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NeSD: Towards a New e-Services Development Framework

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Abstract: E-services have been developed and being studied with the development and progress of ICT, especially the Internet and web technologies in the last decade. Yet there is still a need for effective models and methodologies for e-services development and improvement with a holistic development process view point. The research reported in this paper aims at developing a New e-Services Development (NeSD) model under which the whole lifecycle of e-services could be addressed from multiple disciplines such as business, marketing, and computing. Based on a review and analysis of concepts of services, e-services and New Service Development (NSD) models, we propose an extended definition of e-services and, based on the definition, establish a spiral lifecycle model of NeSD. We believe that the research reported in this paper contributes to a better understanding of e-services, and the development and improvement of e-service systems. Our NeSD model also establishes a basis for further research and development for a more systematic and formalized lifecycle based methodology for analysis, design, delivery and improvement of effective e-services and e-service systems.

Keywords: e-Services, New Services Development, NSD, NeSD, Service Process, Development Framework

1. INTRODUCTION

The concept of services and service systems has experienced enormous development and progress from multiple disciplines in recent years, for example from the management ^{[24][25][26]} and from computing ^{[1][14]}. There has been joint research on the fundamental concepts and issues of services from, for example, service-dominant (S-D) logic and service science, management and engineering (SSME) ^[16]. The creation, modeling, analysis, design, delivery and improvement of services and service systems have been studied from various research communities, such as New Service Development (NSD) from operations management ^[23]; service value modeling and analysis from business and information systems ^[11]; service oriented architecture (SOA) from computing ^[2]; service systems from system science ^{[4][17]}; and the Internet of Services (IoS) from information system and computer science ^{[8][9][18]}. The transition to service economy is certainly accelerated by the development of technologies, among them Information and Communication Technology (ICT) is regarded as an essential facilitating factor.

Along the same timeline, e-services, normally referred to internet and web enabled business applications, have been attracted research and development effort with the development and progress of the internet and web technologies ^{[3][7][12][20]}. E-services are usually defined as services implemented by networked software applications ^[12]. Researchers from different disciplines use “e-services” with different meanings as pointed out by Baida et al ^[3]. This causes confusions and hinders further development and progress of e-services and e-service systems.

The goal of the research described in this paper is to attempt to extend our understanding of e-services and to develop a framework suitable for e-services development and continuous improvement, based on analyzing definitions of e-services in literatures along with the current development on the understanding of services and service systems. More specifically, we propose a definition for e-services based on Hofacker et al’s work ^[12] and a spiral lifecycle model for New e-Services Development, called NeSD, based on New Services Development

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(NSD) framework from operations management ^[23] and the lifecycle process models from software engineering ^[5]. Our definition for e-services captures wider scope of real world e-services applications, which are typically a mixture of automated service processes implemented by networked software applications and manual service processes. The development and improvement of such e-services and the corresponding service systems therefore raise new challenges for suitable and effective configuration and management of different kinds of service components/sub-systems. We believe our research reported in this paper contributes to better understanding of e-services and their corresponding service systems and establishes a basis for further study for a systematic and effective methodology for e-services and e-service systems.

The rest of the paper is organized as follows. In Section 2 we review and analyze the current development of the concepts of services and e-services, existing NSD models, and comparison of e-services and manual services. We then describe our definition for e-services and discuss the distinguished features of e-services compared with other services in Section 3. In Section 4, we describe a spiral lifecycle model of New e-Service Development (NeSD) and briefly describe the goals and activities of each of its phases. Finally we conclude the paper in Section 5 and give directions for future research.

2. BACKGROUND AND RELATED WORKS

In recent years, the understanding of services has been developed rapidly and certainly should have impacts on the understanding and development of e-services. In this section we will first review the current understanding of the concepts of services and e-services. We then review the development of New Services Development (NSD) with a focus on considering using NSD models in the development of e-services. We also discuss existing work in comparing the differences between e-services and non-electronic services.

2.1 Services and e-services

The concept of services has been studied for several decades by business and marketing researchers with recent important development such as service-dominant (S-D) logic ^[24]. The concept of e-service has been studied due to the development of internet and web applications since the end of last century ^[20]. In recent years, an attempt to establish a multi-discipline service science for systematic research and development of information and communication technology (ICT) facilitated services has attracted enormous effort from many disciplines including marketing, information systems and computer science ^{[1][2][14][15][16][22]}. However there is has a gap between the understanding of services and e-services and hence the relationship of the two concepts. The marketing and business community have a focus more on the generic concept and business side of services while e-services are studied more by the information system community ^[3].

Vergo and Lusch define the services as “the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself.” ^[24, p2]. Vergo et al further discuss the fundamental role of value co-creation and value-in-use from service science and S-D logic perspective ^[26]. Based on value co-creation and value-in-use understanding, a more operational oriented definition of services by Lovelock and Wirtz ^[10, p9], where a service is defined as “an act or performance offered by one party to another ... an economic activity that create value and provides benefits for customers ... by bring about a desired change in, or on behalf of, the recipient”, would be more appropriate when we talk about the design and delivery of services.

Early attempts in defining an e-service either focus on the delivery property, for example, e-services are defined as “provision of services over electronic networks” ^[20, p38], or is concerned with the infrastructure for the e-service delivery, for example, e-services are defined as “interactive services that are delivered on the Internet using advanced telecommunications, information, and multimedia technologies” ^[7]. Based on the definition of services of Lovelock and Wirtz ^[10], Hofacker et al define an e-service as “an act or performance that creates

value and provides benefits for customers through a process that is stored as an algorithm and typically implemented by networked software.”^[12]. This definition makes the processes, outcomes, delivery approaches, and necessary infrastructure explicit, as well as the typical algorithmic nature of e-services. However this definition of e-services is too restrict as it requires the whole service process should be a stored algorithm and be implemented by a networked software. Only very few real world applications, such as Google, are within the scope of the definition. Especially when we take the understanding of service systems viewpoint as defined by Vargo et al^[26], this definition of e-services is not suitable for complex service systems in which not all portion of the process could be algorithms and implemented by software applications.

2.2 New Services Development (NSD) vs New Goods Development (NGD)

Vergo and Lusch discuss the transition from goods to services^[25]. Instead of considering services as a type of goods, the service-centered logic considers exchanges in terms of value rather than products. This implies that services are more fundamental than goods so that the development of new products (in terms of services) should also follow the shift.

New Product Development (NPD) has been studied by operations management, initially with a focus on New Goods Development (NGD). In the last 40 years there has been a growing trend to recognize the importance and development of New Services Development (NSD)^[23]. It should be noted that the research and development of NSD is still largely under the understanding that services are either a type of goods or a rather different type of products compared with goods.

Tsai et al compared NGD and NSD based on the review of major models of NGD and NSD^[23]. They pointed out that, although the overall processes and steps of the two types of models are similar with only differences in number of steps and amount of time in transitions between steps, the underlying steps in details are have more differences. Tsai et al therefore, based on existing NSD models, describe a 5-D NSD model capturing the common feature of various NSD models, see Table 1.

Table 1. 5-D NSD Framework, based on Tsai et al^[23]

| Stage | Goal | Main tasks |
|----------|-----------------------|--|
| Discover | Discover new services | New service taxonomy; discover new services. |
| Define | Define new services | The service concept definition; pre-development business analysis. |
| Design | Design new services | Service features design; service operations design; service facility design; service marketing design; service encounter design; service recovery. |
| Deliver | Deliver new services | Field testing; testing marketing; e-service applications. |
| Debug | Debug new services | Success factors; service recovery |

2.3 The differences between e-services and non-electronic services

Although Tsai et al discussed in detail the differences between NGD and NSD, their comparison is more on the goods and services^[23]. There have been efforts in studying the differences and some time similarities of e-services and non-electronic services, for example by Baida et al^[3]. A comparison of e-services and non-electronic services based on a literature review is given by Riedl et al^[19]. The motivation of the research is to study the distinguished features of e-services compared with non-electronic services in order to see the potential influence to NSD. Reidl et al recognized five distinguished features of e-services: (1) low marginal costs of service delivery; (2) high degree of outsourcing; (3) Rapid development of new services; (4) transparent service feedback; (5) continuous improvement and deployment. It should be noted that Reidl et al define an e-service “as a business activity of value exchange that is accessible through an electronic interface”^[19, p2]. This definition of e-services is consist with^[12] but without an emphasis on the service processes and their algorithmic nature.

3. WHY WE NEED A SPECIFIC MODEL FOR E-SERVICES BASED ON NSD?

Since early 80's, there has been extensive research and development for New Services Development (NSD) [23]. The development and progress of the Internet and web technology promotes more rapid development of services, among which e-services play an important role. Although there has been research effort in studying the differences between e-services, i.e. using ICT as an enabler technology, and manual services, a model specifically for the development of new e-services is absent. In this section, we first give an extended definition of e-services, which captures a wider scope of real world e-services applications. We then describe the distinguished features of e-services based on our definition, following a brief discussion of the relationship between those e-services within the scope of our definition and those manual services.

3.1 An operational definition of e-services

As we discussed in Section 2.1, previous definitions of e-services are too restrict that only a few services whose whole processes are implemented by networked software applications are within the scope. In real world e-service applications, even those with significant portion of processes implemented by software applications, such as many e-commerce applications, have steps in the service process require manual handling, such as logistics and distribution of purchased goods. More fundamentally, a service system is “a configuration of people, technologies, and other resources ...” as defined by Maglio et al [16]. This means that a service process is typically a mixture of automated and manual steps/sub-processes. Most modern services are using ICT as an enabler technology rather than replacement of manual processes. Our following definition of e-services is based on the definition of Hofacker et al [12] with important extensions:

An e-service is an act or performance that creates value and provides benefits for customers through a process that integrates stored algorithms and other (manual) processes, normally in an interactive manner and significant portions of the e-service typically implemented by networked software.

There are three extensions, compared with the definition of Hofacker et al [12]: (1) from algorithmic processes to integrated processes: the integration of automated and manual processes captures more services in which ICT plays an enabling role; (2) from fully implemented by networked software to partial implemented by networked software: self-services sometimes are useful but not all services can be and should be implemented by self-service style; (3) an emphasis on the interactive manner during the processes for value co-creation.

3.2 Relationship of automated services, semi-automated e-services and manual services

The extended definition of e-services indicates a classification of services: (1) e-services as defined by our definition; (2) manual services in which all steps of services are delivered manually. E-services could be further divided into two types: automated services as defined by Hofacker et al [12], and e-services other than automated services, called semi-automated services by Cardoso et al [8]. As discussed by Cardoso et al [8], a typical case of automated services is internet services and could be implemented by, for example, web service technology. The Internet of Services (IoS) [8][18] is largely within the scope of automated services. On the other end of the spectrum, manual services are those services fully delivered manually, such as craft making. Large portion of e-services are those combing automated and manual service processes, i.e. semi-automated services. The development of such integrated services and service systems should consider not only the processes delivered by software systems but also processes delivered manually. It is especially important to design such processes with considerations of distinguished features of e-services in order to design a more effective and competitive services and service systems.

3.3 Distinguished features of e-service systems

Instead of discussing the differences between e-service systems and manual service systems, it is more useful to study the distinguished features of e-Service systems, especially for the purpose of more effective approach for new e-Services development. Based on existing research and our analysis, we identify ten

distinguished features of e-service systems. These features indicate that there is a need for a more specific and effective model for new e-services development. We briefly describe the features in the followings.

- (1) Higher regularity of service processes: higher regularity of processes would provide better opportunities to have large portion of service processes implemented by networked software.
- (2) Higher homogeneity of service quality: although heterogeneity of services is a distinguished feature of services compared with goods, such heterogeneity has two sides. On one hand, individual customers would require personalized services due to (naturally) different needs; one the other hand, different service quality, due to different skills and training of the service providers, for the same service needs would be undesired. The portion of services which can be implemented by networked software can maintain the desired heterogeneity of personalized services while improving the homogeneity of service quality, compared with manually delivered services.
- (3) Larger portion of self-services in the service process: most service processes implemented by networked software have in nature higher degree of self-services. On one hand, self-services improve the efficiency and service capability. On the other hand, self-services rise issues about customer's acceptance of the services.
- (4) E-services could provide higher level of personalized services: this is mainly due to the advance of technology especially with the development of the computer and human interface technology.
- (5) E-services can be improved and extended more quickly and cost effective. Manual services often need more time and higher cost to be improved and extended mainly due to the training cycle.
- (6) Better support and more precise data could be collected by e-service systems compared with manual services.
- (7) Continuous service capability and effectiveness analysis is more feasible in e-service systems.
- (8) Higher degree of outsourcing is possible in e-services.
- (9) E-services could be more complex resulting more complex value chains, especially across organizations.
- (10) Integration of manual services and automated services in e-service systems rise new issues at connection points. This indicates that special attention should be paid in designing the mixed service processes and special training should be provided to service personnel.

4. NEW E-SERVICES DEVELOPMENT (NeSD) BASED ON NSD

Our extended definition of e-services specifies a broader and more precise, in terms of operational aspects, collection of service systems facilitated by technologies, especially ICT. We believe that better services and more innovations could be resulted from a sound and effective New e-Service Development (NeSD). Such an NeSD should especially take considerations of the distinguished features of e-service systems. This means that the NeSD should be based on the established NSD but extended with explicit support for taking care of those distinguished features of e-service systems.

In the followings, we briefly discuss major goals and activities in each phase of the NeSD lifecycle model as illustrated in Figure 1.

Service discovery: the main goal of this phase is to discover potential service innovations, especially with

the advanced technology and new approach of providing new services based on available resources. There have been indications that proven successful specification and process approaches in computing and system engineering could be useful to enhance the current techniques.

Service definition – value modeling: the main goal of this phase is to analyze the selected potential services at the business level, without getting into details in the design and delivery of the services. Both business and information systems communities provide useful approaches and technologies for such analysis, for example, the value modeling techniques described by Gordijn et al ^[11].

Service design – requirement analysis: the main goal of this phase is to define the service process based on business modeling and analysis of the service and obtain the requirements of the underlying service systems. With the understanding of our e-service definition, one of the key activities is to analyze which portion of the service system could be algorithmic and hence be implemented by typically networked software. The principle of the analysis is to derive, ideally, the best integration of algorithmic and manual processes.

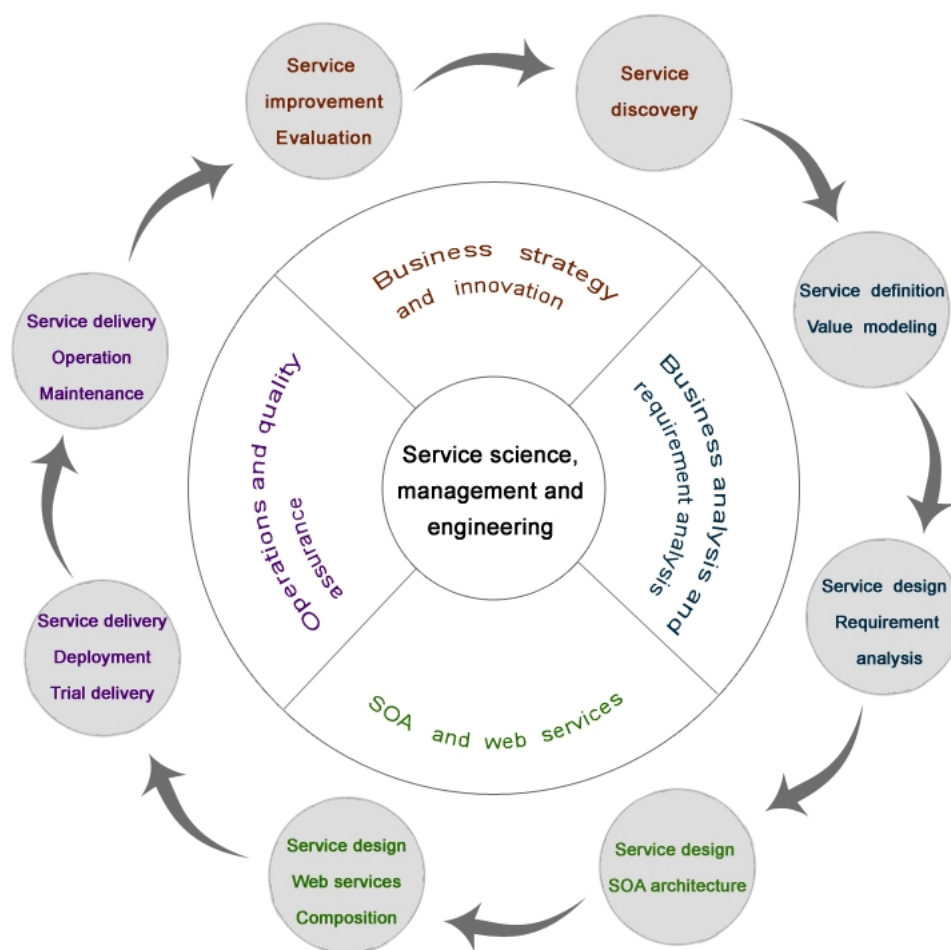


Figure 1. New e-Services Development (NeSD) Lifecycle Model

Service design – SOA architecture design: the main goal of this phase is to design a suitable service-oriented architecture, including people, resources and computing applications based on the requirement analysis.

Service design – web services and composition design: the main goal of this phase is to design and implement the algorithmic portion of the service systems. A key activity is on the connection of different such computing applications with possibly manual process steps for consistent and high quality of services.

Service delivery – deployment and trial delivery: the main goal is to integrate all manual and automatic process steps into a complete process of services. The key activities are not only on the deployment of computing applications, but more importantly also on the combination of manual and automatic process steps.

Service delivery – operation and maintenance: the main goal of the phase is to deliver the services, collect data and analyze the data for indicating possible service failures and potential improvements.

Service improvement – evaluation: the main goal of the phase is to collect data, analyze data and propose possible improvement and possible new services innovations. The activities is not necessarily distinguished with the service delivery phase, but rather a continuous activity, based on feature that automatic service process step(s) can receive detailed and timely data during service delivery.

5. CONCLUSION AND FUTURE WORK

We have briefly reviewed the development of the services and e-services concepts, as well as models of New Services Development (NSD). We proposed an extended definition of e-services for the purpose to develop a model suitable for New e-Service Development (NeSD). The extended definition illustrates more clearly the requirements for NeSD with distinguished features of e-services compared with manual services, therefore calls for a more specific and effective model of NSD, i.e. NeSD. Different from existing NSD models such as the 5-D NSD framework^[23], our NeSD model is based on a spiral lifecycle model and places an e-service (system) in a continuous improvement process. We briefly discussed the main goal and activities of each phase. Due to the limitation of space, a more detailed discussion is not included here.

Our spiral lifecycle model of NeSD borrows from the proven successful spiral model in software engineering^[5]. In fact the spiral model has been successfully applied to complex systems beyond software systems^[6]. Future work includes more systematic study of our NeSD model based on Boehm's spiral model in order to develop a methodology for e-service system development and improvement. Such a methodology could be based on Boehm's spiral model, Osterweil's process analysis^[21], and Zachman's information system architecture framework^[27]. There has been attempt that the lifecycle model approach has been used in business and software lifecycle management^[13]. Zachman's information system architecture framework has also been applied to development methodology of the Internet of Services^{[8][9]}. Such research would provide guide and insights for our proposed future work.

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