

Intelligent Demand Aggregation and Forecast Solutions

Task Leader

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Principal Investigator

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Primary Anticipated Result

Integrated solutions of how to use data mining and statistical analysis techniques for demand aggregation and forecasting in a semiconductor manufacturing network.

Task Background

Given the multidimensional natures of demand fluctuation and the complicated manufacturing network, demand planning has become one of the most critical challenges facing semiconductor manufacturers. Demand information propagated over the network is the most unreliable information that plagues the planning quality of the entire supply chain. Successful determinations of where, when, and in what quantities products will be needed are the key to improving a manufacturer's competitiveness, revenues and profits. The role of demand planning is now very different and becomes crucial for planning an entire manufacturing/supply network. Existing demand planning products, however, are only tools that provide users a friendly "slice-and-die" computing environment. Though the tools allow users to calculate, view and forecast the demand from different perspectives, the planners have to rely heavily on their own understanding of the market and judgement on the trend. Little intelligent information is extracted from the historical data to assist planners. No existing products are capable of advanced, in-depth analysis, such as data mining and statistical analysis techniques, that turn raw demand data into valuable demand-behavior information and business-intelligent information. The goal of this project is to incorporate the data analysis/mining techniques to develop an intelligent demand aggregation/forecast solution.

Research Description

There are three demand planning approaches in practice: "bottom-up" aggregation, "top-down" disaggregation, and "middle-out" aggregation/disaggregation. Different market and product characteristics require different approaches to make accurate demand plans for efficient fab operations. In this research task, we will study the effects of these aggregation/disaggregation approaches and develop strategies for determining the most effective approach for a given situation. We use advanced data mining and statistical analysis techniques to investigate the characteristics of demand data from different perspectives. Fluctuation and correlation of time-variant demands of different products/technologies from different customers or geography areas will be carefully analyzed. In addition, product characteristics and required manufacturing technologies will also be considered using clustering techniques. Quantitative models are then built to understand and characterize the demand behavior over time. For instance, demand behaviors of certain products are closely related, though their

natures seem to be irrelevant. In other cases, some products, though similar in nature, are competing in the market and result in contrary demand trends. Say, Intel and VIA are both customers of TSMC. The two companies' PC chipset products require similar manufacturing technologies but are competing with each other in the market. Should we aggregate and forecast these product demands together to support better factory capacity planning? Furthermore, Intel is located in the US whereas VIA is located in Taiwan. To achieve better logistic efficiency, should the demands be aggregated? Without data mining and analysis, such crucial knowledge would not be acquired to assist the planners. The in-depth analysis of demand data will be followed by the development of effective demand aggregation and forecasting strategies. We'll also incorporate these strategies with the on-line analytic processing (OLAP) technology to develop an integrated prototype software system.

Deliverables for Transfer to Industry

Intelligent multidimensional demand aggregation/disaggregation strategies (Model, Report) (12/2001)

Forecasting methodologies for multidimensional aggregated demands (Model, Report) (12/2002)

Integrated demand aggregation/forecast prototype system (Software, Report) (12/2003)

Graduate Students

TBD (2 Ph.D. and 2 M.S. students)

Industrial Liaisons

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