電子商務研究，2008 年夏季
第六卷，第二期，頁 189-206

SOA 下運用 UMM 發展一獲取候選服務之方法－以我國檢疫通關自動化為例

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摘要

服務導向架構(SOA)成為近年來學界及業界熱烈探討的議題，由於具有標準協定及彈性的架構，適合用以進行跨組織、跨平台及舊有資訊系統的整合。SOA 的導入步驟主要利用服務導向(Service-Oriented)進行分析、設計、開發、測試及部署，然而其中一項重要步驟便是如何在服務導向分析中的企業層及服務層中獲取候選服務(Service Candidates)，目前並沒有標準的方法論。本研究嘗試以我國檢疫通關自動化為例，運用 UN/CEFACT 所提出的 UMM 企業模型來發展一套針對企業層及服務層的分析方法論，以獲取候選的服務，後續作為服務導向設計及開發建置的參考。

關鍵字：服務導向架構、UMM、企業服務、電子化政府、檢疫自動化

A Method for Deriving Business Services in SOA using UMM – Taking a Project of e-Government as a Case Study

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Abstract

Service Oriented Architecture (SOA) has become one of the hottest subjects in academic and industrial studies for recent years due to its flexibility to integrate heterogeneous information platform and properties with technology standard for implementation. The development processes of SOA include steps such as service-oriented analysis, design, coding, testing and deployment, but

there's no standard method to implement these steps. UN/CEFACT's Modeling Methodology (UMM), developed by United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) Working Group, is a methodology to extract the business knowledge and represented using Unified Modeling Language (UML). This study developed a method, based on Business Domain View (BDV) and Business Requirements View (BRV) models of UMM, for deriving business service candidates in SOA. Additionally, this study adopted the e-plan of Customs Quarantine Control (e-CQC), a project regarding e-Government of Taiwan, as a case study to illustrate the process to derive business service candidates. The proposed method provided a comprehensive way to help enterprises or government to derive business services candidates that lead to obtain the application services for implementing SOA.

Keywords: Service Oriented Architecture (SOA), UMM, e-Government

Introduction

Going beyond the traditional solution to integrate the applications across multi-enterprises, SOA has become the latest solution to integrate the heterogeneous IT environment due to its properties with standard data exchange format (e.g., XML) and Web Services technology (Rosenberg and Remy, 2004). "SOA is an approach to build distributed systems that deliver application functionalities as services to end-user applications or to build other services" (Colan, 2004). Additionally, SOA can be implemented by Web Services, but it can use other technologies. A service in SOA is an application function package as a reusable component for using in a business process. The binding between service requester and service provider is loosely coupled. Whatever, the needs for loosely coupled systems arise from the needs for adapting the changing environment such as changing policy, business strength, business focus, partnerships, industry standards, and other factors (IBM, 2002). The SOA solution was adopted not only by enterprises to integrate applications across intra/inter firms, but also adopted by government to integrate intra/inter functional units (Gouscos, et al., 2002; Gortmaker, et al., 2005; Podgayetskaya and Stucky, 2004).

The steps of SOA's delivery lifecycle include service-oriented analysis, design, development, testing, deployment, and administration. However, the most important step during the lifecycle is analysis step that may derive the business services and further used to obtain application services. The primary

questions were asked during analysis step are: (1) what services need to be built, and (2) what logic should be encapsulated by each service. To answer these questions, the means to perform service-oriented analysis should define a preliminary set of service operation candidates and group them into service candidates (Erl, 2004). There are numerous methodologies to complete SOA's analysis step for finding service candidates such as Business Process Model (BPM), ARIS, Line of Visibility Enterprise Modeling (LOVEM), Component Business Modeling (CBM), and Entity Model et al.; nevertheless, there are no standardized means for deriving business services. This situation leads to be difficult to share the documents of information system and hard to integrate applications across intra/inter enterprises. Accordingly, there's a need to develop a unified method to implement analysis step of SOA to identify the business service candidates.

UN/CEFACT, previously called UN/ECE WP.4, was a long existing B2B standards body. In addition, UMM was proposed by UN/CEFACT and its vision was to capture the business knowledge that enabled the development of low cost software components by software vendors to help the small and medium size companies, and emerging economies engaged in e-Business practices (UN/CEFACT TMG, 2001). However, UN/CEFACT was an authority of B2B standard development organization, and UMM will be the underlying methodology for all UN/CEFACT's B2B solutions to be created in the future (Hofreiter, et al, 2004). The UMM can accelerate the IT development and application integration via information sharing with common standard, and it adopts UML and Unified Process (UP) that was proposed by OMG. Further, UMM artifacts must be transformed to the information and communication technology used to implement B2B systems, and two popular technologies to implement B2B are ebXML and Web Services.

This study proposed a method for deriving business service candidates during analysis step of SOA using UMM. The proposed method generates UML diagrams from UMM model that lead to derive operation candidates; additionally, the operation candidates are grouped into business service candidates based on the rules such as functional units or related processes. Finally, the business service candidates are categorized into three layers for clarifying the relationships between services. Furthermore, this study takes a case study to illustrate the proposed method. The case was a project as e-plan of Customs Quarantine Control (e-CQC) that is a part of 'Trade Facilitation Project' proposed by Bureau of Foreign Trade (BoFT), Economic Ministry of Taiwan, R.O.C.. In this case study, the proposed method identifies business service candidates that used to obtain the application services during the design

step of SOA; additionally, this method is developed by using UMM that helps enterprises to share their documents of information systems in a common standard and accelerate the implementation of SOA.

Related Works

1. E-plan of Customs Quarantine Control (e-CQC)

While mad-cow disease and avian-flu were spreading fast via animals and their byproducts that were transported among countries, the affairs of inspection about plants, animals and their byproducts hosted by government agency are more and more critical. The e-CQC, the project executed by Bureau of Animal and Plant Health Inspection and Quarantine Council of Agriculture (BAPHIQ), Taiwan, R.O.C., devotes to integrate business process across multi functional units like service portal, Directorate General of Customs (DGoC), BAPHIQ, branch offices of BAPHIQ, and foreign countries. Meanwhile, the project establishes the mechanism to automate the process for exchanging the Customs quarantine certificate in order to prevent the plants, animals, and their byproducts imported/exported illegally. The efforts of e-CQC attempt to archive the horizontal integration among DGoC and BAPHIQ, and devote to facilitate service delivery and market enhancement/development that e-government engaged. The e-CQC automates the services of imported/exported about plants, animals, and their byproducts; in addition, it is expected to reduce the cost of inspection and facilitate the foreign trade of Taiwan.

2. UMM

The UN/CEFACT's Modeling Methodology (UMM), developed by UN/CEFACT's Techniques and Methodologies Groups (TMG), describe a method and supporting components to capture business process knowledge, independent of the underlying implemented technology so that the business acumen is retained and usable over generations of implemented technology. (UN/CEFACT TMG, 2001). The UMM is a formal description technique for describing any Open-edi scenario as defined in ISO/IEC 14662 Open-edi reference model. An Open-edi scenario is a formal means to specify a class of business transaction having the same business goal. The scope of UMM in Open-dei scenario is the Business Operations View (BOV). The commitment of BOV layer reflects the choreography of the inter-organizational business

proves and its information exchanges. As such, UMM provides a technology-neutral, implementation-independent manner. The latest version of the UMM consists of three views (UN/CEFACT TMG, 2006), and described below:

Business Domain View (BDV)

The BDV is used to identify the business processes in the domain of the business problems that are important to stakeholders. The outcomes of BDV are the categorization of business domain and a set of relevant business processes. It is important at this stage that business processes are not constructed, but discovered. Stakeholders might describe intra-organizational as well as inter-organizational business processes. Both are valid and recorded. However, the description concentrates on so-called business interface tasks, where a business communicates with its partners. All the discovered business processes are classified according to a pre-defined classification schema. The final result of the business domain view allows a business process analyst to find opportunities for business collaborations that are constructed in the following workflows.

Business Requirements View (BRV)

The Goal of the BRV is to identify collaborative business processes between different business partners and to describe the requirements regarding these collaborative business processes. In order to identify collaborative business processes the static descriptions of the internal business processes discovered in the BDV are described in more detail and are analyzed regarding their dynamic behavior and their relationship to each other. Based on this analysis the relevant “real-world”-concepts in the domain are identified and described as business entities and the requirements on collaborations are identified and described as business collaboration use cases and business transaction use cases.

Business Transaction View (BTV)

The BTV represents the view of the business process analyst who transforms the requirements into a choreography of information exchanges. Currently, the overall choreography of the business collaboration is defined by an activity graph called business collaboration protocol. In future version other alternatives might be developed. The business collaboration protocol choreographs the flow among business interactions. This flow depends on the states of business entities. Currently, a business interaction is always defined

by a business transaction, other alternatives might be developed in future versions. A business transaction defines a simple choreography of exchanging business information between two business partners and an optional response. An execution of a business transaction usually results in the change of state of one or more business entities. Thus, the information exchanged in a transaction should be limited to the minimum information needed to change the state of a business entity. Nevertheless, UMM allows the definition of an information exchange in a document-centric approach – even if this is not recommended. A business transaction leads to synchronized states of the business objects at both partners participating in a business transaction.

3. Service-Orientation and SOA

Arsanjani (2004) defined SOA as an enterprise-scale IT architecture for linking resources on demand. It consists of a set of business-aligned IT services that collectively fulfill an organization's business processes and goals. Further, service-orientation is a way of integrating the business as a set of linked services, for they are repeatable tasks within a business process.

Zimmermann (2004) defined three levels of abstraction within SOA:

- Operation: SOA operations are directly comparable to object-oriented methods. They have a specific, structured interface, and return structured response.
- Services: Represent logical grouping of associated operations.
- Business processes: A long running set of actions or activities performed with specific business goal; in other words, the business processes typically encompass multiple service invocations.

Fig. 1 shows that the service definition hierarchy of Service-Oriented Analysis and Design (SOAD) includes three layers: (1) business layer, (2) service layer and (3) component layer. Additionally, the functional domain can be decomposed into business processes and business services, and business services are decomposed into a number of collaborating or orchestrated software services and components (Zimmermann, et al., 2004).

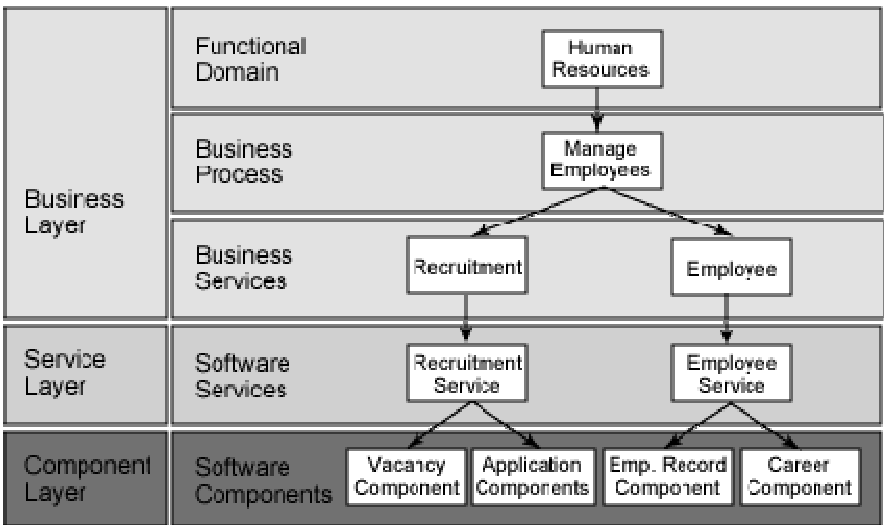

Fig. 1 The SOAD service definition hierarchy

Erl (2004) recommended that the ways to identify business services as:

- Define a preliminary set of service operation candidates.
- Group service operation candidates into logical context as service candidates.
- Define preliminary service boundaries.
- Identify encapsulated logic with reuse potential.
- Ensure the encapsulated logic is appropriate for the intended use.
- Define preliminary composition model.

The term 'candidates' means that the services discovered during the analysis step may be amended during the design step, and that is subjected to the realities of the technical architecture due to constraints, requirements, and limitations specific to the implementation environment.

When the service candidates are identified, it is important to classify these services into service hierarchy. Classification helps determine composition and layering, as well as coordinates building of interdependent services based on the hierarchy. Also, it helps alleviate the service proliferation syndrome result in governance issue (Arsanjani, 2004). This study adopts three layers defined by Erl (2004), such as orchestration service layer, business service layer, and application layer (see Fig. 2).

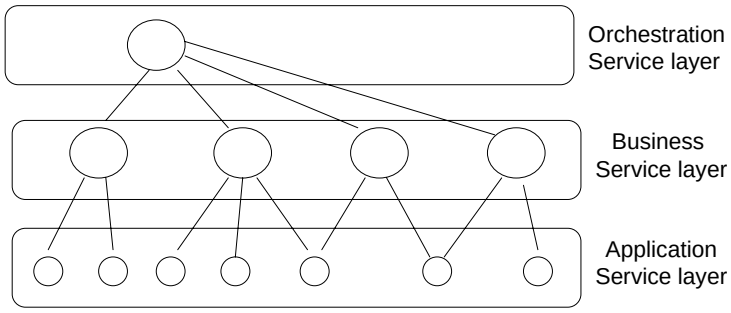

Fig. 2 The three primary service layers

A Method to Derive Business Service Candidates

This study proposes a method to derive the business service candidates during service-oriented analysis step using BDV and BRV models of UMM in a top-down analysis manner. The method consists of four steps, namely (1) to derive the BDV use cases from UMM/BDV, (2) to derive operation candidates from UMM/BRV, (3) to derive and refine business service candidates, (4) to categorize the service candidates. The proposed method matches with the 'Business Layer' of SOAD service definition hierarchy previously mentioned (see Fig. 1). In detail, the 'Functional Domain' layer can be implemented by setp1, the 'Business Process' layer can be implemented by step 2, and the 'Business Services' layer can be implemented by step 3 and step 4 (see Fig. 3).

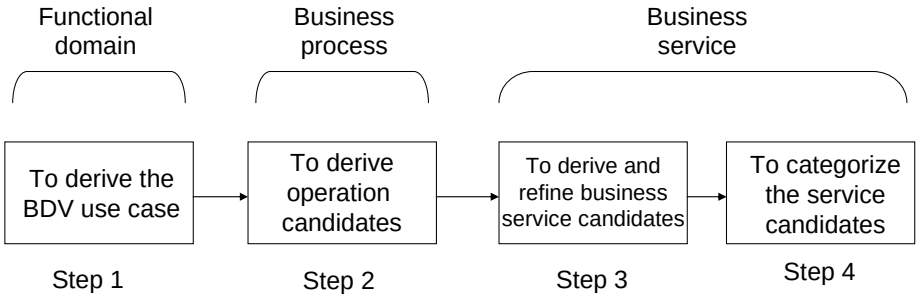

Fig. 3 The method to derive business service candidates

The steps of proposed method are introduced as follows:

Step 1: To derive the BDV use case from UMM/BDV

The goal of UMM/BDV help us to: (1) understand the structure of the business domain, (2) ensure all stakeholders have a common understand of the business domain, (3) identify the stakeholders concerned with the modeled domain, etc. (UN/CEFACT TMG, 2003). The outcomes of BDV are Business Domain Package Diagram (see Fig. 4) and BDV Use Case (see Fig. 5); thus, the business process and stakeholders in a specific business domain can be understood.

Step 2: To derive operation candidates from UMM/BRV

Business requirements are expressed with reference to business entities that are affected by a business collaboration activity. Business collaboration activities are business processes, as requirements and business object flow graphs that define the choreography of atomic business processes, referred to as Business Transaction. In this study, the work steps of BRV are tailored based on the steps proposed by UN/CEFACT TMG (2003), and the steps are described as: (1) describe each business process from BDV in detail, and (2) define Business Collaboration.

The outcomes of BRV are Business Collaboration Use Case (see Fig. 6) and Business Process Activity Model (see Fig. 7, Fig. 8). They can describe the detail business requirements and make us realize the roles, resources, relationships of roles and resources to activities, and define the associations among activities within the business domain.

Step 3: To derive and refine business service candidates

Besides the preliminary operation candidates derived from step 2, the additional operation candidates can be added according to the needs of enterprises. When the necessary operation candidates are obtained, the business services candidates can be captured by grouping the operation candidates based on the specific context and principle/criteria (e.g., functional units, associated affair, and related processes, etc.) of the enterprises.

The next work during this step is to refine the selection of service candidates based on the considerations such as coarse services grain, loosely coupling, independent, reuse, and automated etc.

Step 4: To categorize the service candidates

In order to understand the relationships of service candidates for further design phase, the service candidates have to be categorize into three layers (e.g., orchestration service layer, business service layer, and application service layer) by means of generalization and specialization of service candidates derived from step 3 (Erl, 2004).

Case Study

The case to realize the proposed method is e-CQC that is a project as a part of the 'Trade Facilitation Project' proposed by BoFT, Ministry of Economics (Foreign Trade Bureau, 2004). First, the business domain is decomposed into business collaboration activities. Second, the operation candidates are identified. Finally, the business service candidates are then derived and categorized.

During the step 1, the relevant documents of the project of e-CQC are checked out and the package diagram and BDV use case are derived using UMM/BDV. Fig. 4 demonstrates that the business area as 'Trade Facilitation Project' contains four process areas: namely, (1) government administration, (2) business transaction, (3) international transportation, and (4) international finance payment. The process area as 'government administration' then being decomposed into three business processes such as 'quarantine inspection', 'goods inspection', and 'Customs clearance'. Finally, the business process as 'quarantine inspection' further be decomposed into business processes such as 'portal', 'Customs affairs', and 'quarantine affairs'.

The main components of e-CQC are derived from package diagram; subsequently, the stakeholders (e.g., citizens, Customs, BAPHIQ, branch offices of BAPHIQ, and foreign countries) and their relationships then be identified.

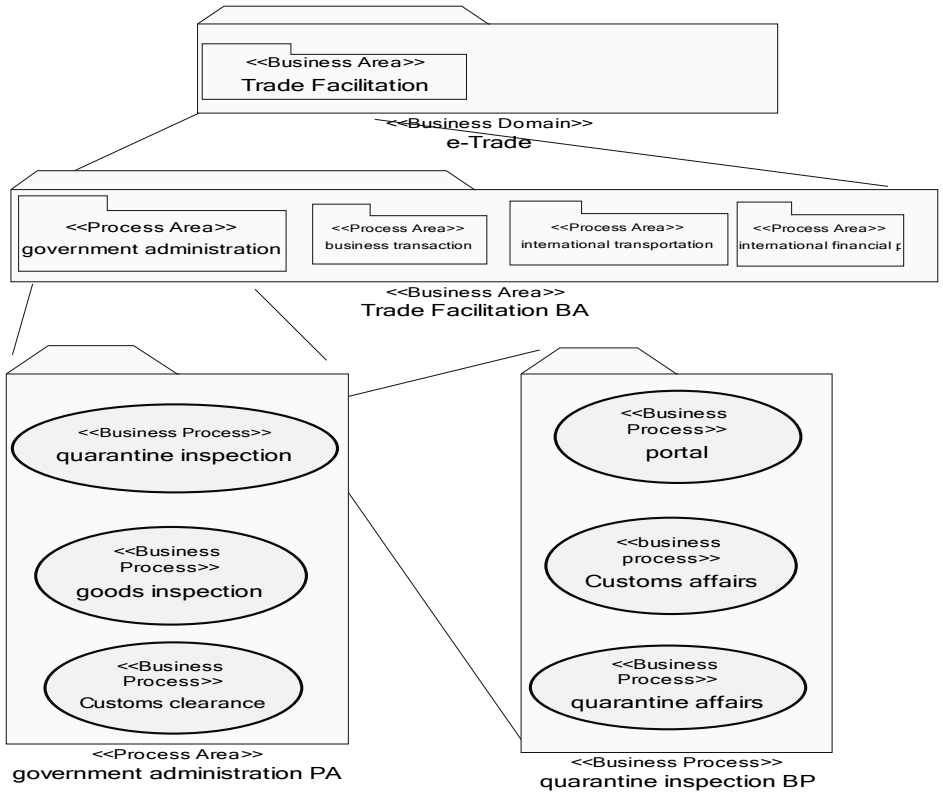

Fig. 4 Business domain package diagram

Fig. 5 shows the use case diagram of business process as 'quarantine inspection' that consists of relevant actors and use case; thus, it represents more comprehensive picture about the e-CQC.

During step 2, the project is checked out and the worksheets of BRV model are filled out based on the outcomes of step1. The business collaboration use case is developed using the BDV use case; and the activity diagram can then be developed based on business collaboration.

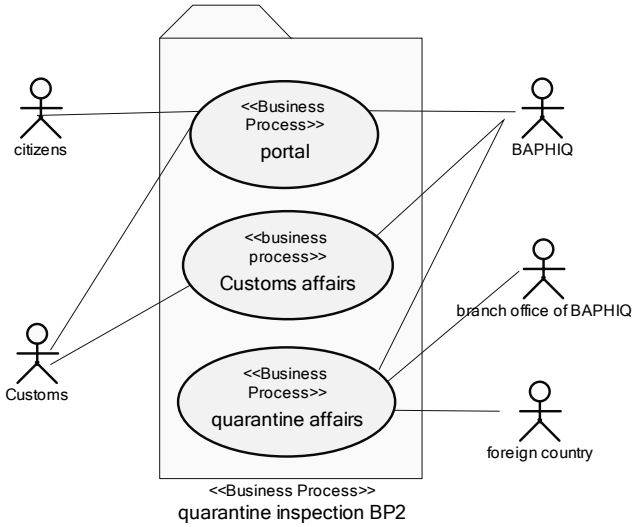

Fig. 5 Use Case diagram of 'quarantine inspection'

Fig. 6 demonstrates that the collaboration use case of business process as 'Custom affairs'. The government actors such as Customs and BAPHIQ interact in order to complete the business collaboration. In detail, the business collaboration use case as 'Customs affairs' may decompose into two use cases as 'apply for inspection' and 'results of inspection'.

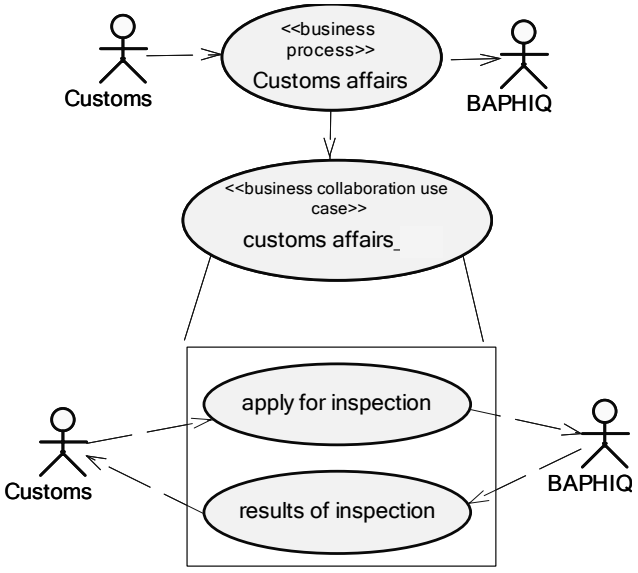

Fig. 6 Collaboration Use Case of 'Customs affairs'

In order to obtain more collaboration activities within business collaboration use case as 'Customs affairs', the business process activity diagram is developed as Fig. 7.

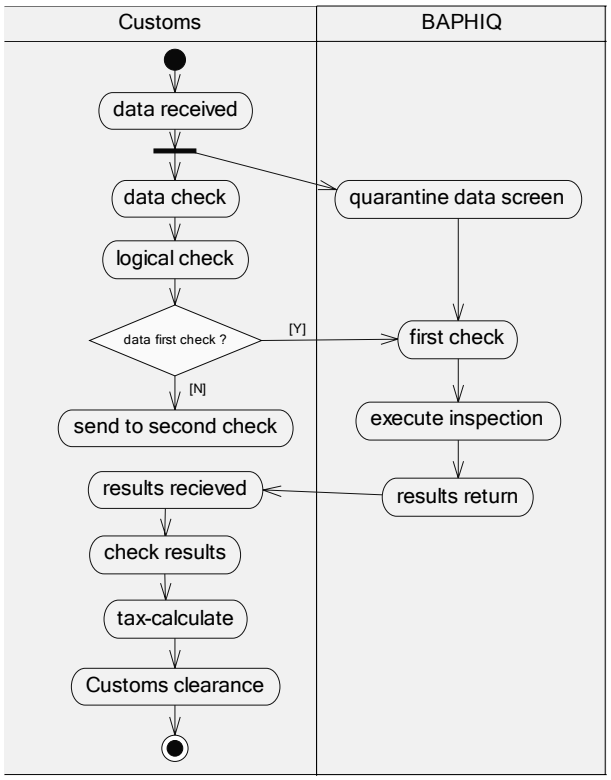

Fig. 7 Business process activity diagram of 'Custom affairs'

To summarize the collaboration activities of collaboration use cases include 'portal', 'Customs affairs', and 'quarantine affairs', the whole picture of e-CQC is represented in the activity diagram as Fig. 8. The process starts from the citizens apply the quarantine inspection about animal or plant products for importing, and the Customs and BAPHIQ then check the applications and relevant documents provided by citizens and agency of foreign countries as trading partners. Finally, a specific branch office of BAPHIQ executes the quarantine inspection and returns the results to Customs for Customs clearance.

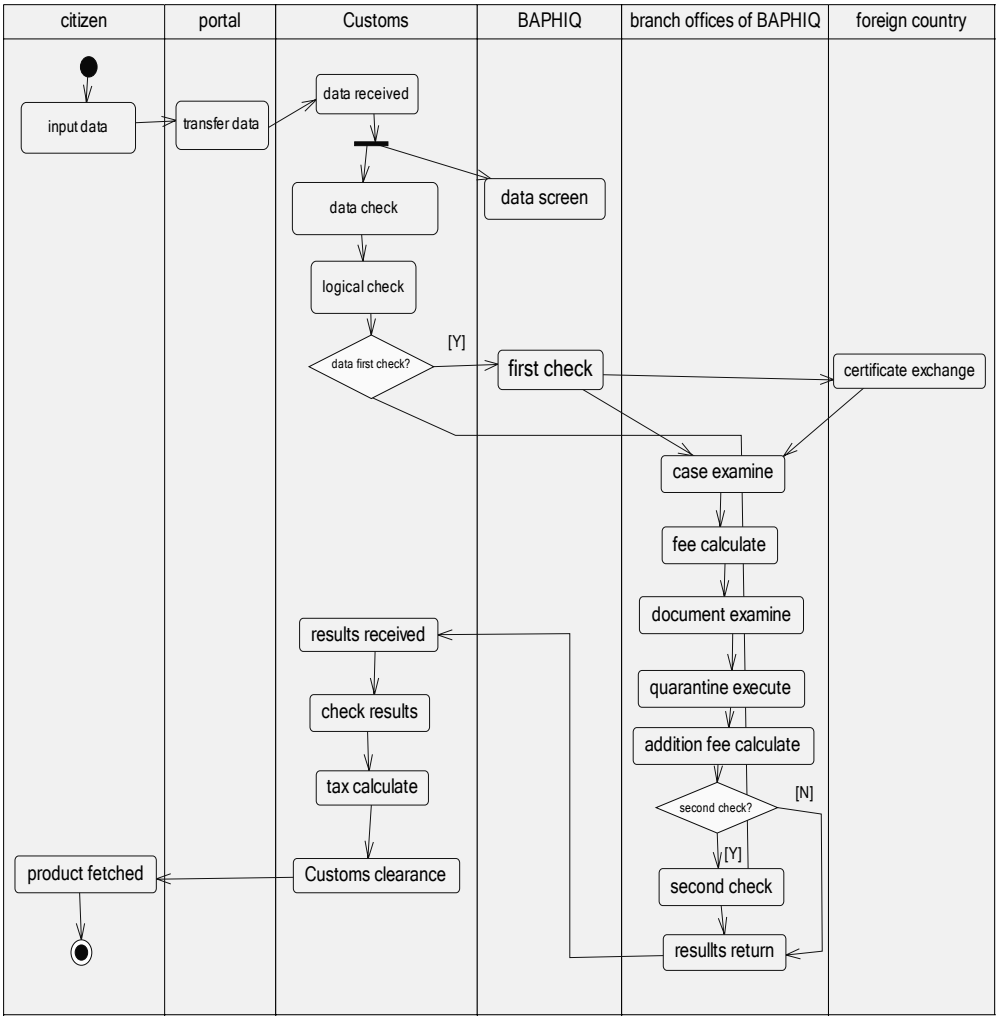

Fig. 8 The activity diagram of e-CQC

During the step 3, the operation candidates of business service candidates are derived using collaboration activities (e.g., application data check, quarantine data screen, and first check of application/certification et al.) obtained from step 2. Furthermore, the operation candidates can be grouped into associated function like ‘quarantine inspection’, ‘quarantine administration’, ‘check of application/ certification’, ‘international certificate exchange’, ‘Custom examine’, ‘Custom administration’, and ‘portal’.

Fig. 9 shows the business service candidates created by grouping operation candidates. The additional abstract services candidates can be identified such as ‘quarantine affairs’, ‘Customs affairs’, and ‘quarantine application’.

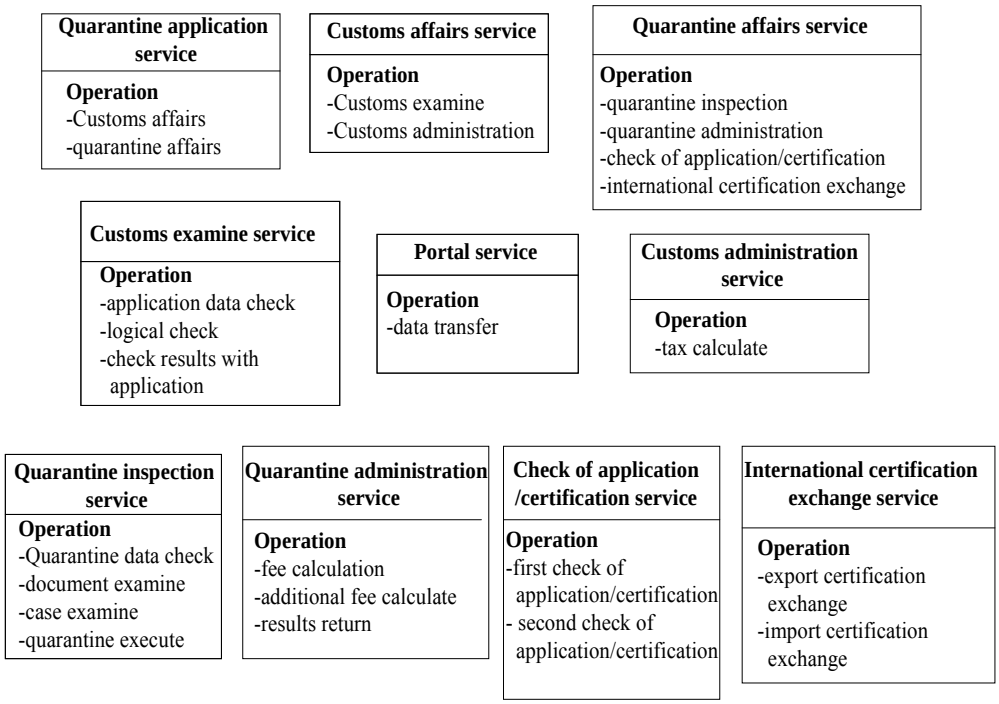

Fig. 9 Service candidates of e-CQC

During the step 4, the business service candidates, obtained from step 3, can be categorized into layers. Fig. 10 demonstrates that the service candidates are categorized into three layers: namely, (1) orchestration service layer contains elements like ‘quarantine affairs service’, ‘Customs affairs service’, and ‘quarantine application service’, (2) business service layer contains elements like ‘Custom examine service’, ‘Customs administration service’, ‘quarantine inspection service’, ‘quarantine administration service’, ‘check of application/certification’, and ‘international data exchange service’, and (3) application service layer contains elements like ‘portal service’.

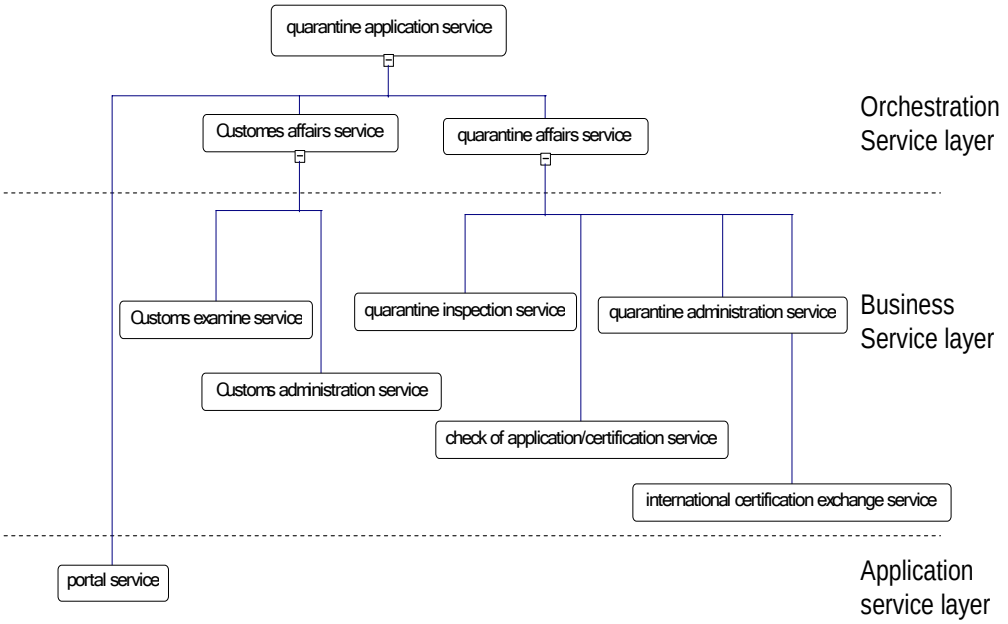

Fig. 10 Classification of service candidates

Conclusion

The e-CQC, a part of the 'Trade Facilitation Project', integrates the business process across Customs, BAPHIQ, branch offices of BAPHIQ, and foreign countries. Therefore, the SOA seems to be the appropriate solution to apply to e-CQC due to the properties like flexibility and industry-standard used to integrate heterogeneous e-Government environment. However, the critical steps of service-oriented analysis are service modeling to locate the proper business service candidates, but there is no standard method to implement the analysis.

The analysis of business services proposed by Erl (2004) describe the steps to capture operation candidates and business service candidates, but not use the standardized notation and method to derive them. This study develops a method to derive the operation candidates and group them into the business service candidates based on BDV and BRV model of UMM. The UMM, developed by UN/CEFACT, has proved to be an appropriate method to derive the business services candidates due to it's comprehensive procedure by using UML to capture business knowledge. Additionally, the proposed method to derive business service candidates include four steps that match the SOAD service definition hierarchy proposed by Zimmermann (2004) that derived the

functional domain, business process and business services in a top-down manner. Meanwhile, the proposed method developed by using UMM that may help enterprises to share their documents of information systems with a common standard and accelerate the implementation of SOA.

The future works of this study are proposed as follows: (1) to extend the scope of application from the e-CQC to whole 'Trade Facilitation Project' to identify the obstacles and opportunities of SOA apply in the e-Government sector, (2) to find the application service candidates during service-oriented design step after derived the business service candidates, and try to use the UMM BRV and BTV model to achieve the steps.

Acknowledgements

The authors are grateful to the Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ), Council of Agriculture, Executive Yuan, R.O.C., for the partial financial support to this work under the grant 94AS-7.4.2-BQ-B2 (2005) and 95AS-13.1.1-BQ-B4 (2006).

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