

A framework for virtual enterprise operation management

Hongmei Gou, Biqing Huang^{*}, Wenhua Liu, Xiu Li

Department of Automation, Tsinghua University, Beijing 100084, PR China

Received 24 August 2002; accepted 1 February 2003

Abstract

This paper presents researches on operation management for virtual enterprises (VEs). A virtual enterprise is a temporary alliance of member enterprises (MEs) formed to exploit fast-changing opportunities. During the operation of a virtual enterprise, its constituent member enterprises, which are geographically distributed and organizationally independent, collaborate with each other to execute the whole business process (BP) of the virtual enterprise. With the aim of addressing business integration for virtual enterprises, this paper develops a framework for virtual enterprise operation management. From the viewpoint of business processes, carried out is integral research on business process modeling, analyzing, and managing for virtual enterprises. Both the distributed business process model and the model of the virtual enterprise itself are established. The former provides the functional basis of the virtual enterprise operation, while the latter provides its structural basis. Further, the two models are integrated through the loading from the distributed business process model to the virtual enterprise model. Through such model separation and integration, business process management for virtual enterprises is enacted and business integration for virtual enterprises is achieved.

© 2003 Elsevier Science B.V. All rights reserved.

Keywords: Virtual enterprises; Business processes; UML; Petri nets; Agents; Workflow management

1. Introduction

Situated in the environment of globalizing markets and increasing customized orientation, modern enterprises are impelled to seek new paradigms, such as concurrent engineering, lean production, agile manufacturing and virtual enterprises (VEs). A virtual enterprise is a temporary organization of companies that come together to share costs and skills to address business opportunities that they could not undertake individually [1]. On the one hand, member enterprises (MEs) in a virtual enterprise will keep their

independence and autonomy. On the other hand, they will contribute their core competencies to the virtual enterprise. Through the combination of the core competencies of member enterprises, the virtual enterprise may become a best-of-everything enterprise. Nowadays, the virtual enterprise is considered as one of the most promising paradigms for the future enterprises.

The lifecycle of the virtual enterprise consists of four major phases: *creation*, *operation*, *evolution*, and *dissolution* [2]. In the operation phase, member enterprises collaboratively execute the whole business process (BP) of the virtual enterprise, thereby achieving the common goal of the virtual enterprise. Therefore, in the whole lifecycle of virtual enterprises, the *operation* phase is of utmost importance in that it directly determines the success of virtual enterprises.

^{*} Corresponding author. Tel.: +86-10-6278-9636;
fax: +86-10-6277-0351.
E-mail address: hbq@ieee.org (B. Huang).

This paper concentrates on the operation phase of virtual enterprises and develops a framework that can effectively execute VE operation management.

In order to successfully operate a virtual enterprise, inter-enterprise integration involving multiple enterprises is required. Similar to intra-enterprise integration [3], the virtual enterprise integration can be hierarchically classified into three levels: physical system integration, application integration, and business integration.

- Physical system integration realizes communication among physical components distributed at various member enterprises by means of computer networks and communication protocols. It addresses system interconnection and data exchange both within individual enterprises and among multiple enterprises. It can also be called integration at the datum level.
- Application integration realizes interoperability and information sharing among computerized applications distributed at various member enterprises. It provides interoperability of applications on heterogeneous platforms as well as access to common shared data by distributed applications. It can also be called integration at the information level.
- Business integration realizes business process coordination and knowledge sharing among functional entities distributed at various member enterprises. It provides protocols and/or mechanisms to enable functional entities to collaboratively execute the whole business process of the virtual enterprise. It can also be called integration at the knowledge level.

When combined together, the three levels of integration provide all functions demanded by the virtual enterprise operation. New theories, approaches and technologies should be developed to achieve the above virtual enterprise integration since virtual enterprises have many unique characteristics that differentiate them from traditional enterprises, which will be detailed later in [Section 2](#).

By now, a large number of projects have been launched for virtual enterprises. Some of the most highly promoted ones are the North American NIIP (National Industry Information Infrastructure Protocols) [1,4] and the European PRODNET II (Production Planning and Management in a Virtual Enterprise) [5]. Most of these projects intend to develop information infrastructures and supporting platforms for virtual

enterprises and most of their earlier efforts are focused on reusing, extending and integrating various industry standards and enabling technologies. For example, NIIP bases its developments on key technologies such as communications (the Internet), object technologies (OMG, Object Management Group), and information technologies (STEP, Standard for the Exchange of Product Model Data). The basic platform of PRODNET II also adopts and integrates multiple standards or technologies, e.g. EDIFACT for the exchange of business messages, STEP for the exchange of technical product data, and federated/distributed database. Results obtained from these projects efficiently enable physical system integration and application integration for virtual enterprises.

As for business integration for the virtual enterprise, since it concerns collaboration among autonomous and not totally cooperative entities in a distributed environment, it is not purely a technological issue but demands essentially new theories, mechanisms, and approaches. Therefore, business integration is a key element in the virtual enterprise operation and requires considerable innovative efforts. At present, although advantages of the virtual enterprise paradigm are well known at the conceptual level [6–9], research on business integration for virtual enterprises is still in its infancy with quite limited results and lacks comprehensive schemes and effective mechanisms. For example, the PRODNET project designs an execution infrastructure [5,10] to support business process coordination in virtual enterprises. It identifies three levels of abstractions in the PRODNET coordination kernel: Core Cooperation Layer (CCL), Enterprise Management Functionalities (EMF), and Virtual Enterprise Management Functionalities (VMF). Roles and functions of each level are identified, but there are no approaches and/or mechanisms to realize its identified functions.

With the aim of addressing business integration for virtual enterprises, this paper develops a framework for virtual enterprise operation management. It takes business processes as the viewpoint, based on which detailed approaches and mechanisms are further proposed.

Why the business process is taken as the viewpoint? In order to enhance production efficiency and agility, the focus on business processes has gained common understanding among modern enterprises. Such focusing is more important for the virtual enterprise, because one of its major functions is the distributed

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات