The Open System for Master Production Scheduling: Information Technology for Semantic Connections Between Data and Mathematical Models

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ABSTRACT

Commonly provided by ERP vendors, master production scheduling (MPS) systems often strive to meet the needs of a large user base while limiting software functionality. Subsequently, business process reengineering becomes the means for firms to adapt to MPS software packages. This article develops a flexible approach for MPS delivery as an alternative to packaged software. The article examines the general case of open system architecture to deliver a specific master scheduling model to end-users. The open system approach fulfills a goal to standardize and speed the process of modeling in practice by creating a supply network for mathematical models that is searchable across the Internet with precision. The value lies on quickly putting state-of-the-art modeling in the hands of many users with no local computer implementation other than downloading an Excel spreadsheet.

Keywords: Internet, M Language, Master Production Scheduling, Mathematical Models, Modified Dixon-Silver Heuristic, Open System Architecture, Spreadsheet

INTRODUCTION

The master production schedule (MPS) is an important tool for manufacturing firms. It is the core system for determining customer service levels and inventory targets. Many industries such as food processing use MPS computing systems as part of operations planning.

For make-to-stock manufacturing characteristic of the consumer goods industries, a planner must calculate the amount of production needed per day to meet anticipated customer demand, which is seldom constant. This is the MPS. A common example is the schedule of
end-item production for a fruit juice or soft drink bottling line.

The primary inputs for the calculations are the beginning inventory level for each end-item and the sales forecast. Other inputs include holding and setup cost, manufacturing rate, setup time for each end-item, and the amount of production capacity.

The process of converting a sales forecast into a feasible production schedule is a complex problem. In most situations, there are many end-items to schedule. Retail promotions and differences in consumer preferences cause a wide range of demand patterns, creating an irregular interval of production.

Because of this complexity, mathematical models of various types are the means used by planners to speed calculations and to optimize cost. The origin of personal computers has led to a 25-year trend toward model-based, MPS systems. Programmers translate complex MPS algorithms, some involving optimization, into code that runs on a personal computer or other enterprise platforms.

Each year new MPS models appear in the operations management literature. Advances include improved algorithms and model formulations for even more sophisticated problems. However, the rate of implementation is low. Successful modeling approaches often take years to enter practice.

Enterprise Resource Planning (ERP) vendors offer MPS computing systems as part of large manufacturing software packages. To meet the needs of a diverse user base, ERP vendors limit the amount of functionality to the lowest common level. In turn, business process re-engineering becomes the means for firms to adapt to the limited functionality.

A criticism exists that research relating to MPS systems for manufacturing operations is lacking in the evolving context of supply chain management (Lee, 2008; Shi & Xiao, 2008). Further, it is evident that no single software solution exists for calculating the MPS across all make-to-stock industries. Hence, a flexible approach for the delivery of a specific MPS model matched to a particular operational situation would be valuable to many firms, both in the United States and worldwide.

An emerging trend in Internet computing offers an innovative way to make MPS software available to practitioners. With the recent successes of Apple’s iTune’s and Google Apps, an Internet-based architecture called Software-as-a-Service (SaaS) is becoming widely adopted in industry. One analyst estimates that virtually all new software will eventually use the SaaS approach (Ray, 2008). Salesforce.com and NetSuite, inc. already deliver large volumes of browser-based software through SaaS. This is an alternative for companies facing the high cost of software implementations (Lee & Schuster, 2007).

Building on the SaaS trend, this paper examines the Open System for Master Production Scheduling (OSMPS), which allows access to a sophisticated mathematical model from any Internet connection worldwide. The architecture provides interoperability along with a form of portability, and complies with open software standards (Killen, 1992). In contrast to Open Source (Ven, Verelst, & Mannaert, 2008) where users have unrestricted access to the code, the OSMPS only exposes the interface to a mathematical model via standard Internet protocols such as Simple Object Access Protocol (SOAP) and Web Service Definition Language (WSDL).

The components of the OSMPS are two-fold:

1. A computer model for calculating the MPS called the Modified Dixon-Silver Heuristic (MODS) (Allen, Martin, & Schuster, 1997), which resides on a server.
2. The M Dictionary (Brock, Schuster, Allen, & Kar, 2005; Brock, Schuster, & Kutz, 2006), an Internet-based way of achieving machine-understandable semantics for describing data fields that are inputs, outputs, and attributes of a mathematical model.
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