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# Virtual Business Collaboration Conceptual Knowledge Model (VBCKM)

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**ABSTRACT**

Within the context of virtual business collaboration modeling, many recent works have been accepted to consider some essential virtual business collaborative models. Practical dynamic virtual organization may be a combination of those models and some other elemental features with some modifications to meet the business opportunity requirements. Therefore, some guidelines and rules are needed to help in constructing a practical collaboration model. This work aims to determine the essential features that must be considered in order to automate the creation of dynamic virtual organization. By integrate "Select-and-Modify" approach with "CommonKADS" methodology, the work of this paper propose a strategy-driven approach for virtual business collaboration modeling construction. Also, some generic knowledge-based components have been designed to support this creation, which can increase the flexibility of the knowledge-based approach facilitates future integration. This paper is considered as integration and extension to the recent work "New Federated Collaborative Networked Organization Model (FCNOM)", which has proposed an integrated framework that combines the existed collaborative-networked organization perspectives, as well as, proposes new.



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## 1. INTRODUCTION

Business Opportunities (BO) drive the needs for cross-organizational business collaboration, which may be integrated in huge application scenario in order to achieve a specific goal of being active in fulfilling a complex project [1]. The nature of Virtual Business Collaboration Modeling (VBCM) Construction (or the lack of it) reflects premise the confusion in the strategy of this modeling technique [2]. This research integrates and extends our recent work "new federated collaborative networked organization model (FCNOM)" [3].

The motivation of this work is to determine the essential features that must be considered in order to automate the VBCM construction. By the work of this paper, a new solution for (semi-) automate the construction process has been proposed. The proposed solution can be summarized as follows: (1) proposing a strategy-driven approach for virtual business collaboration modeling construction, which integrates "Select-and-Modify" approach [4] with CommonKADS methodology [5], (2) design generic knowledge-based

components to support Virtual Business Collaboration Model (VBCM) construction, which can increase the flexibility of the knowledge-based approach facilitates future integration.

This paper is organized as follows: Section two, will discuss some relate work. Section three, will discuss some about Knowledge Molding (KM) techniques. Section four, will addresses the Business Collaboration Models Hierarchical Classification essential features. In section five, describes the conceptual generic KBS components, which can be reused while this Construction.

## 2. RELATED WORK

The application of VBCM collaboration modeling is a new research area. But some recent work such as Vomp project utilized ecosystem services handle Dynamic Virtual Organization (DVO) creation [18]. Unfortunately, ecosystems have no agreement in business markets, because business market needs more market-based tools. Collaboration initiatives like Collaborative Planning. Forecasting, and Replenishment (CPFR) approach [19], which focus on collaboration data modeling by identifying common data streams, aggregating and adjusting according to each organization' s perspective. Qiang at el. [20] proposed a formulated knowledge network collaboration model as a variation inequality problem. The DECOR project ("Delivery of Context-Sensitive Organizational Knowledge" [21]) develops method and tools for Business Process Oriented Knowledge Management (BPOKM), By merging elements from the CommonKADS and the IDEF5 [22] methods, the DECOR-BKM provides the methodological guidance for running a BPOKM project. Unfortunately, all of those works did not design any virtual business collaboration knowledge modeling.

## 3. KNOWLEDGE MOLDING

Many Knowledge Management (KM) methodologies are existed (e.g. CommonKADS, SPEDE [7], MIKE [8], and MOKA [9]). However, CommonKADS is considered the most motivated methodology to automate (part of) the process of creation and operation of DVO.

### a. 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 [10] [11]. 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).

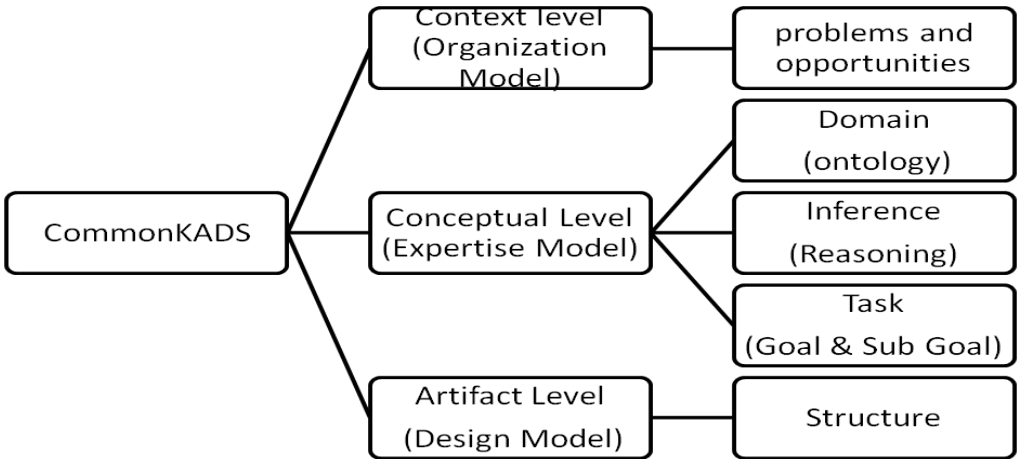


Figure 1. CommonKADS Modeling Suite

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.

### b. Hierarchical Classification

In [12], Chandrasekaran introduced a variation of Hierarchical Classification (HC), which is taxonomy of concepts within the domain being classified. These concepts are organized from most general at the top of the hierarchy to most specific in the leaf nodes. To perform HC, it requires that the domain knowledge should be organized in a tree like structure (classification hierarchy) and an algorithm to search the hierarchy.

## 4. Business Collaboration Models Hierarchical Classification

Within the collaboration-modeling context many recent works have been accepted to consider, the essential VBCM are; virtual faces, co-alliances, star alliances, value alliances, market alliances and parallel alliances [13] [7] [14]. A practical dynamic virtual organization may be a combination of those models and some other elemental features with some modifications to meet the BO requirements. Figure 2 shows a heretical classification of the virtual business collaboration construction, which has been classified according to HC approach.

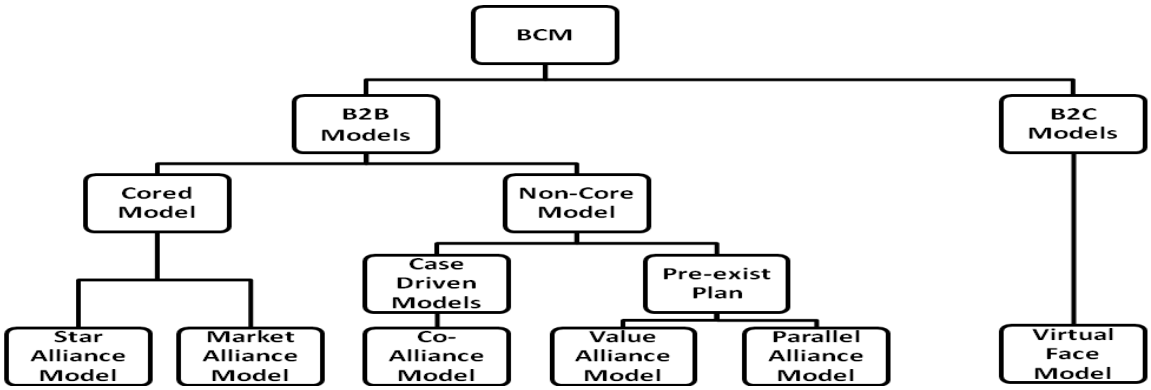


Figure 2. Heretical Classification of the Virtual Business Collaboration Construction

The Basic Collaboration Models (BCM) classification hierarchy as shown in Figure 2 can be described as follows: Each node in this tree represents a feature of the BCM that share common business character, which is called business feature. The business feature at top of the hierarchy represents the most general one, with more and more specific sub- business feature distributed in layers below. By pruning the business feature space at high levels of the generality, establish-refine cuts through some of the computational complexity inherent in the problem.

## 5. Virtual Business Collaboration Construction Conceptual Knowledge Model

The CommonKADS' context level had been introduced in the recent research included FCNOM; a complete organization model worksheets utilization has been described in [3]. The CommonKADS' artifact level, which will utilize the CommonKADS' design model, will be introduced in future work. In this paper, we will concern with the conceptual level.

### a. Inference Structure

The inference process aims to model the reasoning and problem solving and describes the mapping between task oriented roles and domain level entity types. This level is supposed to be as much as possible independent of the domain: they should be described in a task specific way. It describes the type of knowledge that it is possible to deduce given inputs and domain models. An inference is close to the notion of inference rule in logic. The reasoning of VBCKM is represented in the inference structure presented in Figure [3].

As shown in this figure the inference structure, contain four basic inference steps and three transactions functions:

- Cover inference step, takes its input from the BO data, the cover inference uses collaboration casual model to find list of suggested collaboration model class.
- Predict inference step, delivers an expected model for the suggested collaboration model.
- The transfer function obtains for getting the actual collaborative features.

The third inference step is a simple comparison of the selected basic collaborative features and the expected model, which uses the collaborative network organization (CNO) business constrains static model. The result will be some equality value as well as some discrepancy

- Specify inference step, the objective of this step is specifying the set of actions based on the expected collaboration model and the founded discrepancy. Thus by using the CNO business rules model.
- The transfer function modify for getting the actual changes, then the next transfer function is to generate the Concrete Collaboration Model.

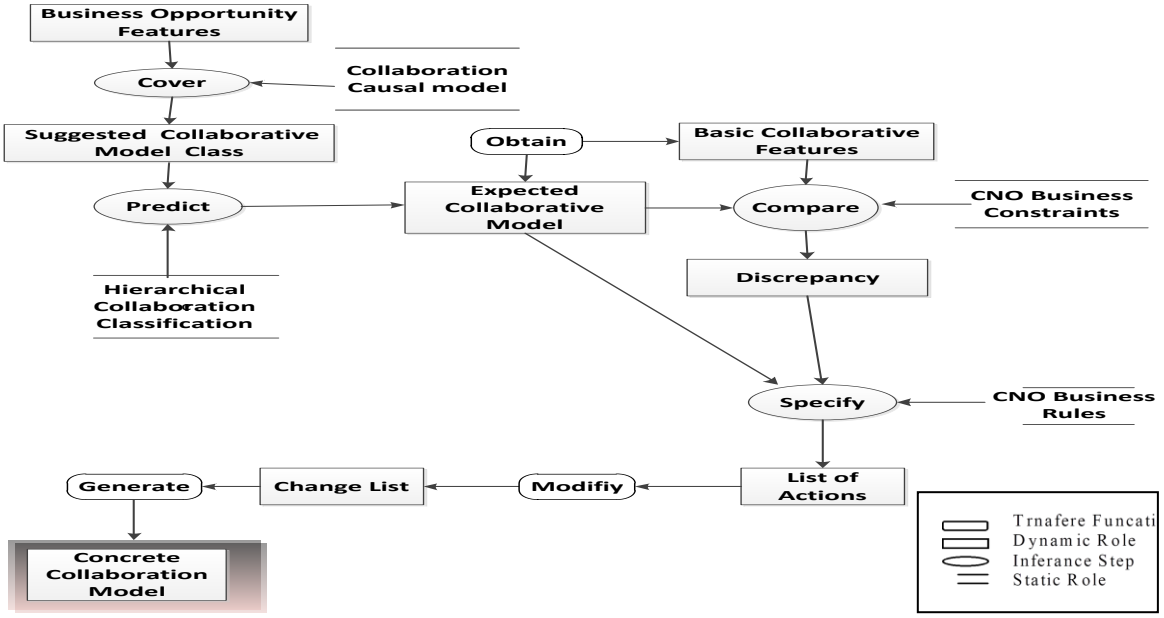


Figure 3. VBCKM Inference Structure

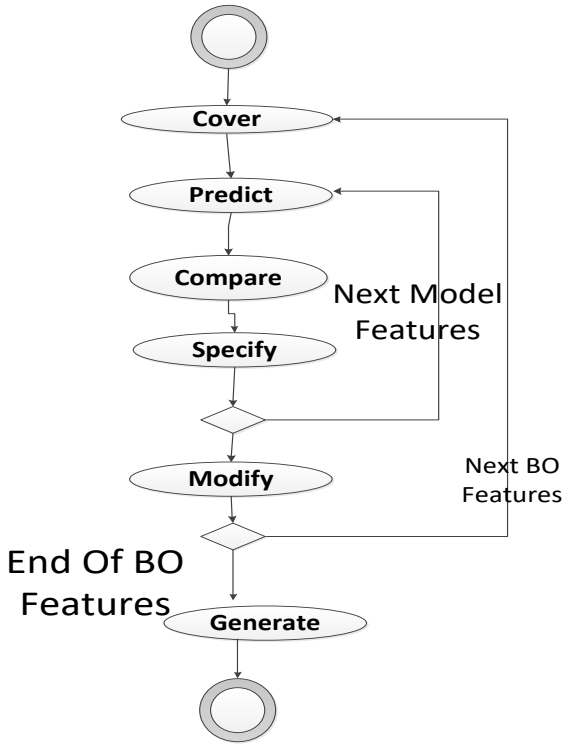


Figure 4. VBCKM Control Structure

**b. Control Structure**

Tasks and inferences use a task-oriented ontology, the terms of which are called roles. Tasks describe the goals of the problem solving and the actions that can lead to reach the goals, including goals and tasks decomposition. Basic tasks are implemented by means of inferences. Figure 4 defines a specific control structure on the actions defined in Figure [3]. The activity diagram shows a structure for data driven inference and a control structure over all actions present in the diagram, including iteration. This step done as following:

**c. Conceptual Modeling of Domain Ontology**

The domain level provides ontology modeling. Modeling domain knowledge implies capturing the static structure of information and knowledge types. Part of such a schema is shown in Figure 5.

This work distinguish a number of different data model containing sets of rules, we have four data model within VBCKM that was built upon the structure of the underwriting process, which can be described in briefly as:

- *Collaboration Causal model*, which contains concepts on collaboration strategies in order to suggested collaboration model class.
- *CNO Business Constraints*, which includes the CNO business constraints, which have been considered by the CNO (time, financial concerns, management, regulations etc.).
- *CNO Business Rules*, which focus on control or influence the behavior of the CNO' business.
- *Hierarchical Collaboration Classification*, which includes the rules of establish and refine the heretical classification of the virtual business collaboration.

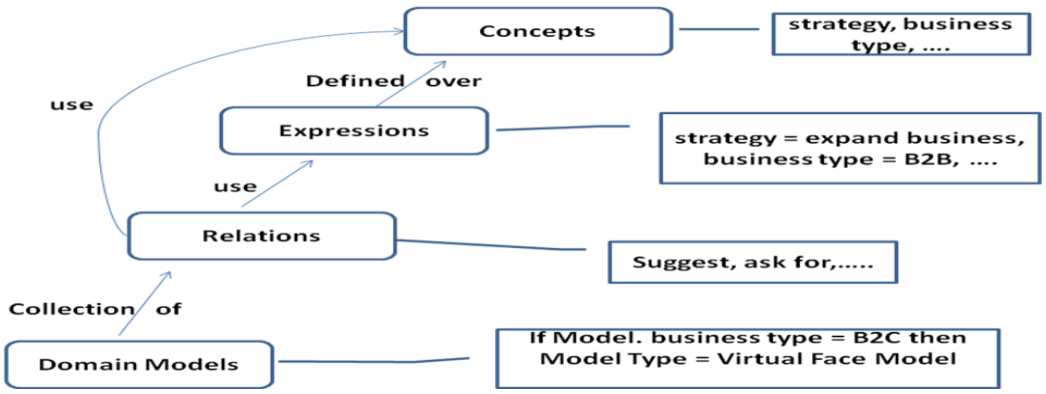


Figure 5. Part of VBCKM ontology

**6. Conclusion and Future Work**

The CommonKADS' context level had been introduced in the recent research included FCNOM; a complete organization model worksheets utilization has been described in [3]. The work in this paper has been concerned with the CommonKADS' conceptual level by, proposed Virtual Business Collaboration Construction Conceptual Knowledge Model (VBCKM). VBCKM has been 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 work 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.

## References


[1] Hamid R. Motahari Nezhad, Claudio Bartolini Jamie Erbes, Sven Graupner, "A Process- and Policy-aware Cross Enterprise Collaboration Framework for Multisourced Services" Hewlett-Packard Development Company, L.P. 2012.

[2] TUDA (lead), ASC, TIE, INESC, UVA, UVI, ISOFT, TANet, AZEV, ABB ADVENTURE: "ADVENTURE deliverable 2.1 Project Vision Consensus Document", ADVENTURE Project Consortium, 2011.

[3] Morcous M. Yassa, Hesham A. Hassan, Fatma A. Omara: "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

[4] Hesham A. Hassan K. Orsvarn, O. Olsson : Guidelines for adapting an interpretation model in an Application : Proceedings of Knowledge engineering forum 1995.

[5] Schreiber et al., "Knowledge Engineering and Management: The CommonKADS Methodology", MIT Press, Massachusetts, 1999.

[6] Luis M. Camarinha-Matos et al. "Classes of Collaborative Networks" "Encyclopedia of Networked and Virtual Organizations" Information Science Reference, USA,2008,

[7] Shadbolt, N.; and Milton, N. (1999). From knowledge engineering to knowledge management. British Journal of Management, 10, 309-322.

[8] Angele, J.; Fensel, D.; Landes, D.; and Studer, R. (1998). Developing knowledge based systems with MIKE. Journal of Automated Software Engineering, 5(4), 389-418.

[9] MOKA Home Page, Last Accessed April (2010), Available at URL: http://web1-eng.coventry.ac.uk/moka/

[10] Sachin s. Bhandari*, nopasit chakpitak, komsak meksamoot, tirapot chandarasupsang "Knowledge Engineering Approach For Power Transformer Asset Management",Journal of Engineering Science and Technology Vol. 7, No. 1 (2012) 73 - 88 © School of Engineering, Taylor's University.

[11] Navid Shariat Zadeh: " Design and Development of a Maintenance Knowledge-Base System Based on CommonKADS Methodology "Master Thesis Department Production Engineering and Management School of Industrial Engineering and Management, Royal Institute of Technology June 2010

[12] Chandrasekaran, B. "Generic tasks in knowledge-based reasoning: High-level building blocks for expert system design", in IEEE Expert, p. 23-30, fall 1986.

[13] Janice Burn, Peter Marshall, Martin Barnett: E-Business Strategies for Virtual Organizations: Butter worth-Heinemann, UK (2002).

[14] Nick Lethbridge "An I I-B Based Taxonomy of Constituent Market Orientation and Ownership of Virtual Marketplaces", Informing Science Developing Effective Organizations Volume 4 No 1, 2001

[15] Ellen Baker, Melanie Kan, Stephen T.T. Teo, (2011) "Developing a collaborative network organization: leadership challenges at multiple levels", Journal of Organizational Change Management, Vol. 24 Iss: 6, pp.853 – 875.

[16] Malekpour A., Mohammad Reza Nami: Toward Autonomous Virtual Organizations: International Journal of Hybrid Information Technology Vol.2, No.1, Australia (2009)

[17] Sari B., , T. Sen and S. E. Kilic : Formation of Dynamic virtual enterprises and enterprise networks: International Journal of Advanced Manufacturing Technology : Springer, (2007)

[18] Charles Huber, Adrian Plüss : Roadmap design for collaborative virtual organizations in dynamic business ecosystems : EU project (2003)

[19] Matt Johnson : "Collaboration Data Modeling: CPFR Implementation Guidelines", Annual Conference Proceedings of the Council of Logistics Management, UK, 1999

[20] Anna Nagurney and Qiang Qiang: "A Knowledge Collaboration Network Model Across Disciplines", International Conference on Social Computing, Behavioral Modeling, & Prediction, National Institutes of Health, Bethesda, Maryland, 2010

[21] Giorgos Papavassiliou, Spyridon Ntioudis, Gregoris Mentzas, Andreas Abecker:" Business Process Knowledge Modelling: Method and Tool", German Research Center for Artificial Intelligence (DFKI), 2001

[22] Abecker A., Herterich R., Müller S. (2001), Das DECOR-Projekt: Geschäftsprozessorientiertes Wissensmanagement mit dem CognoVision-Tool. In: KnowTech-2001 – 3. Kongress über Wissenstechnologien, Dresden. In German.

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