ISSN 1512-1232

UTILIZING COMMONKADS AS PROBLEM-SOLVING AND DECISION-MAKING FOR SUPPORTING DYNAMIC VIRTUAL ORGANIZATION CREATION

Morcous M. Yassa*, Hesham A. Hassan *, Fatma A. Oamara*

**Faculty of Computers and information*
Cairo University
Giza, Egypt
Email: markyassa@gmail.com, , h.hassan, f.omarag@fci-cu.edu.eg

Abstract

Business Opportunity (BO) needs business collaboration and rapid distributed solution. Legacy systems are not enough to cope with it and there is a need to create Dynamic Virtual Organizations (DVO). While ecosystems have no agree in this area of business markets, some earlier DVO work used ecosystems to handle BO. The main objective of this paper is to show how CommonKADS knowledge engineering methodology is used to model DVO; life cycle, identification, and formation. Towards this objective, different perspectives used to analyze Collaboration Network Organization (CNO) have been discussed. Also, four more perspectives (CNO boundary fixing, organizational behavior, CNO federation modeling, and external environments) have been suggested to obtain what we called a Federated CNO Model (FCNOM). We believe that according to the work in this paper, the negotiations within CNO components during its life cycle will be minimized, the DVO configuration automation will be support, and more harmonization between CNO partners will be accomplished.

Keywords*: CommonKADS; Problem-Solving; Decision-Making; Dynamic Virtual Organization*

I. Introduction

The collaboration between partners and the technological agility are essential to the new trends of business. Therefore, these two issues increase the need to address diverse aspects of distributed computing concepts that support the various capabilities that make up such as business collaboration. One of the main trends of distributed computing is what is called Collaboration Network Organization (CNO), which defined as global a competitive dynamic business environment [5]. On the other hand, Dynamic Virtual Organizations (DVO) is considered one instance of CNO. On the other hand, Business Opportunities (BO) needs business collaboration in order to achieve a specific goal of being active in fulfilling a complex project [7]. When a short-term BO occurs, fast configuration of a temporary consortium, which appropriate to its needs will be formed. This consortium is so-called DVO, which represents a temporary alliance of different organizations that sharing knowledge, skills, and resources in order to respond to achieve the specific BO [7]. Foster at el. [12] thought that the real and specific problem to build DVO is to motivate the grid-computing concept to harmonize resource sharing, handle dynamic problem solving, and deal with multi-institutional. Unfortunately, there is a few number of projects in this context have been considered [17].

VOmap project [19] utilized ecosystem services handle DVO creation. Unfortunately, ecosystems have no agree in business markets because business needs more market-based tools. CNO works as an alliance of organizations and their interconnected supporting institutions, in a federal, trust and common operating principle's infrastructures, with the main goal of increasing both their chances and their awareness towards collaboration in potential future DVO.

ISSN 1512-1232

Camarinha Matos et al. [5] thought that many enterprises would be part of some CNO that will act as environments for the DVO formation. One of the main weaknesses in this area is the lack of appropriate theories, consistent paradigm's definition, and adoption of formal modeling tools.

The motivation of this work is to determine the essential features that must be considered in order to automate the creation of DVO by integrating the Select-and-Modify modeling approach for [9], and CommonKADS methodology [3].

The contributions of this paper can be summarized as follows; First, propose a strategy-driven approach for virtual business collaboration modeling construction, which integrates the CommonKADS methodology with the Select-And-Modify approach. Second, generic knowledge-based components are designed to support this creation, which can increase the flexibility of the knowledge-based approach facilitates future integration. This research integrates and extends our recent work "new federated collaborative networked organization model (FCNOM)", which proposes an integrated framework that combines the existed CNO perspectives, as well as, proposes new [20].

The paper organized as follows; Section 2 proposes the process of constructing a virtual business collaboration model. CommonKADS utilization for supporting DVO Creation is discussed in section 3. Finally, the conclusion and the future work are discussed in section 5.

II. Virtual Business Collaboration Models Construction

Burn et al. [14] thought that DVO' structure considered complex also, described simple elemental structures, which model how virtual business can be collaborated. The basic virtual business collaborative models are; virtual faces, co-alliances, star alliances, value alliances, market alliances and parallel alliances. A practical DVO may be a combination of these elemental structures [23].

Therefore, some guidelines and rules are needed to help in constructing a practical collaboration model. The easiest way to achieve a real collaboration model is to utilize the select and modify approach adapted by Hesham at el. [9]. In this approach, the target model is achieved through executing two steps. The first step is using some business features to select the nearest model(s), whereas the second step is to modify the nominative model(s) to construct the final model. For this purpose, some key business features that could be used f or the selection of the nominative collaboration model are summarized in Table 1. Models that satisfy most of the features will be considered in the selection process. Other matched features will be used in the modify step.

III. Utilizing Commonkads For Supporting Dvo Creation

Many Knowledge Management (KM) methodologies are existed (e.g. CommonKADS, SPEDE [31], MIKE [32], and MOKA [33]). However, CommonKADS is considered the most motivated methodology to automate (part of) the process of creation and operation of DVO.

IV. CommonKADS

CommonKADS is considered the most robust suitable methodology, because of having the following features: such as supporting object oriented approach, platform independent, hybrid approach, gradually extension of the methodology as a result of feedback from practitioner and scientists over the years, also it has the ability to model the complex systems taking easy steps [34] [35]. By utilizing CommonKADS the knowledge of the problem can be structured in three stages, context level, concept level and artifact level as follows (see Figure1).

ISSN 1512-1232

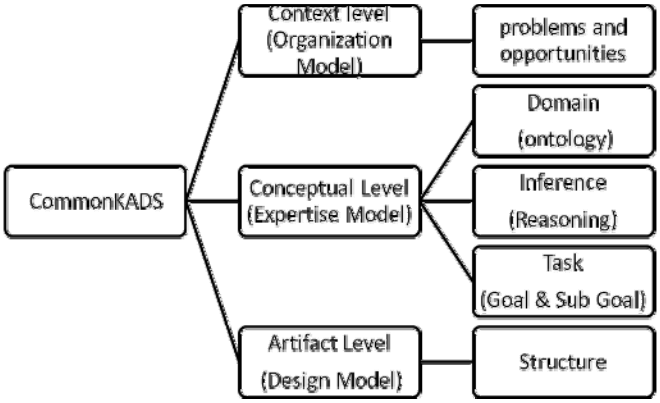

Figure 1. CommonKADS Modeling Suite

The CommonKADS Expertise Model aims to model a problem solving behavior from a knowledge level perspective. This methodology, classify knowledge as three categories: domain, inference, and task. Domain part contains the application ontology as well as set of relationships to each other, while both inference and task describe control knowledge that reflects the problem solving sequence.

V. The Proposed DVO Framework

The motivation of the proposed work is to determine the essential features that must be considered in order to automate the DVO construction. This roadmap will utilize the CommonKADS as follows:

−The CommonKADS' context level will be utilized in this paper; complete organization model worksheets utilization has been described.

−Our recent work will concern with the CommonKADS' conceptual level by, proposed Virtual Business Collaboration Construction Conceptual Knowledge Model (VBCKM)[36]. VBCKM determined the essential features that must be considered in order to automate the contraction of a collaboration modeling. As well as, propose a complete solution for (semi-) automate the construction process. VBCKM is a strategy-driven approach for virtual business collaboration modeling construction, which integrates the CommonKADS methodology with the Select-And-Modify approach. VBCKM minimizes the negotiations within CNO components during its life cycle, supports the configuration automation, as well as, helps decision making for collaboration modeling constructing, and achieves harmonization between CNO partners.

However this research has not been cover the CommonKADS' artifact level (VBCKM' design model), which contains algorithms and tools required for implementation. We are currently worked towards describing the structure of the software system needed to implement the knowledge and communication models. Nowadays, the area of define roadmap to design CNO architecture based on Grid-Cloud convergence as well as many other paradigms in an incremental and harmonious fashion. There is a need to determine the essential features that must be considered in order to design CNO architecture based on Grid-Cloud convergence, as well as describe the landscape structure for this harmonious fashion. Identified in this framework to cover both domain knowledge and control knowledge. These

knowledge components have been modeled using a famous knowledge-based methodology called CommonKADS [3]. The CommonKADS control structure models for DVO identification and formation phases are shown in the following sub sections:

Model	Description	Core	Strategy	Stage	Type of Portal	Management Suit	Information Flows	Customer contact	Planning (when,	Members Replaceable

ISSN 1512-1232

							Dependency		**where)**	
Virtual Face	Basic B2C	Group split from the "physical"	Customer service, personalization marketing	Presentation	Static	Not a part of the VO taxonomy				
Star Alliance	Independent members	Yes	Expanded business lines	Interaction	Dynamic interaction	Suit each member but the core may dictate	Operational + Coordination	core	The core	May not be replaced
Market Alliance	Market set management rules	Essential core but not mange	Development of business	Collaboration	Dynamic interaction	Must suit each member else will get out	Operational	Core	Before creation	With similar function
Co-alliance	Independent members permanently each equal commitment	No core	Cost reduction And speed of processing	Communication	Tailored	Management is complex,	Between all members	All members	Specific Function	Perhaps
Value Alliance	Supply chain	No core	Concentration	Fulfillment	Links to back-end	No overall management	Operational + Coordination	Limited to the first and last	No built-in planning/ coordination	Replaceable (similar function)
Parallel Alliance	Supply chain but mutually dependent	No core	Concentration	Fulfillment	Links to back-end	Only within the limits set, by the initial planning.	Operational + Coordination	All members	No built-in planning and coordination	difficult to replace with similar function

TABLE I. BASIC BUSINESS COLLABORATION MODEL GENERAL FEATURES

VI. DVO Life Cycle Control Structure

The concept DVO represents as one of the main instances of CNO [5]. DVOs considered in Grid computing as multiple autonomous members, which might be formed within the framework OGSA standard [11]. A well-accepted life cycle model for DVOs includes four distinct stages [5] (see Figure 2):

- Creation; Including identification phase and formation phase.
- Operation: All participants' work towards a common target.
- Termination; A report is composed. Asset dispersal takes place.

The work in this paper will consider the creation of DVO only, which include the identification and formation phases.

According to Fig. 1, the DVO life cycle is explained as follows:

- Business Opportunity (BO); as input to the DVO Identification phase.
- DVO Identification Phase concerns with parameterizes the BO by determining the needed competencies and other needed elements (e.g. skills, capacity).
- If there is any BO requirements' conflict or any needed information about the BO, the loop will reverse the sequence to pervious step.
- Rough DVO Model is the output of the Identification phase which addresses the needed competencies for further matching of partners.
- DVO Formation phase concerns with assessing the potential partners upon selected criteria and generates suggestion partners.
- A new condition will be executed as follows:

−If there is any BO requirements' conflict or any needed information about the BO, the loop will reverse the sequence to Identification phase.

−If the conflicts within the partners list, it will go back to Formation phase.

ISSN 1512-1232

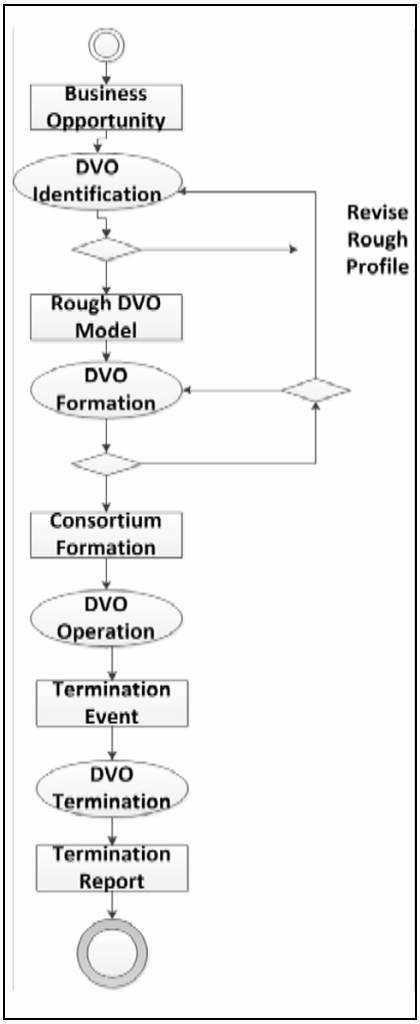

Figure 1. Activity diagram defining a control structure of DVO Life Cycle

- DVO Operation phase concerns with real operation during the DVO running with set of management services that monitor the DVO operations.
- Termination event is the event, which drives the operation of DVO to be terminated.
- Finally, DVO Termination phase concerns with close all the DVO activities and it will not be achieved anymore and end the contractors.
- Termination Report, which reports the termination process, includes the ended contracts needed processes also, the announcement for closing the shared operations, will be produced.

A. DVO Identification Phase Control Structure

The DVO Identification phase consists of steps, which concerned with parameterizes the BO by determining the required competencies and other needed elements (e.g. professional skills, needed capacity), as well as, identify the first draft of the business plan include the needed aspects.

Fig.2 defines a specific control structure for the DVO Identification phase, using an activity diagram that shows a structure for data-driven inference and a control structure over all actions present in the diagram, including iteration. This Identification phase would be implemented as follows:

ISSN 1512-1232

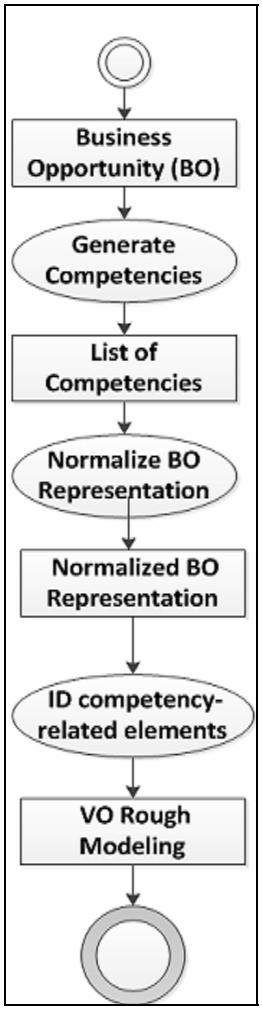

Figure 2. Activity diagram defining a control structure of DVO Identification phase

Figure 3.

- BO, as input for the DVO Identification phase, which involves the product, service, equipment, etc... That will initiate a business line.
- DVO generated competencies concerns with realizing the BO into elements. It may iterate to rich the atomic elements, which related to some needed competencies and some related characters.
- This step output a list of needed competencies with some related information.
- Normalized BO representation step will produce normalized required competencies by eliminating redundancies and sub-summations.
- DVO Rough Model is the output of the Identification phase and should contain some information about BO such as the needed requirements, the duration, and the quality requirements of the business.

B. DVO Formation Phase Control Structure

The DVO Formation phase concerns with partner search and select, as well as, the agreement and contract negotiation. The output of this step will be a suggested DVO consortium. Figure 3 defines a specific control structure for the DVO Formation phase, using an activity diagram that shows a structure for data-driven inference and a control structure over all actions present in the diagram, including iteration. This Formation phase would be implemented as follows:

ISSN 1512-1232

As shown in Figure 4, the DVO life cycle is explained as follows:

- DVO Rough Model as input for this step, which is the output of DVO Identification phase.
- Allocate Services and Recourses, which obtains the resource, and access information needed for the DVO operations.
- If there is a conflict or any other issues, a loop will be going back to Allocated Services, and Resources step.
- The pervious step generates a list of needed resource and access information.
- Partner Search and Select is the step where a list of partners will be generated.
- After this step, condition checking should be tested.
- If any conflict about services occurs, it will be back to the Allocated Services, and Resources step.
- If the conflict about the partner, the branch will be back to the Partner Search and Select.
- The Compose DVO concerns with the agreement and contract negotiation.
- The final output of this phase is the suggested consortium, which contain every detailed need to set up and run the created DVO.

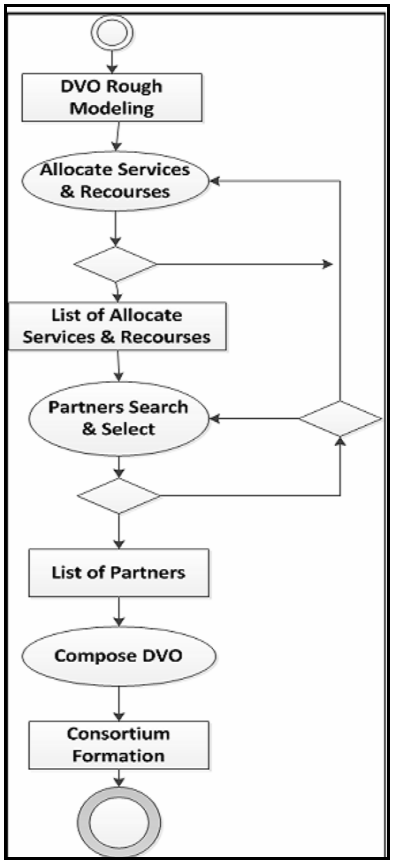

Figure 4. Activity diagram defining control structure of DVO Formation phase

VII. Conclusion and Future Work

This research proposed an approach to automate the process of DVO creation, which is CNO-based. This approach extend our work FCNOM, which is adapted based on previous work with four new perspectives are included, as well as utilizing CommonKADS for Supporting DVO creation to build generic solution. This work generates a general framework that contains a set of reusable components (inference, ontology, etc.…), and provides the flexibility to reuse these components for Supporting DVO creation. By using this approach, the view of CNO environment becomes clear

ISSN 1512-1232
and unified. Furthermore, it minimizes the negotiations within CNO components during its life cycle, supports DVO configuration automation, as well as, helps decision making for DVO, and achieves harmonization between CNO partners.

The recently Forrester Research [8] has mentioned cloud computing could be included in the business economics. Evolution of cloud computing, featuring convergence of business and IT and open service oriented are become the marketplace [2].DVO relies on the needs of collaboration among involved partners. Furthermore, to enlarge partners' collaboration sharing software services is needed. Based on the Software-as-a-Service (SaaS) model, which helps both DVO clients to be more confident when accessing services from DVO members, and to DVO members to have a support on how their services should be properly developed and made available to DVO clients.

Refferences

1. Ãngel Ortiz Bas, Ã*f*ngel Ortiz Bas :Balanced Automation Systems for Future Manufacturing Networks: 9th IFIP WG: Valencia, Spain (2010)
2. Benoit Hudzia, Jonathan Sinclair, Benoit Hudzia, Maik A. Lindner, Alan Stewart, Terry Harme : Architecture for Compliance Analysis of Distributed Service Based Systems (2011)
3. Bob Wielinga, Nigel Shadbolt, Walter Van de Velde :The CommonKADS Methodology : MIT Press, UK (2000)
4. C. -M. Chituc, Azevedo, A.; Toscano :Multi-Perspective Challenges On Collaborative Networks Business Environments: IFIP Vol. 186, Springer,USA (2005)
5. Camarinha-Matos, Afsarmanesh, H. : Collaborative Networks Reference Modeling: Springer (2008)
6. Camarinha-Matos, Filipa Ferrada, Ana Inês Oliveira: A Roadmap For Strategic Research On Virtual Organizations: Proceedings Processes and Foundations for Virtual Organizations, Kluwer Academic Publishers (2003)
7. Florian Skopik, Daniel Schall, Hong-Linh Truong, Schahram Dustdar: D4.5.1a – c-Human Interaction Services , Specifications – M12 issue : Collaboration & Interoperability for Networked Enterprises (2009)
8. Forrester Report: The Evolution of Cloud Computing Markets: USA (2010)
9. Hesham A. Hassan K. Orsvarn, O. Olsson : Guidelines for adapting an interpretation model in an Application : Proceedings of Knowledge engineering forum (1995)
10. Ian Foster و I., Kesselman, C., Nick, J., Tuecke : The Physiology of the Grid: an Open Grid Services Architecture for Distributed Systems Integration. Technical report, Global Grid Forum (2002)
11. Ian Foster, H. Kishimoto, A. Savva, D. Berry, A. Djaoui, A. Grimshaw, B. Horn, F. Maciel, F. Siebenlist, R. Subramaniam, J. Treadwell, J. Von Reich : The Open Grid Services Architecture, Version 1.5: Open Grid Forum, USA (2006)
12. Ian Foster, Carl Kesselman, Steven Tuecke :The Anatomy of the Grid Enabling Scalable Virtual Organizations: Proceedings of the 7th InternationalEuro-Par Conference Manchester on Parallel Processing Springer London (2001)
13. Jorge Minguez, David Baureis, Donald Neumann : Providing Coordination and Goal Definition in Product-Service Systems through Service-orientedComputing : 44th CIRP Conference on Manufacturing Systems (2011)
14. Janice Burn ,Peter Marshall, Martin Barnett: E-Business Strategies for Virtual Organizations : Butter worth-Heinemann, UK (2002)
15. John R. Schermerhorn , James G. Hunt, Richard N. Osborn, Mary Uhl-Bien : Organizational Behavior, 11th edition : (2010)

ISSN 1512-1232
16. L.M. Camarinha-Matos, H. Afsarmanesh, M. Ollus: Virtual Organizations: Systems and Practices: Springer Science(2005)
17. Malekpour A., Mohammad Reza Nami :Toward Autonomous Virtual Organizations : International Journal of Hybrid Information Technology Vol.2, No.1, Australia (2009)
18. Sari B., , T. Sen and S. E. Kilic : Formation of Dynamic virtual enterprises and enterprise networks: International Journal of Advanced Manufacturing Technology : Springer, (2007)
19. Charles Huber, Adrian Plüss : Roadmap design for collaborative virtual organizations in dynamic business ecosystems : EU project (2003)
20. Morcous M Yassa,, Hassan, H. A., & Omara, F. A. (2012). New Federated Collaborative Networked Organization Model (FCNOM), International Journal of Cloud Computing and Services Science (IJ-CLOSER) Vol.1, No.1, March 2012, pp. 1~10
21. Morcous M Yassa, Hesham A Hassanm Fatma A. Omara :Virtual Business Collaboration Conceptual Knowledge Model (VBCKM) : International Journal of Cloud Computing and Services Science (IJ-CLOSER) Vol.1, No.3, August 2012, pp. 148~154

Article received: 2013-03-08