the services industry provides the majority of all jobs in Western countries, and services tend to be delivered more and more using the Internet. The service economy is becoming increasingly dominant in developed economies, with knowledge assets playing a great role relative to physical and financial assets. (Rouse & Baba, 2006)

Services are often characterized as intangible, perishable, experience-based, difficult-to-standardize products needing many interactions between customers and services providers. Grönroos (2001) identified three basic characteristics of services:

1. Services are processed consisting of activities or a series of activities rather than things.
2. Services are at least to some extent produced and consumed simultaneously.
3. The customer participates in the service delivery process.

All kinds of information and communication technology (ICT) are applied to support the creation of service networks. *Service networks* are constellations of independent organizations that work together in various configurations in order to deliver services. The provisioning of services can be viewed as a series of activities leading to some observable behavior between service providers (or service brokers) and service requesters. They are delivered using the Internet, accessible from any place at any time and often involve no direct human involvement of the service provider. The term *e-services* is typically used to describe a variety of electronic interactions ranging from basic services, such as the delivery of news and taking out an insurance policy, to more complex services, such as the delivery of context-aware, personalized services.

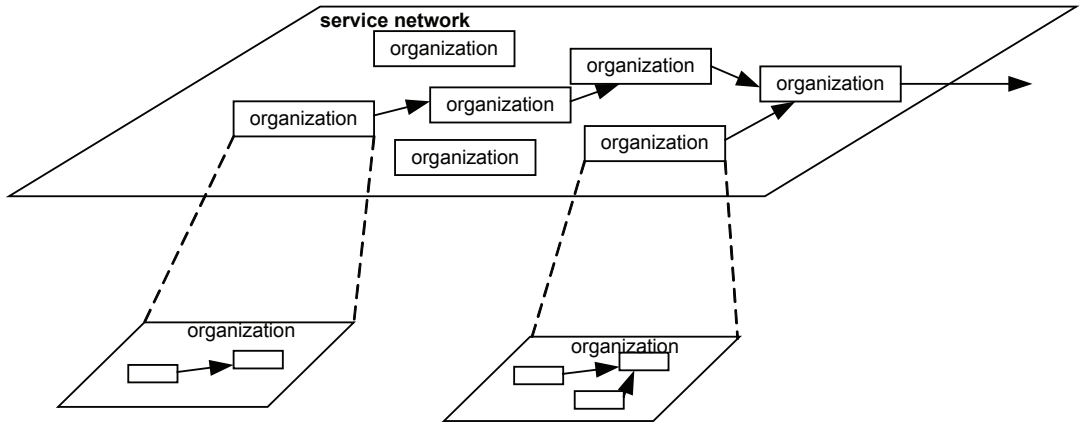
To understand a service network, both the network and the decision makers involved need to be understood. Stakeholder theory states that those who can effect change or be affected by it should be accounted for in the transformation process (Pfeffer, 1981). The diversity of key stakeholders and their interests makes evaluating the design and the efficiency and effectiveness of service networks very complex. Often stakeholders are characterized by opposing interests, having heterogeneous systems and being part of multiple service networks. The effective management of such services network is key to success, which requires understanding each other's interests, business processes, and information systems. Often organization network managers, a particular type of electronic intermediary (e-intermediary), specialize in coordinating such networks (Janssen & Verbraeck, 2005b). Design decisions are critical, as they determine the efficiency and effectiveness of the service networks. The development and growth of service networks requires the developer to carefully identify, evaluate, and understand the possible impact of the various design alternatives. A business engineering methodology can be of help in designing and developing service networks by providing insight into current network structure and potential structure, and by evaluating the implications of potential arrangements. Simulation can be used to compare the performance of the current and possible situations in a business engineering methodology. Simulation of service networks is much more difficult than physical networks, as the products often concerns intangibles. The *objective* of this article is to discuss research issues concerning the simulation of service networks to support business engineering.

BACKGROUND

Service networks can use a large variety of coordination mechanisms and structures to coordinate the activities of participants. Service networks consist of organizations cooperating together, and the management of the networks has a large impact on the total performance. Figure 1 shows a service network schematically.

The dynamic nature of service networks—that is, the changing number and/or types of partners, and the involvement in several networks—increases the difficulty and complexity to understand the dependencies in the network. The creation of flexible, temporary service networks results in the creation of business processes that are no longer self-contained within a single organization. The effectiveness of service networks depends more and more on the performance of external partners that are often unknown and viewed as black boxes (Tewoldeberhan & Janssen, 2007). Therefore,

Figure 1. Example of a service network



some organizations can be considered as white boxes and others as black boxes in the networks, as schematically depicted in Figure 1. Not all organizations must be involved in each service provisioning process. Organizations might be selected and dynamically assembled based on the services needed by the customers. A service network consists of multiple businesses having varying types of relationships.

The core of a service network is the *coordination* of the various interdependent activities performed by autonomous organizations. There are two opposing views on coordination. In a *coordination of tasks* approach, the design of processes is dependent on the coordination mechanisms that manage the dependencies between tasks (Malone & Crowston, 1994). The *coordination of commitments* approach emphasizes networks of commitments that organizations establish through intentional acts of speech (Winograd & Flores, 1987). This coordination approach emphasizes the fulfillment of human commitments and describes activities in terms of contracts and promises. A traditional approach to supply chains is the coordination of tasks view. In a service network, both views apply, as the activities performed by the independent organization needs to be coordinated in order to agree on and fulfill commitments.

The requirements of an organization are not easily elicited and can demand innovative mechanisms or deliberate trade-offs. The timely sharing of information among organizations is often a major issue (Christopher, 2003). Information sharing is necessary for efficient coordination of the service network and to optimize performance. The organizations making up the network often want to avoid that information is provided to other network members. Information might be used to negotiate lower prices or undermine competitive advantage, as competitors might learn from it. Another typical issue in the business engineering of service networks is the selection of coordination mechanisms, as members can have different and even opposing requirements. For

Table 1. A list of business engineering issues

• Which information architectures and structures are most beneficial in which situations?
• Aligning mechanism with service and markets characteristics?
• Integration of the information systems of network members?
• How to manage the service network?
• Should intermediaries be used to coordinate the service network?
• Level of coarse and fine-grained services
• Evaluation of implications of changes
• Pooling and sharing of services
• Conflicting interests of network members
• Incomplete information, ensuring information privacy
• Ensuring quality of product to buyer and payment to sellers
• Tracking and tracing
• Reducing transaction risk and increasing trust
• Use of software agents as assistance in search and evaluation
• Intelligent product and vendor matching mechanisms
• Product distribution/delivery
• Creating and disseminating product information
• Information processing and aggregation
• Open and closed networks
• Spot sourcing for dynamic networks vs. systematic sourcing for sustainable networks
• Type of management information and dissemination of management information