



## **Chapter XIV**

# **A Planning and Scheduling Methodology for the Virtual Enterprise**

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Virtual enterprises consisting of geographically dispersed, independent units are a reality in the global economy. These units concentrate on core technologies and create partner networks for the design, manufacturing and sale of their products. This chapter documents a methodology, more flexible and efficient than the more traditional techniques, to schedule activities in virtual enterprises and enterprise networks. The presented technique that stepwise searches for improved activity schedules has the advantage that in any stage of the iteration process a resource-feasible schedule is available. Investing in network and computation capacity will result in more efficient schedules. The virtual enterprise unit will view the platform as a time-phased capacity trading marketplace.

## **INTRODUCTION**

Few firms are so large and few products so simple that one organization can manage the entire provision of the goods. Rather, most supply chains require the coordination of independently managed units who seek to maximize their own profits.

The basic responsibilities of the virtual enterprise planning and production control system described in this chapter are to provide customers with realistic due dates and to provide units, part of the core enterprise, and subcontractors with realistic plans. The goal is to schedule work such that all customer orders are met on time with low inventory and short lead times and at the lowest production cost.

There are several good reasons for keeping inventory low and lead times short:

- Both allow a VE<sup>1</sup> to stay agile and respond quickly to changes in demand or in the production environment.
- Low inventory of finished products, raw materials and intermediate products will reduce “capital binding” and losses due to “product aging.”
- Furthermore, shorter lead times will limit the time between a defect taking place and the discovery of the issue (the moment of discovery will trigger corrective actions; all production since the occurrence of the defect can be scrapped).
- Another strategy in customer support is possible. We do not need to anticipate the demand anymore (using more or less sophisticated forecasting techniques) but we can produce on request of the customer.

## Material Flow Dynamics in the Virtual Enterprise

The concept of a virtual enterprise consisting of separately owned, individual units and independent subcontractors creates more agility and increases efficiency. This concept resulted already in tremendous changes all over the industry.<sup>2</sup> Large conglomerates have been split into independent units and new global competing groups have been formed in a few years.<sup>3</sup>

Changes that are the result of market, customer and material flow dynamics make it often necessary to rapidly reconfigure a virtual enterprise and also to swiftly renegotiate with partners (including subcontractors) in the enterprise to manage any critical disruptions to the planning in order to protect delivery precision.

## Implications for the Traditional Planning and Control Hierarchy

The flexibility that these virtual enterprises need also changes the traditional product planning and control hierarchy shown in Figure 1:

- *On the strategic level:* Not only a “capacity plan” and “personnel plan” will be created for the core enterprise entities but also a “subcontract plan” that identifies products and volumes subject for subcontracting and preferred subcontractors.
- *On the tactical level:* The “sequencing and scheduling” module has the responsibility to build a schedule not only for one shop floor but for the different virtual enterprise units. Part of the “sequencing and scheduling” task is the selection of subcontractors and service providers that are required to realize the plan. It is worthwhile to mention that this subcontracting gives the tactical level the option to extend or reduce production capacity, in the past the sole responsibility of the strategic level.
- *On the control level:* This level consists of several units, some of them part of the core enterprise and others consisting of subcontracting units and service providers. Every subcontractor partner in the virtual enterprise can behave cooperatively or self-interestedly and this results in an optimization exercise with limited information and concurrent goal optimization.

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