SERVICE NETWORKS PERFORMANCE ANALYTICS:A LITERATURE REVIEW

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Abstract: The success of developing service networks rely on obtaining a correct understanding of the end-to-end business processes. However, there are major concerns as to the lack of research efforts to examine methods to successfully manage the complexity of service networks. The insufficient communication efforts between business and technical experts results in a dissatisfactory service delivery and the inability to predict and measure the service network performance. This literature survey is initiated with purpose of finding a novel way to represent business processes in service networks and analyses the process performance. Specifically, we discuss the need to conceive tools and techniques to manage the complexity of service networks without jeopardising the performance of service networks and provide an overview of current simulation-based modelling approaches and optimising business processes.

1 INTRODUCTION

The business and engineering world has transformed from an object-orientation view towards a service-orientated view. Many resources are co-created in the service systems, including people, software systems, computing devices and sensor networks, organisations and shared information. In such increasingly complex and dynamic markets and operating environments, it requires an innovative smart service network to place equal emphasis on the business domain and technical domain. Thus it is crucial to have a transparent communication network between business modellers and technical modellers and between business design and Information Technology (IT).

The starting point of successfully developing a smart service network is to have a comprehensive picture of the process in which all the required services are delivered and all the stakeholders are involved, as well as to find a novel way to explain the picture to both business and technical experts. This enables us to integrate knowledge on people, process and systems which make u a smart service system. In the past, business process modelling and simulation has been widely used to improve the understanding of the business picture and to observe the impact of process changes in business process reengineering (Low et al., 2007). In this literature survey, we look into the complex environment of service networks and adopt the process-orientation view to provide an overview of current simulation-based approaches in modeling and optimising the business processes.

2 SERVICE ENVIRONMENT

The growth in ‘service science’ as a discipline has underscored the need to investigate the contributory value of business processes and its influence on how a service system (including people, technology, and organisations) affects the delivery of organisational performance. Within organisational and technological management theory, understanding and measuring value (i.e. application of competences) of service networks is considered one of the key problems which prevent the sustainability of organisational growth. Service science explores the value co-creation of interactions between service systems (Spohrer and Magilo, 2008). ICT contributes towards organisational “flattening” (Friedman, 2006) which adds to the complexity and evolvement of service systems (Chesbrough and Spohrer, 2006). Technological advances continue to act as a driving force for ‘making new patterns and a new elevated level of value creation possible’ (Normann, 2001; p. 8).

As service networks continue to grow, understanding the dynamic exchange of resources which creates “value”, determined through specific relationships and interactivity between service systems and specifically business processes is of significant importance. Within a service system, measurement of performance, i.e. performance analytics, plays a fundamental role, to inform management of quantify activities and reduce uncertainty by mapping business processes and their influence on service performance. This places more importance on the need to simulate service network behaviour and a means to analyse, predict, and even measure service performance.

3 BUSINESS PROCESS ORIENTATION

Since 1990s, the concept of business process orientation has been introduced and reported to improve the organisation performance in terms of faster time cycle, reduced cost, and less duplication of work across functions (Galbraith, 2001). In process representation, there are six common perspectives (Lin et al. 2002): functional, behavioural, organisational, informational, verification and validation, and modelling procedure, which are essential for managers to organise the business activities, and for technical experts to clarify the cross-functional interactions within the business system. Within a business system, different modelling techniques are required to represent one or more of the aforementioned perspectives.

3.1 Business Process Modelling

A business process may involve multiple service providers and service users, and numerous information systems to process the information exchange among those stakeholders. Business process modelling maps the business activities into a visual representation. A business process model is a simplified representation of a system in certain business domain, which is used for improving the understanding the essence of the core business logic. Common business process modelling techniques include (Giaglis, 2001):

- Flowcharting: static graphical representation of process flows;
- IDEF0: models what activities a system performs;
- IDEF3: models how the system operates;
- Petri nets: models parallel dynamic systems and their behaviour;
- Knowledge-based techniques: links process to organizational rules and objectives
- Role activity diagramming: models roles with their associated activities.

3.2 Business Process Simulation

Simulation is a powerful, rigorous yet practical suite of methods and tools that not only helps to better understand and manage service systems at large, but also the processes that embody them as well as their supporting information systems. In doing so simulation allows us to iteratively discover, define, refine and improve our knowledge of the principles and laws of such systems, and make more informed and accountable decisions. Regardless of the application domain, we may discern the following dimensions of simulation models (Seila, 1995):

Tabel 1 Dimensions of simulation models

Dimensions	Characteristics
Stochastic	Allowing to randomly selecting some parameter values
Deterministic	Predictable behaviour and excluding probabilistic nature of real-world events
Steady-state	Time-invariant data aggregations or consolidations
Dynamic	Dynamic system behaviour over time
Continuous	Changes occur continuously
Discrete (event)	Stable systems between two events/time intervals

There are three mainstream paradigms in simulation modeling, namely Discrete Event Simulation (DES), System Dynamics (SD), and Agent Based Modeling (ABM), all of which have been widely used in various areas from business and supply chain to healthcare and urban planning (Borshchev and Filippove, 2004). SD is a successful system thinking approach that captures the causal relationships within large scale systems at top management levels. It analyses feedback loops and the emerging behavioural effects, such as exponential growth or decline, which result from them. It is appropriate for decision making at aggregated levels, with a comprehensive integrative perspective and relatively minimal data requirements (Schieritz and Milling 2003). Compared with SD, DES has a narrow scope in modelling the system at operational levels. It models the system behaviour as its states evolve over time by following sequential system events (Robinson 2004), and is appropriate for detailed analysis of a specific system or linear process. In order to achieving the insights of how the system performs, DES requires accurate data on the system operation history or estimation for the proposed system (Borshchev and Filippove, 2004). ABM simulates the operation and collocations between autonomous agents. Instead of global system behaviour, ABM defines the system behaviour at individual level, and the behaviours of many individual agents together perform the global behaviour. Each agent has its own individual perception and incomplete information of an end-to-end process, and they are able to communicate and share information with other agents by following their own behaviour rules.

4 PERFORMANCE ANALYTICS

A service network comprises of a complex system which relies on the harmonisation of numerous actors. Service performance is often influence by external entities causing structural variability across a service eco-system which impacts of the networks characteristics and ultimately, its performance. Therefore, performance analytic is critical in order to gain a thorough understanding of what influence service performance for two main reasons; firstly to enhance service management decision-making tasks with simulation results, and secondly, to feed this information into service requirements engineering (service computing) within a BPM lifecycle.

Figure 1 depicts the BPM lifecycle; basic BPM view (model, simulate, implement and test, deploy and execute) and the need to analyse performance; BAM and service network analytics (analyse, monitor, measure, and optimise). We encapsulate this lifecycle view to service networks.

In alignment with performance analytics, the Information Technology Infrastructure Library (ITIL) has suggested to answer four important questions. The first question is "where do you want to be?" This suggests that organisation must be committed to service transformation and cooperated to meet the business objectives, mission, and vision. The second question, "where are we now?" may be a difficult question to answer but managers must identify where changes are needed, for example, people, process, practice, technology/technical infrastructure, and data (i.e. metrics) to steer the service towards the service vision. The third question asks, "how do we get to where we want to be?" which requires a more detailed plan including a top-down (process-orientated technical infrastructure) and bottom-up (influence the development of processes) of a service system. The fourth and final question is "how do we know when we have arrived?" This is a critical question as it determines the success criterion (which is a major factor within service science). Therefore, it is paramount that management focus on a number of performance metrics.

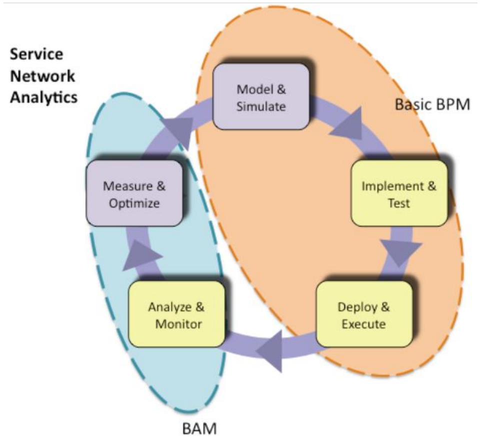

Figure 1 BPM Lifecycle (S-Cube, 2009)

In order to implement an approach to service network analytics, one must adopt a generic view of the activities which are performed within a service in order to understand how a service provides value to the stakeholding business(es). The objective of implementing a performance analytics strategy is typically a means to improve the business processes which underpin their value propositions which they serve. This acts at the motivation to develop a performance analytics strategy.

Figure 2 above illustrates the five tiers which form the service network anatomy; the human and software infrastructure and the software and human services governed by service level agreements (SLA) and Quality of Service (QoS); the atomic services monitored controlled by process metrics; the service processes managed by participant metrics; and the business transactions managed by network key performance indicators (KPIs). These five abstracted levels are interconnected, and the value of the indicators at different tiers are influenced or co-created via metrics at other tiers.

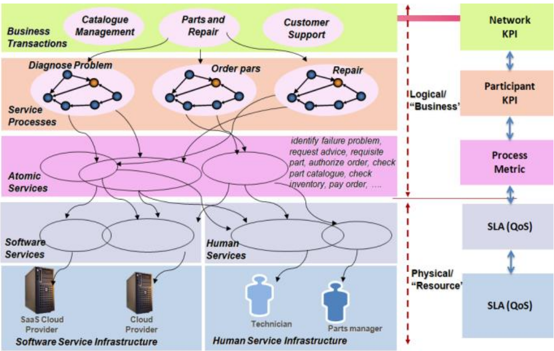

Figure 2 Service Network Anatomy (S-Cube, 2009)

5 SUMMARY & FUTURE WORK

This paper offers a platform which provides a general overview of the need to develop methods of service analytics through the experimentation of simulation techniques and summarises the fundamental techniques to simulate service interaction to determine service analytics. In addition, we anticipate the service network performance analytics offer greater transparency, which is considered a critical factor within service deployment and innovation to discover the service enabling or inhibiting factors of business process behaviour across service networks. Thus, we propose that employing service network analytics facilitates managers ability to (re)configure service networks to (re)construct reusable methods and process patterns or blueprints to support service networks through the visualisation of dynamic business process to open up new possibilities on the generation of service innovation. As part of our future work, we will examine the affordance of various simulation techniques in analysing service performance through a number of case studies to report how service behaviour impacts on service performance.

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