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Framing Services based on Value Activities in Healthcare

G.Dantanarayana[#1], C.Wickramage[#1], P.Jayaweera[#2]

[1]*Department of Computer Science, Faculty of Science, University of Ruhuna, Sri Lanka*

[1]gilmini@dcs.ruh.ac.lk

[1]chathurika@dcs.ruh.ac.lk

[2]*Department of Computer Science, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka*

[2]pja@sjp.ac.lk

***Abstract*—Present-day successful ICT deployments in any sector heavily depends on accurate and complete service designing and then deployment in domains with relevant technical environments. In healthcare service sector, ever increasing specialties, large number of providers offering wide spectrum of services and associated highly complex service coordination in networked environments intensified the pressure on stakeholders of service-solution development workflow. The research work presented in this paper is partial contribution in getting established framework for systematic facilitation and guidance for healthcare service designers to achieve the success. Such a framework should assist different modeling layers in service-solution development ranging from higher motivation levels to lower technical realizations. In order to achieve this business/IT alignment, notion of "Value" has been introduced covering broader aspects gluing aforementioned layer focuses while ensuring bi-directional traceability between such modeling layers. Introduced value actor, value activity, value object and associated classification schemas are the central contribution of this research. Further, we have briefly demonstrated the applicability of this approach in simple case study. Our initial intuition through the completed case study is this approach assists service designers in early identification of correct and complete services, then to design and deploy with guaranteed successful service solutions.**

***Keywords*— e-Services, Goals, Value Activity, Value Object**

I. INTRODUCTION

Providing an e-Solution that captures the dynamic behavior of an organization, to an enterprise is the key to success of the entire business. The base for a successful electronic business solution is identification of services. Though it is complicated still it is necessary to get complete intuition on services as delivered on IT enabled businesses. For this purpose different models are to be constructed not only to identify the competitive environment of a business, but also to identify new requirements of dynamic and ever changing business environment. Therefore networked business atmosphere of service oriented enterprise applications is creditable to consider in this context. In service based organizations, different value objects have to be offered by means of e-Service in majority of the cases.

Healthcare domain is a special networked business environment as it centered around a special customer called patient to whom bundle of services are offered by huge spectrum of healthcare services providers. Often time, different healthcare applications to facilitate these service providers and service recipients encounter interoperability issues when to achieve health information exchanges. SAIF is one global healthcare standard focused mainly on achieving working interoperability based on service oriented architecture. However, it could be noticed that a number of IT solutions deployments in healthcare domain failed mainly because of lacking systematic guidance in service designing based on different actor perspectives in order to meet their requirements.

As the main objective in this research work, a methodological support has been provided to model services in service oriented business organizations using notions of value activity types in networked environment. Thus a foundation for higher level service identification and planning services has been provided when designing healthcare solution. Further, the paper illustrates how the activities can be used to realize different values through business service processes from a new value perspective. This work leads to get establishment on roles and the responsibilities by analyzing actor involvement in services.

The rest of the paper is structured as follows. Section II describes research background with relevant standards and related work on how service identification leads to business-IT alignments. Section III, outlines the proposed Value Activities based Healthcare Service Design in accordance with the different actor perspectives and the goal oriented value objects pertaining to healthcare industry. Next, Section IV illustrates how the proposed approach is applied to identify services of an enterprise and finally, Section V concludes with brief evaluation and benefits of the proposed approach.

II. RELATED WORK AND RESEARCH BACKGROUND

IT and healthcare domain related standards are focused when proposing the Value Activity classification and the metamodel derived. The main focus is given to HL7, SAIF, BMM, e3-Value constructs and metamodel are briefly introduced below. Also background of service designing discipline discussed here.

A. Health Level Seven International (HL7)

HL7 is an organization that develops international standards for IT in healthcare domain initially concerning

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point-to-point messaging **Error! Reference source not found.Error! Reference source not found.**. HL7 being most widely used healthcare standard is a comprehensive framework for exchange, integration, sharing and retrieval of electronic health information supporting clinical practice and the management to deliver and evaluate the healthcare service. Development, adoption, market recognition, utilization and adherence standards are specified in HL7 covering the complete life cycle of businesses.

B. Service Aware Interoperability Framework (SAIF)

Object Management Group (OMG) the organization introduces standards related to Object Orientated and related IT solution development standards and HL7 has proposed SAIF the leading framework that is attended to guarantee interoperability among healthcare applications. SAIF resulted as an extension for the HL7 and tries to cover several aspects in healthcare service modeling based on working interoperable behavior in this domain[1]. However research analyzing SAIF conclude that it failed to satisfy the principals relative to both architecture and computation behavior in information modeling [2]. Value Activity Classification and the metamodel designs have been proposed considering SAIF sub-frameworks; Enterprise Conformance & Compliance Framework (ECCF) and Governance Framework (GF).

C. Goal Modeling

BMM capture the goals that are represented using higher level modeling concepts in the notions of ends and means. The business value objects and the business service processes essential for exchanges can be identified with the use of BMM, thus goal models were further utilized as the foundation in designing e-Services of a business [3]. The elements of business plans and the interrelation of factors and elements identified and defined are indicated by the use of BMM [4].

D. e3-Value Constructs

e3-Value modeling is an approach to model networked businesses in terms of values and analyzing profitability. The goal of e3-Value modeling is to bridge the gap between business and IT groups, mainly for development of e-business systems [5], [6]. Also it was designed to help define how economic value is created and exchanged within a network of actors. Value actor, market segment, value object, value port, value interface, value activity, value exchange, etc are graphically represented by its notations.

E. Metamodel

When a modeling language is defined in the form of a model like UML class diagram is a metamodel [6]. The semantics are defined in metamodelling in order to model elements within a model. The essentials included and the irrelevances excluded in a system or a software are captured through this type of modeling [8]. The way of new characteristics and constraints are assigned to a meta class by extending the semantics, with the use of stereotypes.

F. Background of e-Service Designing

e-Service designing approach is immerged due to increasing complexities of the business requirements. Therefore it is focusing on how systematic requirement identification approach adopted in order to identify advance e-Servicing of the business. The recent research study [13] has been focused on e-Service identification utilizing with standard modelling methodologies, i* and e3-Value modelling. Also the work suggested how to explore commercial e-Services from the goal perspectives of the business.

III. VALUE ACTIVITIES BASED HEALTHCARE SERVICE DESIGN

Categorizing actors by deciding on their goals collaborations of the concerned business situation is a fundamental step in service designing [9],[10],[11]. Immediately after identifying the value actors next is to get the intuition with the required activities related to them. Framing services to value activities that subject to identify processes of the e-solution is challenging. Lack of step vise approach in classifying services separately in health care scenario is worth addressing. In this study we propose value activity classification based on the goals of different actor perspectives as a solution for the above situation. Further identification of the value objects that exchanged when offering and receiving the services according to inherited characteristics pertaining to healthcare domain is proposed as in [12]. The relationships among value actors, value activities and value objects are graphically represented using meta models [Fig. 1. (a), Fig. 1. (b) and Fig. 1. (c)].

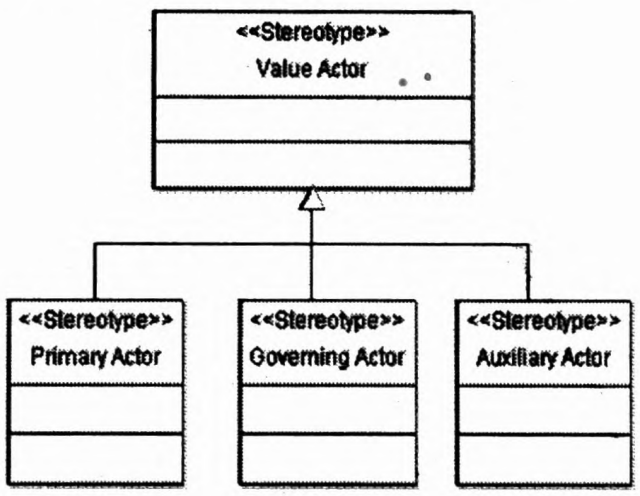

Fig. 1. (a). Metamodel for Value Actors

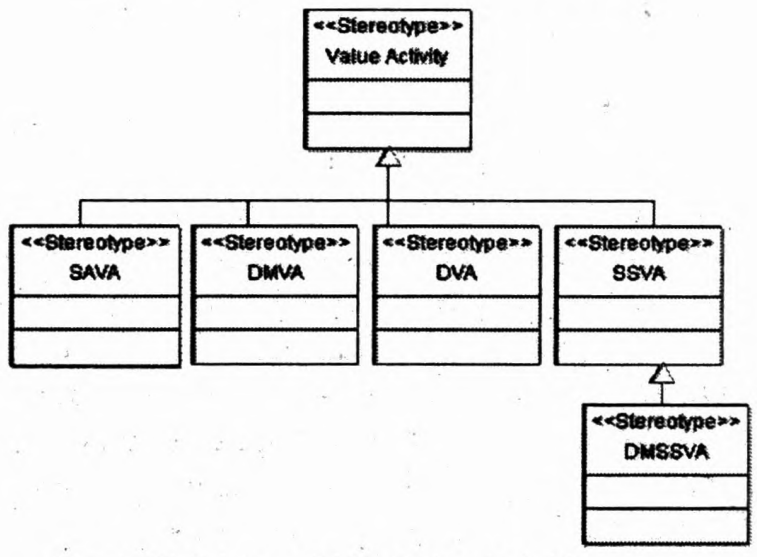

Fig. 1. (b). Metamodel for Value Activities

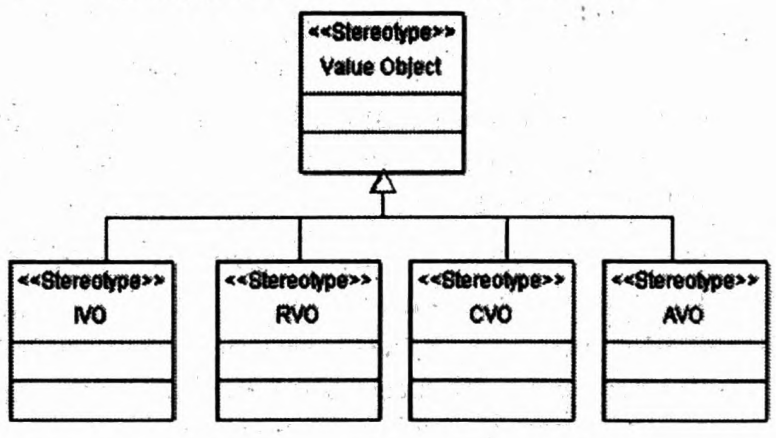

Fig. 1. (c). Metamodel for Value Objects

A. *Value actor classification*

The healthcare industry is a special service provider when compared against other common businesses and the primary actor in this industry, the patient is a special customer. Most of the service activities in the health care industry are controlled by a governing party, i.e. a physician with authority to oversee whole patient-healthcare service provider collaborations. All the other services provided can be considered auxiliary services/value offerings to a main process. Such main processes are mainly to facilitate primary actor-governing actor service collaborations. Thus it can be deduced that health care industry consists of three major perspectives namely Primary Actor Perspective, Governing Actor Perspective and Auxiliary Actor Perspective resulting value actor classification as proposed as in Fig. 1. (a).

B. *Value activity classification*

1) Service acquisition value activities (SAVA): The very initial value activity where the primary actor awards an intrinsic value object (as expressed in [12]) receiving a proof evident in order to request for the service from the enterprise is a service acquisition value activity.

Example: Registration

Patient requests the service by offering payment to acquire healthcare services. The patient receives a proof of evidence in return as a confirmation to acquire the health care service.

2) Decision Making Service Activities (DMSA): Decision making activity supports overall service offering of the whole healthcare collaborations that is controlled by a governing actor and it is categorized under DMSA. This may consists of set of Decision Making Levels.

Example: Diagnosis

Physician controls a patient case by investigating the patient status as a preliminary diagnosis activity of the entire service orchestration. It is impossible to fulfill case service requirements without this preliminary activity. Diagnosis can be leads to several other levels of decision making activity where different physicians may involve.

3) Directing value activities (DVA): The activity that a governing actor directs to enact and control other Auxiliary Collaborations between other supportive service providers in order to meet primary actor case service requirements comes under this category. Auxiliary parties involve in corresponding activities under governing actors directions and instructions. The service would be completed at this level in special situations without directing further activities. Governing actor controls the business with a personal verification by guiding the primary actor to gain the service leading to auxiliary value activities.

Example: Prescribe

Physician directs the patient with a personal verification to gain the services such as medical tests, medicine, directing to another party to diagnosis, etc.

4) Service supportive value activities (SSVA): The supportive activities that take place in providing comprehensive services in collaboration with a governing party of the entire healthcare collaborations are categorized as service supportive value activities. SSVA can be categorized into Service Acquisition Service Supportive Value Activity (SASSVA), Decision Making Service Supportive Value Activity (DMSSVA) and Directing Service Supportive Value Activity (DSSVA). More often these services are provided directly to the primary actor as per requests from governing actor.

Example: Treatment

Pharmacists an auxiliary party supports healthcare enterprise by providing medicine to a patient by verifying personally directions provided by a physician.

Example: Diagnosis Support Medical Test

Medical Laboratory Technicians an auxiliary party that supports healthcare enterprise by providing medical laboratory tests as information supporting decision making by physicians.

Four types of different value activities in healthcare domain can be identified and classified as proposed above. The metamodel for the Value Activity Classification is depicted in Fig. 1. (b).

The metamodel for the proposed Value Object Classification in [12] can be shown as in Fig. 1. (c).

C. *Value based Healthcare Service Classification*

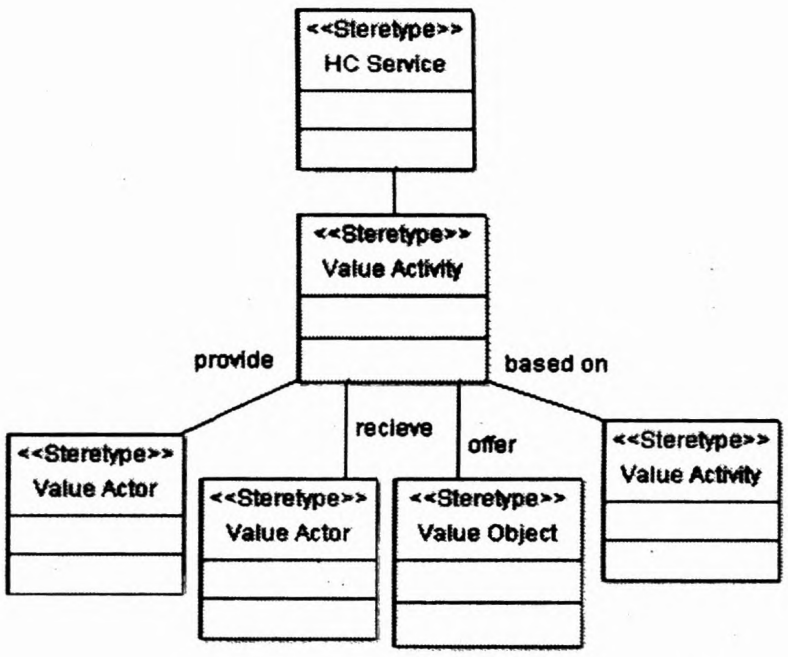

Fig. 2. Metameta-model for Healthcare Service

It is important to identify the relationships systematically among modeling concepts in the proposed classifications in order to design services in healthcare domain. When Value Actors involved with specific Value Activities, relevant Value Objects that are generated can be comprehended according to the proposed classifications above. The metametamodel for Healthcare Service (Fig. 2.) illustrates the relationship of these components related to major service. A Value Activity may depend on another Value Activity of same type or different type as discussed in Section III.B. above. The two actors at the receiving and providing ends respectively generate and offer Value Objects accordingly when the service is provided.

The metametamodel (Fig. 3) illustrates activity modeling of major activities based on four value activity types that follow the meta class. When a service is offered, one or several Value Objects may exchange. Some of the Value Activities may based on more than one Value Activity. It also presents the possible multiplicities of the Relationships.

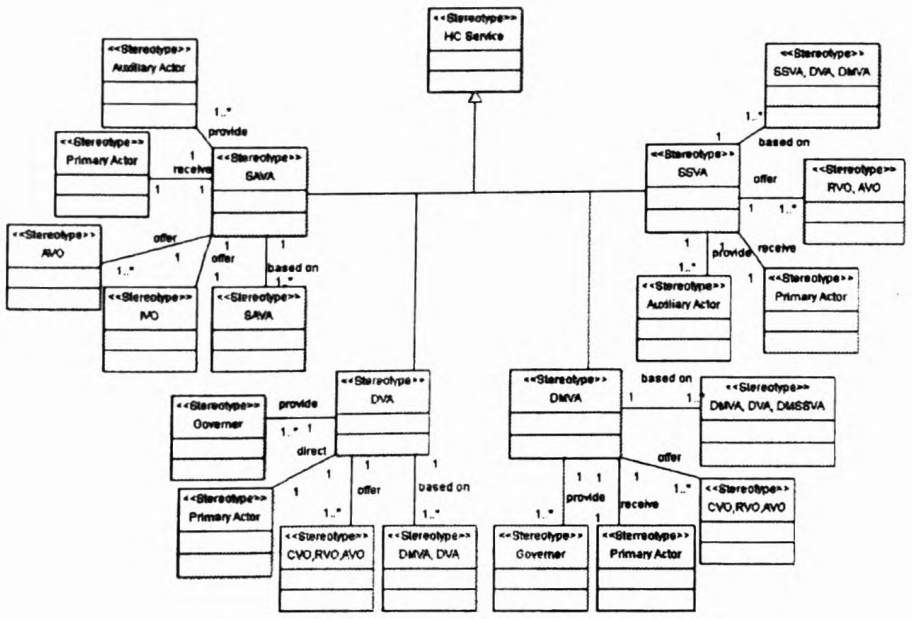

Fig. 3. Metametamodel for Healthcare Service

IV. Application of Proposed Classification

Services generated from goals of different actor perspectives of an enterprise, should be decided initially in order to identify Value Activities. Based on the three major perspectives of healthcare domain; the Primary Actor Perspective, the Governing Actor Perspective and other Auxiliary Actor perspectives services can be identified systematically reducing the complexities in services and related requirements elicitation. The systematic guidelines given below can be followed in applying the proposed approach in HC service modeling.

Guideline 01: Decide actor perspectives
Guideline 02: Determine initial value activities in relation with actor perspectives
Guideline 03: Clarify the service provider, the service receiver and the Value Objects generated for each activity
Guideline 04: Identify the Value Objects generated for each activity
Guideline 05: Analyze and verify the prerequisite service activities that effect the determined activity
Guideline 06: Model the identified prerequisite activities in the same method

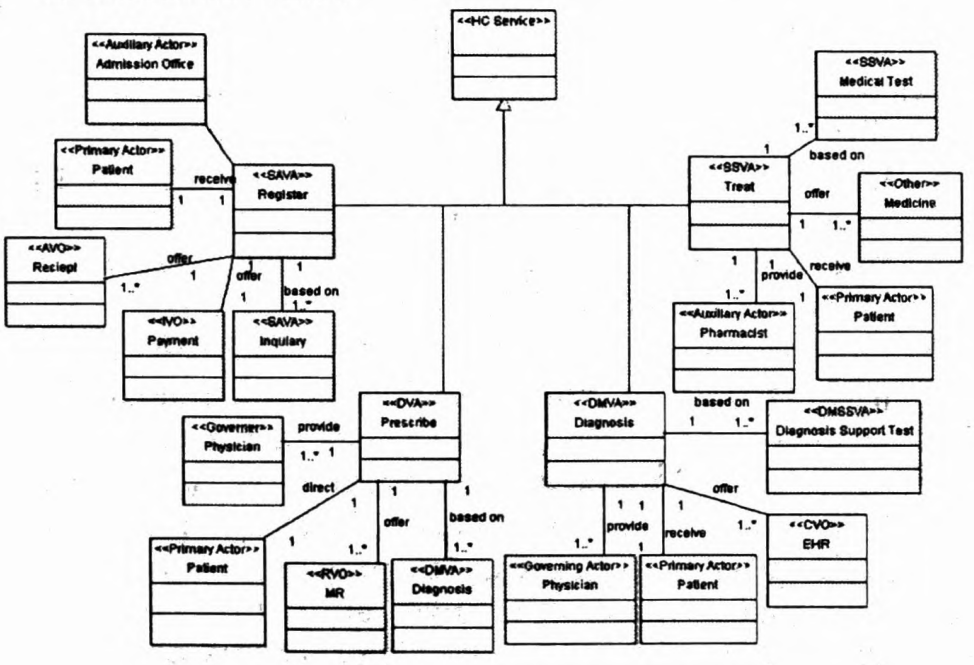

Fig. 4. Metamodel for Healthcare Service

Considering the proposed step vise generalization now it is possible to simplify services in a real situation according to the activities identified in above approach. The identified value activity types are used in analyzing in order to figure out prerequisite services in the same domain and they are also modeled using the meta-model proposed. The interconnections of the value activities for an ordinary case in healthcare service are exemplified in Fig. 4. The Value Objects identified can be further assisted to simplify the services of the business using the systematic approach expressed in [12].

Assessing the constructs, metamodels proposed here could be done by applying with varied case studies from healthcare. For instance, general clinical work flow undergoes the major steps such as registration, diagnosis, prescribes and treatment where it could be analyzed with the metamodel application exemplified in figure 4.

V. Conclusion

The service oriented business requirements can be identified considering different actor perspectives thus reducing the complexity of the solution. It can be concluded that a service is offered in terms of value activities. Mainly the healthcare service is provided using several activities and they can be categorized into four types of different value activities. The identified initial activities can be a collection of activities of same value activity type or can be of different value activity type. The main benefit of the said approach is to provide a foundation for service identification and planned services when designing e solution for the selected healthcare domain. Immediately after identifying the services the flow and the relationship can be modeled using the suggested metamodels.

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