Sindh Univ. Res. Jour. (Sci. Ser.) Vol.49 (004) 743-746 (2017)

http://doi.org/10.26692/sujo/2017.12.0051

SINDH UNIVERSITY RESEARCH JOURNAL (SCIENCE SERIES)

VBEML: Virtual Breeding Environment Modeling Language

S. N. PATHAN, N. J. RAJPER, H. A. NIZAMANI

Institute of Mathematics and Computer Science, University of Sindh, Jamshoro

Received 5th July 2016 and Revised 21st August 2017

Abstract: This paper presents Virtual breeding Environment modeling language (VBEML). A Virtual Breeding Environment (VBE) needs to be modeled in order to understand its complex composition and behavior. There is no modeling language dedicated to the specification of VBE The VBEL allows to define the basic structure of a VBE, its constituent elements and other details which define the essential structure of a VBE .

Keywords: Virtual Breeding Environment, Modeling languages, virtual organization. Back Project, Maximum A-Posteriori

1 INTRODUCTION

Virtual Organization (VO) is a set of independent organizations that share resources and skills to achieve its goal (Camarinha-Matos, *et al*. 2004). It is an opportunity-driven, temporary and timely alliance of autonomous entities (organizations, individuals, etc). It is created between different (possibly previously unfamiliar) organizations to capture and fulfill a business opportunity and then dismantle itself. But, lack of trust between previously unknown organizations, time required to align coalition partners' business processes and underlying infrastructure, geographical, temporal and cultural differences are one of the major concerned faced my VOs to be accepted for its potential.

The concept of Virtual Breeding Environment (VBE) has come up to tackle above hindrances. It is a base long-term organization between different autonomous and possibly competing entities (organizations, individuals, cetera) (Camarinha-Matos, *et al*. 2004). Virtual Breeding Environment (VBEs) acts as platform where the creation of VOs can readily take place. Such VOs respond with high flexibility to rapid changes in the market demands. They overcome general concerned mentioned above faced by individual VOs due to support infrastructure already under placed by the VBE. When an opportunity arises, suitable partners are chosen quickly from the VBE members to form a VO. VBE Members can be different organizations such as business entities, ministries and environmental organizations. These organizations should be registered at the VBE, accept the general VBE rules and policies, and have access to common information and tools for operation in a VO.

A VBE needs to be modeled in order to understand its complex composition and behavior. The benefits of having a specification language specifically geared towards a particular domain are manifold such as, it abstracts away unnecessary details of implementation, let work directly with notions and concepts of the domain at hand, precise models (VBEs in our case) allow for various analysis to be conducted on the blueprints rather than developing a fully-fledged running systems. There is no modeling language dedicated to the specification of VBEs with constructs that directly reflect and represent VBE domain concepts. Using generic (and rigorous) modeling languages for VBE specification puts off domain users as they are usually not technical-savvy. Hence, there clearly is a research gap that needs to be filled by developing a domain-specific modeling language that caters for the VBEs.

The rest of the paper is organized as follows. Section 2 provides materials and methods and comprises of comparing the VBE with VO, Section 3 presents VBEML constructs and Section 4 presents the General structure of VBEML finally section 5 comprises of the conclusion and future work.

2. MATERIALS AND METHODS

To come up with the solution to identified research gap in Section 1 following method was adopted:

Step 1: Study already developed modelling languages (generic as well as domain-specific if any) to identify if any of them could be reused for VBE modelling language with as less adaptation as possible.

Step 2(a): If such language is found, adapt it with for VBE modelling by applying required modifications.

++Corresponding Author: Email: S_naz2009@yahoo.com nr76@usindh.edu.pk, hn@usindh.edu.pk

Step 2(b): If no such language is found then develop a new modelling language that takes into account aforementioned requirements.
Step 3: Evaluate and update the chosen or developed modelling language in the light of new findings identified by implementing the case studies.

Presently there is no modelling language that accommodates the VBE terminology naturally with abstraction level that domain experts feel comfortable to work with. Nonetheless, there have been some efforts to understand VBEs through their models. Some of these efforts have used generic (and rigorous) modelling languages (Pierre-Yves, 2007) with no explicit constructs for domain concepts such as VDM-SL (Vianna Development Method – Specification language) (Shela., *et al*. 2015) (Den Berg, *et al*. 1999) (Peter,.995) and RAISE (Rigorous Approach to Industrial Software Engineering (Nami, *et al* .2007). Therefore, there are limitations in expressiveness and there is a need to have a modelling language. On the other hand, we come across specific but referential models of VBE such as ARCON reference Model (Camarinha-Matos, *et al*.2008) (David. *et al*. 2008) that happen to be very abstract and need to be materialized or instantiated which is open to research. VOML (Noor, 2012) is one such attempt towards this materialization. It is expressive enough to accommodate VBE terminology and formal enough to pay the way for tools development and carrying out some analysis.

2.1 VOML Framework

Virtual Organization Modeling Language (VOML) (Noor 2012) Framework consists of three Languages:

- VO-Structural (VO-S) modeling language
- VO-Reconfiguration (VO-R) Modeling languages
- VO-Operational (VO-O) Modeling language

VO-S is aimed for domain experts, VO-O for technology experts and VO-R for adaptation of VOs mainly by domain experts as well. However, the framework does not explicitly claims to be able to model VBE as well, but, since the VBEs and VOs share many characteristics it is suggested that the above languages would be suitable for modeling VBEs well (Noor, 2015). So, our first job was to investigate the above assumption. To do this, we investigated the similarities and differences between a VO and a VBE. **(Table 1)** given below explicates some of them.

Table 1: Differences between VOs and VBEs

VO	VBE
VO is a short term Association	VBE is a long term association
VO has specific business goal(process)	VBE is a facilitator and doesn't have a specific business goal(rather a list of processes)
Types of members in VO are: partner, associative and extEntity	ManagementMembers and BusinessMembers are membership types at VBE level.
VO purpose is to obtain business opportunity and fulfill it.	VBE's purpose is to facilitate VOs obtain its goal as smoothly as possible.
VO serves as external customer	VBE works for its members
Main VOs constructs are: tasks, process, members, VBEassets (used by VOs), data-flow and VO-reconfiguration policies.	Main VBEs need constructs to model: competencies, members, VOs, members, VBEassts (offered to VOs), VBE-reconfigurations policies

The VOML framework appears to have all the elements deemed for a modeling language suitable for VBE specification to some extent. It is abstract enough and contain many VBE specific constructs (by the virtue of being a VO modeling language) such that, technology naïve and domain experts feel comfortable with. It also caters for specifying more concrete, technology-oriented aspects of VOs (and hence VBEs). Hence, VOML shows great potential to be extended for VBE modeling and therefore it can offer a complete platform for both VBE and VO modeling as one integrated unit.

It is therefore, VOML is chosen a choice of framework for the extension of VBE modeling in this research.

3. VBE MODELLING LANGUAGE

The VBE modeling language consists of two languages; VBE-Structural (VBE-S) modeling language targets modeling structural aspects of VBE that are defined at the persistent and business levels. VBE-Reconfiguration (VBE-R) language caters for adaptation and restructuring needs of VBE once it is operational. The VBE-R plays its role at business level.

Besides these two levels, VOML framework consists of third level as well named configuration level which comprises of technology-inclined (yet generic enough) ensembles of components and connectors whose organization at any specific moment in time represent business and configuration level specification

at more concrete details. This works focuses on the two levels only.

3.1 VBE-Structural Modeling Language

The VBE-S modeling language consists of six elements. 1) profile 2) competency 3) Members 4) VBE assest 5) VO and, 6) Behavior. **(Fig. 2)** represents overall structure of VBEML.

- Profile is a set of structured information describing the organization in general such as about domain and sub domain of VBE.
- Competency represents the ability or the skill to carry out certain task. It consists of one or more *capabilities* and their associated *capacities*. Capability represents the resources needed by the offered ability or the skill and the Capacity specify the amount of that resource needed or offered by that capability.
- Members in VBEML are categorized as *Management Members* and *Business Members*. Both are permanent members of VBEML. Business Members are those members who work with their different competencies in VBE such as competency1 competency2 etc. Management Members are those members who work for the management of VBE such as competencies Manager and VBE coordinator.
- VBE assets are resources and task. Resources are used by different tasks and VOs in order to accomplish their goals.
- Behaviour refers to the governing rules, policies and established protocols at the VBE.

```
VBE VBE-id
        {
            VBEprofile                {...}
            Competency                {...}
            VBEasset                  {...}
            VOs                       {...}
            Behavior                  {...}
        }
```

Fig 2: VBE-S Constructs

4. GENERAL STRUCTURE FOR VBEML

```
VBE vbe-id {
   VBEprofile
    {
      domain: domain-id
      subDomain: sub-domain-id
    }
Competency
{
  capability capability -id {
  resource resource-id , capacity {  resourceSpecificAttr, resourceSpecificAttrsValue  }
                              ...
  resource resource-id , capacity {  resourceSpecificAttr, resourceSpecificAttrsValue  }
                                    }
              ...
 capability capability -id {
  resource resource-id , capacity capacity-id {  resourceSpecificAttr, resourceSpecificAttrsValue  }
                              ...
  resource resource-id , capacity capacity-id {  resourceSpecificAttr, resourceSpecificAttrsValue  }
                                    }

}
Members{
       managementMembers{

            member-id
                      {
                       Role: role-id1,...role-idn
                     e.g{VObroker | infrastructureMaintainer| competencyManager| conflictResolver}

                      }

      } businessMembers{
            member-id
                      {
                       providesCompetncy{ competency1, ..., competencyn }
                       memberInVOs {
                                VO-id { competency1, ..., competencyn }, ..., VO-id { competency1, ..., competencyn } |
inactive}
                      }

                           }
 VBEassets{

        VBEresources { MemberDataBase, }
       VBEtasks    {partnerSelection4VO, opportunityBidding, }

}
VOs{   ... }

Behavior
{
 Governance {GroundRules, MemberJoining, conflictREsolution, etc  }
 Reconfiguration {  VBEEvolution,   }
```

General Structure of VBEML

5. CONCLUSION

This research attempts to fill the gap that exists due to non-availability of modeling language specifically geared towards VBE domain experts which could be used for performing different sorts of analysis on VBE models and Used by technology experts to develop more concrete models of the VBE. In this paper we presented a Methodology to Design domain-specific Modeling Languages, a basic structure of VBEML. In Future we will evaluate and extend VBEML in the light of new findings obtained by implementing case studies. We also aim to look into reconfiguration aspect of VBE using APPEL policy language and developing an Editor for specifying VBEML models.

REFERENCES:

Afsarmanesh, H., and L. M. Camarinha-Matosh (2008) VBE Reference Framework in University of Amsterdam published in Springer.

Camarinha-Matos L., and H. Afsarmanesh (2004) The emerging discipline of collaborative networks. In: Proc. Virtual Enterprises and Collaborative Networks Springer US.

Nami, M. R., M Sharifi, and A Malekpour (2007) A preliminary formal specification of virtual organization creation with RAISE specification language in 5th ACIS International in ieeexplore.ieee.org. 227-232. IEEE.

Pierre-Yves S. and P. Heymans (2007) Generic semantics of feature in Computer Science Department, University of Namur, Belgium.

Rajper N. J. (2012) "Virtual Organization Modelling Languages", PhD Thesis, http://hdl.handle.net/2381/10942, Leicester, UK.

Rajper, N. J. (2015) Assessing VOML Framework in the light of Modelling Language Criteria for Virtual Organizations in Institute of Mathematics and Computer Science, University of Sindh, Jamshoro.

Romero D, N. Galeano, A. A Molina (2008) Virtual breeding environment reference model and its instantiation methodology. In Working Conference on Virtual Enterprises 15-24. Springer

Schobbens P. Y, P. Heymans, J. C. Trigaux, and Y. Bontemps (2007) Generic semantics of feature diagrams. Computer networks. 7; 51(2):456-79.

VanDen B. M. V., M. Verhoef, and M. Wigmans (1999) Formal Specification and Development of a Mission Critical Data Handling Subsystem, an Industrial Usage Report 1999.