4 ROLE BASED AND PROCESSES BASED MODELLING APPROACH FOR ORGANIZATION NETWORK

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Nowadays, virtual enterprise, extended enterprise, wide supply chain and enterprise network are organizational structures recognized by the scientific and professional communities. The challenges in the engineering of these systems consist in proposing solutions that take into account both the social and the technical aspects simultaneously. The modelling approach and the models are components of the system engineering framework [GERAM 1999]. This paper proposes a role based and process based modelling approach for organization networks. This approach uses a combination of the role based modelling approach and the process based modelling approach. This paper shows the importance of the role concept and proposes new definitions.

1. INTRODUCTION

Our work aims to develop an engineering and integration methodology for enterprise networks. To achieve such a purpose it is necessary to define the enterprise entities of these networks as recommended by (GERAM 1999). A set of hypothesis will be introduced in order to define these enterprise entities.

In setting up enterprise networks, partners decide to create a long or a short term cooperation as illustrated in the literature by extended enterprise, virtual organization, etc. However, partners often create long term cooperations that are less structured in order to develop business or to create virtual organization. This working model is explained by the fact that it is very expensive and very difficult to create virtual organizations each time. So, partners need a structure where the cooperation is configured. The virtual enterprise modelling report of the Voster project says that about 70% of the studied projects assume the existence of such structure. It is called network, source network, support Network, or breeding environment (VOmap project). In our study we use the name of source network.

A central and important aspect in setting up source network is the work preparedness. Source network is regarded as a breeding ground for the preparation

and formation of virtual enterprises where partners will establish a degree of preparedness for forming particular virtual enterprise (Tølle 2003).

The hypotheses on what our work is based are :

- Since the reported studied have shown in most cases the existence of a source network and since the project of virtual organization set up is very expensive and difficult, we decided to take into account the source network concept in our study.
- Since adding an external enterprise to network members in order to set up a virtual organization makes the development period and cost longer, we decided to work on source network where only the internal members are selected to set up a virtual organization.
- Since a weak work preparedness related to virtual organization launching and operation do not allow the network to fill the present challenges that are rapid answer to customer needs, flexibility, and reactivity, we decided to work on source network where work degree preparedness is very high.

These hypotheses imply a separation between the life cycle of the source network and the life cycle of the virtual organization. In the rest of the paper, we consider the network source and virtual organization as two distinct organizations.

1.1 Enterprise entities of the enterprise networks

Based on these hypotheses, we could set up an enterprise network where the strategic and tactic activities have been implemented and where the behaviour of partners in virtual organization operation is designed. Our work consists in developing an engineering methodology for such an enterprise network.

This methodology uses the product, business and organization network enterprise entities. The product enterprise entity represents all product and customer services of the organization network (see GERAM 1999).

Based on the hypothesis announced above, we decided to use the business concept instead of virtual organization concept. «A business is a series of processes, each having a clearly understood purpose, involving more than one organization, realised through the exchange of information and directed towards some mutually agreed upon goal, extending over a period of time » ISO/IEC 14662. We assume that a business is acted by the apparition of an external event of the network and ach ieved by the delivery of the product (service) required to the customer.
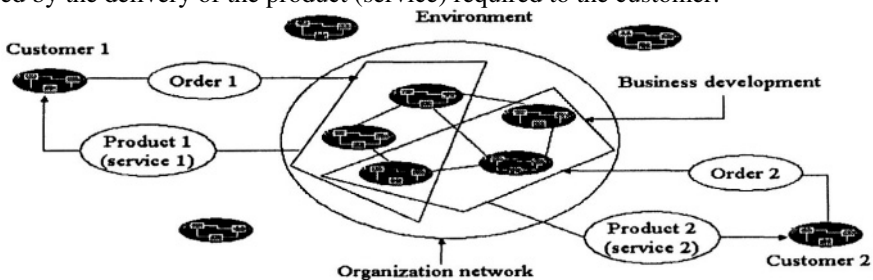

Figure 2 : Organization network, business and product enterprise entities

An organization network is a   long term cooperation of a set of organizations that combine their competences and resources around a common objective. The operational work of the network is configured around the concept of business. The

following figure globally shows the relation between the organization network, business and product enterprise entities.

2. ORGANIZATION NETWORK MODELLING CONCEPTS

Modelling concepts define and formalize most concepts of organization modelling. The concepts used in developing our methodology are based on several sources. Firstly, we used the concepts defined in different known methodologies as CIMOSA, GRAI-GIM, PERA, GERAM, UEML, ODP, OORAM, etc. Secondly, the concepts can be defined from enterprise ontologies as TOVE ontology. Finally, concepts can be found in work on organization networks as (TELEflow project) (Globemen project) (UCANet 2001) (Boughzala I. 2001), etc.

Of course these sources of concept definitions are very rich; nevertheless we consider to add some new concepts to model organization networks necessary. In this study we focused on the role concept. This section will introduce the role concept and some other concepts.

In order to define and to model the role concept we use role theory, studies related to organization modelling and computer information systems.

In general, role theory has focused on the behaviour characteristics of a person (who occupies social positions) and on its relationships with others people within a stable social system. Several researchers have worked on the role concept. Role is a "position occupied by a person in a social relationship (Biddle 1966)"(also see (Holm 1997) (Campbell 1999)). In describing labour between members, Holm said that a social group consists of a collection of roles, which must be present to enable the group to exist and to develop. It then becomes important to study different leader roles, functional roles, pedagogical roles, status roles, and so on. For studying these roles the organizational role theory is a perspective among researche interested in the roles of formal organizations (see (Campbell 1999)).

In organization science, several definitions have been assigned to the role concept. Ould (Ould 1995) introduced the concept of organizational role as an area of responsibility which ranges from concrete things (work station, functional unit, etc.) to abstracts things (customer, supplier, etc.). Marshall (Marshall 2002) defined organizational roles as operational views that allow defining process steps. In WFMC glossary, an organizational role is a group of participants exhibiting a specific set of attributes, qualifications and/or skills. Finally, (Eriksson 2000) defined role as a description that tells an actor how to function in a given context.

In computer science, the role concept have been used in object oriented methodologies and multi-agent systems. Several definitions have been used in both domains. For the first domain, we present the definition proposed in (Balabko 2003) that defines the role concept as an abstraction of the behaviour of an object. However, for the second domain we have chosen the Ferber's (Ferber 1995) definition "role concepts represent the agent positions in an organization and the set of activities that are supposed to be carried out in order to accomplish its purposes.

The advantages of using role concept have been illustrated in (Marshall 2002):

- Role concept controls complexity by partitioning knowledge of an entity into separate domains.
- The real behavior of an entity is delegated to its values(values list what an entity has and does), which is to be reusable both within and between

domains.

- This partitioning allows knowledge to change over time.

Based on the different works cited above, we propose two concepts of role : organizational role and resource role. An important difference between both these roles is explained by the fact that an organizational role makes reference to global missions carried out by a center of activities which we name "organizational unit", while role resource represents operational and local missions carried out by a specific resource in the network.

We define organizational unit as a center of activities that accomplish missions and compound all the means necessary to its operation. An organizational unit can be specialized through granularity levels, it can be an enterprise network, enterprise, filial, department, professional unit or work station. A work station is an elementary center of activities defined by its activities (Nanci 2001), while professional unit, which is also an elementary center of activities, is defined by its missions.

Both role concepts are defined below and organization role specialization will be introduced.

2.1 Organizational role concept

As far as we are concerned we define an **organizational role** as an abstraction of the behaviour of an organizational unit. It models the macro-competences and the characteristics that an organizational unit has to fulfil in carrying out a set of activities in a given context.

As illustrated in the following figure, an organizational role is described through the attributes : name, missions, rights and obligations, macro-competences, performance indicators. Name indicates the name of the organizational role. Missions represent the main activities to achieve in carrying out the organizational role. Rights and obligations represent rights and obligations associated with the organizational unit in carrying out the activities related to the organizational role. Macro-competences are the competences required to carry out such an organizational role. Performance indicators are variables that indicate the results of the executed activities by the organizational unit in carrying out the organizational role.

Name
Missions
Rights and obligations
Macro-competences
Performance indicators

Figure 2 : Organizational role construct

2.2 Resource role concept

As defined in (Vernadat 2001), a resource can be either human, machine, or application. A **resource role** describes what do a resource in a given context. Characteristics associated with resource role are name, aptitudes, tasks and performance indicators. Name indicates the name of the resource role. Aptitudes represent the necessary characteristics required to fulfill the role (human role is modeled by competences, application role by functionalities and machine role by capabilities). Tasks indicate the tasks related to the resource role. Performance

indicators are variables that represent the resource performances in carrying out the tasks.

Figure 3 : Resource role construct

Name
Aptitudes
Tasks
Performance indicators

Each attributes of both these role types could not only be described through values but also through models.

2.3 Organizational role concept in organization networks

The practice studies on organization networks reported the real existence of the role concept. Most projects studied in (Katzy 2003) define necessary management roles for the creation and administration of virtual enterprises, which entails detailing what is generally called the broker function. These management roles are called, for example, business integrator, marketing manager, co-design manager, co-maker manager and legal expert in (UCANet project); broker, competence manager and network manager in (GLOBEMAN21 project); cooperative agent in (Boughzala 2001), etc. the importance in studying these roles have been introduced in (Katzy 2003) and (Lupu 1999).

An organization network is a complex organization that implies several enterprise entities. So, it is necessary to define organizational role in a single enterprise before doing it in a network.

Enterprise functions group activities. As far as we are concerned, these activities can be divided into three types. The first type represents activities that directly take part in the product (service) realization of the enterprise (activities related to purchasing, production, selling, etc.). The second type models the activities that support the enterprise operation (activities related to information system management, competence management, etc.). Finally, the third type represents management and coordination activities.

So, we can describe the enterprise operation through management and coordination functions, support functions and functions that take place in product (service) realization. This leads us to specialize the organizational role in accordance with these function types. An organizational role of an enterprise can be :

Management role : it represents a set of macro-competences and characteristics that an organizational unit has to fulfil in carrying out one or several management and coordination functions.

Support role : it represents a set of macro-competences and characteristics that an organizational unit has to fulfil in carrying out one or several support functions.

Functional role: it represents a set of macro-competences and characteristics that an organizational unit has to fulfil in carrying out one or several functions that directly take place in product (service) realization.

Through the concepts presented in the introduction of this paper, we can conclude that it exists two organizations in an enterprise network : what we named organization network (source network) and business (business results from the network operation).

So, it is possible to define organizational roles that characterize the organization network, business and relationships between organization network and business. These roles are introduced in the following figure and paragraph.
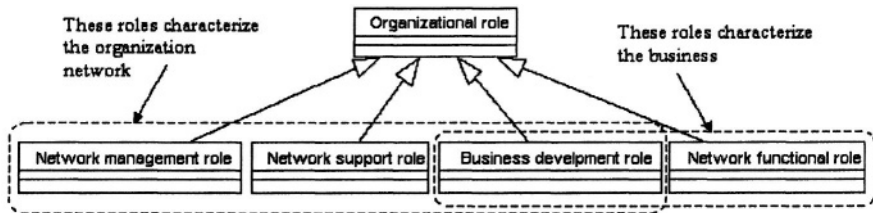

Figure 4 : Organizational roles of an organization network.

Respectively, network management role, network support role and network functional role have the same definition as those for the enterprise but they have different missions. The business development role represents macro-competences and characteristics that an organizational unit has to fulfil in carrying out one or several functions related to business initiating, launching and managing.

3. MODELLING AND METHODOLOGY PRINCIPALS

We consider an organization network as a set of organizational units related by cooperation, collaboration, authority and coordination relationships. We model the operation and the organizational structure of the network and of its organizational units through a role based and process based approach modelling (see figure 5). This approach uses two modeling views : structural view and dynamic view. The structural view models the organizational structure of the network. It essentially shows the authority and coordination relationships between organizational roles, and the assignment of the organizational roles to organizational units. The dynamic view models the interactions (circulation of product and control flows) between the organizational units by modeling processes whose activities are defined by the organizational roles. The model developed here can be compared to the UML role based activity diagram. Both models that correspond to theses two views are included in a paper submitted to the International Journal of Networking and Virtual Organization.
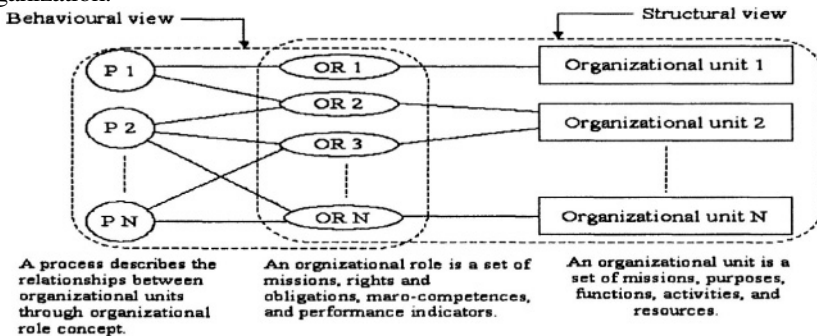

Figure 5 : Role based and process base modelling approach

The rest of these sections introduces our methodological principals. Our methodological approach uses the classical principals of decomposition and

composition introduced in (Ferber 1995). The organizational unit of the level n represents the organization network (see figure 6). The organizational units of the level n–1, that compose the network, can be considered as actors that have their proper behaviour. If we are interested in the operation and the organizational structure of these organizational units, each of them could be decomposed on organizational units of the level n–2. We can do the same thing for levels n–2 and n–3. This decomposition process will finished either when all the organizational units of the reached level are a work station or a professional unit, or when we make an abstraction of the operation and the organizational structure of the organizational units of the reached level.

These organizational units that constitute the network are composed of resources (human, machine and application) that came either from several partners or from one specific partner. The figure 6 presents the basic procedure of our methodological approach and the decomposition model of an organization network.
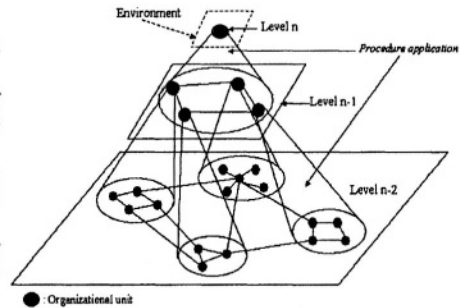

Figure 6 : methodological principals

This paragraph explains how we apply the modelling approach through decomposition process. Globally, the implementation of an organization network (organizational unit of level n) consists firstly in defining its missions and purposes. Secondly, the carrying out of the basic procedure (see figure 6) mainly allows the definition of organizational roles, organizational units and processes (of the level n–1) necessary to the operation of the network. Each of these organizational units of the level n–1 have its proper missions and purposes. In a similar manner, if we are interested in the definition of the operation and the organizational structure of the units of the level n–1, we will apply the basic procedure on each of them, in order to define the organizational units of the level n–2 and their interactions. So, we can apply the procedure each time we want to go down from one level to another.

4. CONCLUSION

The paper proposes a role based and process based modelling approach for organization networks. Firstly, we introduced the organization network concept and business concept as enterprise entities of our study. Then, we presented two main new modelling concepts for organization networks which are organizational role and

resource role. After that, we introduced the role based and process based modelling approach through a set of principals applied in our methodology. Such methodological principals are very important in organization network modelling since they allow on the one hand, modelling the organizational structure of the network composed of a set of partners, and on the another hand, checking partner behaviour by the definition of their rights and obligations. These rights and obligations are modeled by organizational role construct.

Note that this study is a part of our results in developing an engineering methodology for organization networks. More details on these methodologies are included in a paper submitted to the International Journal of Networking and Virtual Organization.

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