White Paper

THE DEMAND-DRIVEN SUPPLY CHAIN

In the past, manufacturing companies measured the success of their supply chain, their business processes of planning, procurement, production and distribution, by quality product, price and profit. Today, those same companies recognise that the performance of their supply chain is clearly linked to their financial success.

The demand-driven supply chain enables manufacturing companies to sense and respond to unexpected changes to customer demand and market dynamics. Intelligent Information Network infrastructures and IT applications such as enterprise resource planning systems help support the business processes of key inventory management and regulatory compliance which are critical to achieving efficient supply chain performance.

Cisco Systems

Introduction

Serial supply chains that service the traditional product development, production, distribution, and sales cycles are no longer capable of satisfying the dynamic and changing buying signals emanating from customer demand. Today's business climate requires parallel activities and an unprecedented level of flexibility of operations to accommodate rapid changes in supply and demand. This in turn impacts procurement, inventory management, production and distribution.

Manufacturing companies can no longer compete just on the basis of their own performance. Their suppliers and customers in the distribution channel have to perform to a collaborative standard. Conventional financial planning through an annual budget round is not a dynamic process, and has difficulty accommodating rapidly changing circumstances or new market imperatives. Best in class manufacturing businesses agree that financial success is clearly linked to the performance of their supply chain. This means that traditional product differentiation and overhead cost reduction are not sufficient to maintain and build a market position.

To address these issues, manufacturing companies are employing a more dynamic and holistic approach, commonly referred to as the 'demand-driven supply chain'. This approach broadens the definition of supply chain management to address the whole spectrum of business processes within a manufacturing company. Now suppliers and distribution outlets collaborate with a manufacturing company to combine supply chain planning with supply chain execution to enact the demand-driven supply chain.

A critical success factor of the demand-driven supply chain is the management of bi-directional information flows within and between companies. The IT infrastructures of manufacturing companies must be capable of supporting the parallel flows of information required to support the increase in information load required by the demand-driven supply chain. Manufacturing companies are therefore increasingly demanding a robust, expandable network infrastructure to support secure, inter company communications.

This paper describes how IT applications, such as Enterprise Resource Planning systems (ERP), and Intelligent Information Network (IIN) infrastructures can support the business processes of key inventory management and regulatory compliance in a demand-driven supply chain.

Contents

The Business Environment and Processes

The classic idea that, in a manufacturing company, Supply Chain Management (SCM) is concerned with the business processes of Procurement, Materials and Vendor Management, i.e. the management of the raw material supply and inventory, has been surpassed by a more holistic view. That change is the demand-driven supply chain, which is involved with all the business processes from Business and Financial Planning, Procurement, Production, through to Distribution.

Figure 1 below illustrates the building blocks of a manufacturing company's business processes in the demand-driven supply chain.

Figure 1: Business Process Building Blocks

The scope of the demand-driven supply chain touches all of the business processes in a manufacturing company. Inventory planning and regulatory compliance are two of the activities that are critical to achieving efficient business operations.

Inventory planning

The optimisation of inventories is achieved by maintaining a balance between supply and demand. In an environment of long production runs in a static product mix, balance can be maintained with gradual refinement of plans and forecasts. In today's world of changing demand and rapid response along with much shorter product lifecycles, success can only be achieved and maintained dynamically. This involves a bi-directional flow of supply and demand information to provide the basis for immediate, accurate decisions.

This approach realigns the notion of inventory planning as a forecast of what will happen at a future date, to a dynamic, collaborative sense and respond environment. This fusion of supply chain planning and supply chain execution encourages better integration of business processes to achieve a smooth, seamless flow of materials and services across the extended supply network.

The demand-driven supply chain affords views of the key inventories from financial, supplier, production and distribution angles, in both supply chain planning and execu-

tion. This allows companies to accommodate changes in market imperatives affecting dynamic changes in supply and demand.

To support the demand driven supply chain, the business process relationship with the five key inventories must be identified:

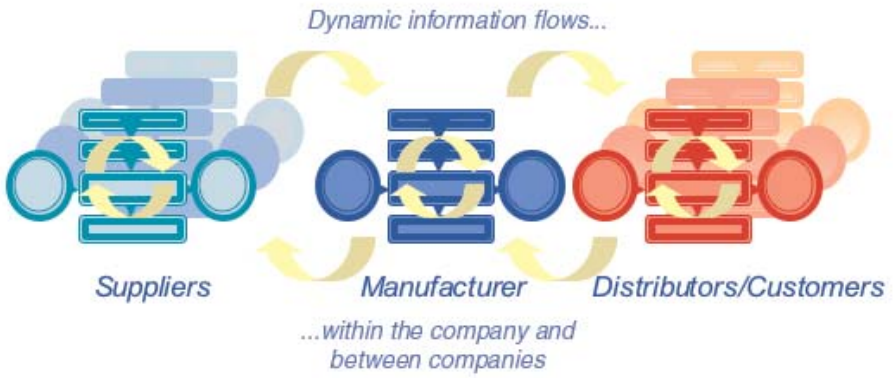
Type of Inventory	Organization
Raw materials	Financial, Supplier, Production
Work in progress	Financial, Supplier, Production
Finished goods	Financial, Supplier, Production, Distribution
Service, recycling and returns	Financial, Supplier, Distribution
In-transit	Financial, Supplier, Distribution

The demand-driven supply chain information flow between the business processes in a manufacturing company does not operate in isolation. Not only are the operating units of the manufacturing company interdependent and interrelated, they are equally interdependent and interrelated to the corresponding operating units in their external supply companies, and with their distribution outlets.

There are inevitably numerous suppliers to the manufacturing company, who in turn has numerous outlets in the form of other manufacturers, distributors, customers, and retailers, etc. Each company has its own internal supply chain, which is distinct from its suppliers and distributors who form the extended supply chain. In a demand-driven supply chain, it is advantageous for all participating companies' business processes to be visible to the relevant groups along the supply chain.

Figure 2 below illustrates the business information flows between Business Process in a multi company demand-driven supply chain.

Figure 2: Multi-Company Information Flows



Within a manufacturing company's internal supply chain there are bottlenecks, e.g. failure of timely supply of a part. Any one of these bottlenecks may turn out to be the link in the chain that limits the extent of inventory reduction. Bi-directional information flows providing visibility of key status indicators in the supply chain can enable support for quick responses to help resolve bottlenecks.

Case study

Adept Technolgies Inc

Adept technologies is a manufacturer of robots and robot control mechanisms that are used by many of the world's largest telcoms, consumer electronics, semiconductor and pharmaceutical companies. The robots that Adept manufacturers are complex, and requiring up to 300,000 parts sourced from suppliers around the world.

Adept wanted to ensure that it could grow its business, whilst maintaining the high levels of customer service it offers and without increasing its costs.

Adept decided to implement a Cisco Demand-Driven Supply Chain solution, including routers, firewalls, IP Communications and security products.

Cisco Integrated Services Routers (ISR) were deployed at Adept manufacturing facilities, service depots and vendor locations throughout the supply chain. This infrastructure, in combination with a system provded by logistics expert and Cisco Partner D.W. Morgan, provided Adept with the supply chain visibilty they required to increase their efficiency and manage their growth cost-effectively.

Lee Blake, Vice President and General Manager of Adept Services describes the difference that the Cisco Demand-Driven Supply Chain solution makes: ***"This solution will let us converge worldwide resources to respond immediately to customer needs. We might connect a customer in China to a service person in Germany, who could despatch the neccessary part from a Singapore facility. We know what parts are available, where they're located, where they're needed , and how to ship them fast and cost-effectively."***

For example, supplier companies A & B are set up to support an information flow to replenish materials on a 'demand sensing' response schedule, and supplier company C is reliant on receiving email or fax orders. Supplier companies A & B automatically trigger responses to demand in real time, through their business process routines, to replenish goods. Supplier Company C is not synchronised with the process and is awaiting a manual purchase order to be raised. If the parts that company C supplies are time critical, a weak link in the supply chain is created. The good news is that the potential weak link is identified. Company C must be encouraged to join the information flow of the demand-driven supply chain or risk losing business.

Regulatory influence

Concurrently with managing the five key inventories, globalisation requires supply chain operations to support the latest regulatory compliance edicts, even when their mandate is outside the companies manufacturing geography. These regulations include the Restriction of Hazardous Substances directive (RoHS) and the Waste Electrical and Electronic Equipment (WEEE) directive. Both RoHS and WEEE are legal obligations in the European Union (EU) and manufacturers who supply the EU must also comply.

Compliance involves significant new tracking, reporting and labelling requirements as well as changes in field service practice to ensure that when the product is returned, the producer knows its exact status. All suppliers in the supply chain are affected and must exchange additional information.

Initial compliance implementation has mainly dealt with the collection and reporting of data to populate new databases of the components in shipped products. In the future, a new product design flow that considers sustainable engineering from the outset is required. This will enable designers to make appropriate trade off decisions as the information is accessible to ensure a product can be designed to minimize waste.

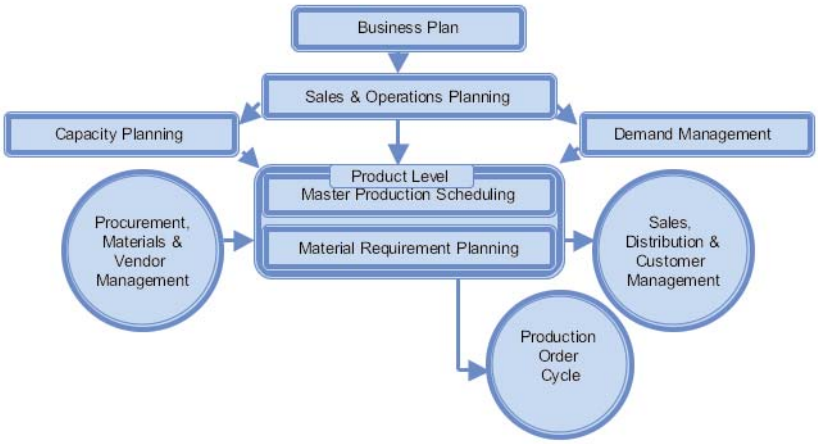
When considered along with environmental and recycling regulations, the pressure is to develop new thinking to keep product lines competitive. A product in the hands of the consumer has to be seen as a platform, a product that generates revenue by refreshment with new functionality without complete replacement rather than as a legacy product to be displaced. An example might be downloading firmware via telephone or wireless networks.

This means that processes across the lifecycle, including design, production, and operation are all increasing their dependence on good data communications.

The IT Enterprise Resource Planning (ERP) Systems Environment

Enterprise Resource Planning (ERP) systems are an Information Technology (IT) representation of the Business Processes found in a manufacturing company. The following diagram illustrates that the building blocks of the functions of an ERP system (Figure 3 below) map to the building blocks of the business processes (Figure 1) in discrete modules which are connected together and use a common set of definitions and terms comprising the manufacturing companies' master information.

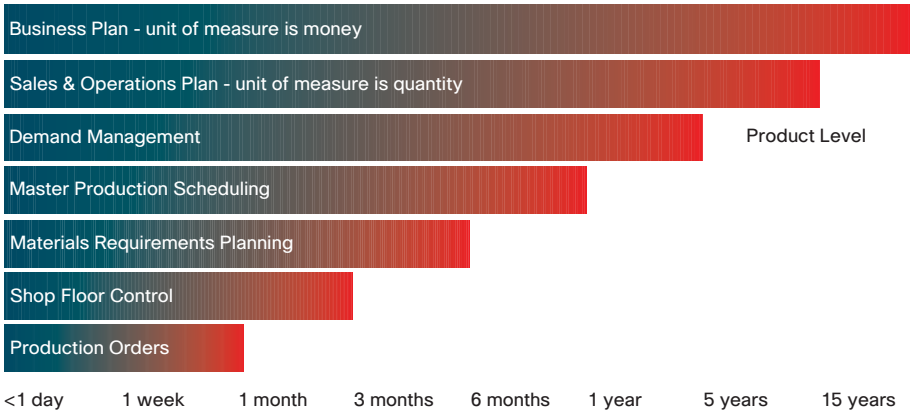
Figure 3: Building Blocks of ERP Functions



The measurements of business process in an ERP environment are distinctly divided into the management of planning activities with respect to money and quantity, and the management of product via demand, procurement, production and distribution activities over time.

The following diagram (Figure 4) illustrates the time-based activities in a typical ERP system, the Business and Sales and Operations Plan time is company and industry dependent and the time can vary greatly, the product level operations are quite typical.

Figure 4: Building Blocks of ERP Functions



Case study

Hanor

The Hanor Company is one of the leading pork producers in the US. The company has built its reputation on constant process improvement and innovation and has used technology to ensure that it creates and maintains its competitive advantage.

Because the business deals with livestock, it has to be a 24 hours a day, 7 days a week operation. To ensure that production operates as effectively as possible, Hanor's network has to provide a high level of support and availability to all users, many of whom operate remotely from the company headquarters. As Joe Bradford, Hanor's Information and Systems Coordinator explains: ***"We have customers worldwide, all with different requirements; the network allows us to fine tune the production system , so it just can't go down."***

Like many other businesses, Hanor has to comply with increasing regulation. The means that data management and integrity is of paramount importance, as Hanor's Senior VP and Managing Partner , Baxter Gutknecht says: ***"Like most businesses we continue to have to manage regulatory concerns. This really has to do with making sure that the data is accurate, it gets to where it needs to and importantly it stays confidential."***

Hanor's network is 100% Cisco products, including the security it operates. Hanor uses a Cisco self-defending network that provides its users, suppliers and customers with 24/7 network access in a totally safe environment for their information and the services that they need.

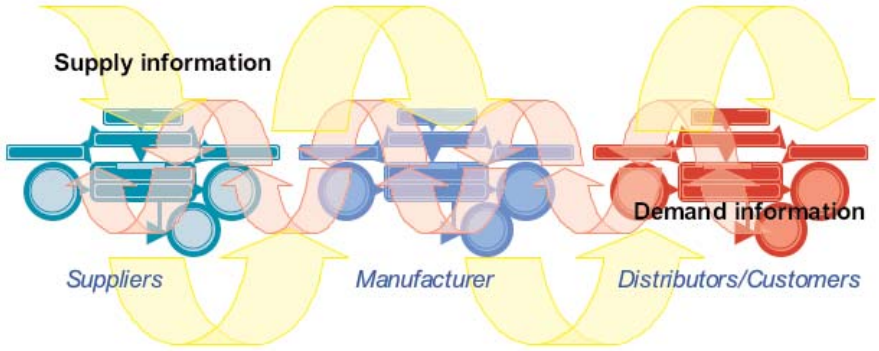
Planning activities provide a long and medium term vision on which to build an ERP system in terms of cash requirements, capacity to build and production resources.

Demand Management is a critical dynamic activity straddling the planning and execution boundary. Measured in quantity, time and money, the demand is calculated from planned requirements, customer requirements, and any other demand that may arise.

Product level execution activities in an ERP system include the procurement, production and distribution activities. The ERP system is the source of actual status information over time versus the plan. The system is also the primary means of communication of new and changed tasks, priorities, schedules affecting the plan for all the business processes in the demand-driven supply chain.

It is a business imperative of a demand-driven supply chain that information flows to support inter company collaboration in business planning, production and distribution are available through the ERP system and a robust communications network. The following diagram illustrates these information flows.

Figure 5: Multi-Company Bi-directional Information Flows



It is important to remember that as each company participates in more than one supply chain, bi-directional information flows are happening between multiple companies. This adds to the demand for intelligence in the network to support profiles for privacy, e.g. in terms of the sensitivity of information exchanged, customer information, intellectual property rights, pricing and discount information.

Companies driven by customer demand, share their market and product knowledge, accommodate dynamic changes in demand, and react faster to unpredictable market conditions. In order to synchronise supply with demand, a network wide visibility of the whole supply chain is required, coupled with the ability to act on information that is securely available to those with appropriate privilege levels. This requires an intelligent network infrastructure that can support the peaks and troughs of information flow, and can bring together local and remote information to support rapid decision making and immediate action.

"It is mandatory to perform an assessment. . . The cost overrun and performance horror stories you hear [about converged networks] are due to a lack of network readiness assessments."
Jeffrey Snyder,
Analyst, Gartner Group

"As companies continue to move more applications and voice traffic across their IP networks, a proper lifecycle is essential. Without it companies will not benefit from the productivity-enhancing features that a converged infrastructure can deliver."
Yankee Group (February 2004)

Lifecycle Services

Vendors must provide a broad portfolio of Lifecycle Services that can help customers to improve business agility, flexibility, standardization and network availability to increase business process value and return on investment from a DDSC solution.

A Lifecycle Services approach must define the minimum set of activities needed to help customers successfully deploy and operate the technologies used in the DDSC solution and to optimize their performance throughout the six phases of the network lifecycle:

- Prepare: Make sound financial decisions by developing a business case that establishes the financial justification for making a technology change
- Plan: Assess the existing environment to determine whether it can support the proposed system
- Design: Develop a comprehensive detailed design that meets business and technical requirements
- Implement: Integrate devices without disrupting the existing network or creating points of vulnerability
- Operate: Maintain network health through day-to-day operations
- Optimise: Achieve operational excellence through ongoing improvement of system performance and functionality

This approach enables customers to achieve a high-performance and high-available network. It enables the successful integration of advanced technologies, it lowers operational costs, and maintains network health through day-to-day operations.

The Underlying IT Infrastructure Environment

Embedded Business Processes supporting the demand-driven supply chain

Integration – Service Oriented Network Architecture (SONA)

The Cisco Service Oriented Network Architecture (SONA) is a comprehensive framework that provides an extensive set of network integrated services supporting a wide range of applications and their security, accuracy, reliability flexibility, responsiveness and compliancy requirements, and facilitates enterprise wide Service Oriented Architecture (SOA) deployments. The Cisco SONA framework also helps business adapt to the evolution of application architectures and the transformation towards service- oriented organizations. The Cisco SONA framework helps in the following steps:

- Internet Protocol (IP) becomes the pervasive network protocol and the network provides shared transport and fabric infrastructure for all business application logic traffic
- Convergence, the network architecture assumes the responsibility of providing utility service application functions and therefore offloads unnecessary application demands
- Service Integration, network and application resource functions are managed as virtual resource pools which are loosely coupled and reusable
- Virtualization, configuration, provisioning and management of application functions and network resource functions is automated and controlled by centralized business

Integration - Application Oriented Networks (AON)

Adding value and intelligence to the network, Cisco Systems Application-Oriented Networking (AON) technology enables the network to better understand business-application communications to support more effective business decisions.

AON is based on technology that enables the network to read application to application messages flowing within the network, such as purchase orders, investment transactions, or shipment approvals. This technology supports Cisco's vision for the Intelligent Information Network (IIN), a network-embedded intelligent message routing system that integrates application message-level communication, visibility, and security into the fabric of the network. AON technologies uses the intelligence and reach of the network to provide improved real-time visibility and responsiveness to rapidly changing business conditions, and does not require changes to existing applications.

Mobility - Radio Frequency Identification (RFID)

The Cisco Application Oriented Network (AON) technology provides inherent RFID support to the demand-driven supply chain to increase visibility into product information and optimize business flow for lower operating costs. RFID must be scalable, agile, and highly secure and deliver RFID capabilities to optimize available network capacity and simplify RFID infrastructure deployment.

Community – Security

Security is an integral part of the network operation, for two main reasons. Sensitivity of the data, e.g. that pricing, customers, discounts and volumes can not be identified

without the neccessary authentication and authorization. Secondly, to ensure and protect the functioning of the network, where interference could mean the difference between huge fines for late delivery or extra margin for on time delivery. The culmination of providing a secure communications infrastructure for demand-driven supply chains is that highly sensitive, but critical, information can be exchanged, whilst mitigating data theft through unauthorised access, data disruption through denial of service attacks, and system protection against viruses and Trojan horses.

The importance for a manufacturer to have its IT infrastructure up, running, self healing and available is paramount, especially with a demand-driven environment.

Capacity - Storage

In a demand-driven environment, information volumes exchanged over the network will increase, and information will need to be shared amongst various entities and locations. Intelligent, virtual storage management on the network will be a critical component in the success of enabling the relevant participants to see their own secure information. For instance, this could be a financial controller in a manufacturing company having visibility of one of the Third Party Logistics (3PL) partners alerts to an on-time delivery of a large delivery in order that title transfers can be made ahead of the deadline to avoid late penalty costs.

Self Defending Networks

The Self Defending Network is Cisco's long term strategy to protect an organization's business processes by identifying, preventing and adapting to threats from both internal and external sources. As a result of this protection, organizations are better able to take advantage of the intelligence in their network resources, thus improving business processes and cutting costs.

There are three principal characteristics of the Self Defending Network:

- Integration of security throughout all aspects of the network,
- Collaborative processes occurring between the various security
- Network elements and the ability of the network to adapt to new threats as they arise.

This adaptability allows for innovative behavioural methods to be deployed in order to recognize new types of threats as they arise, automatically. Mutual awareness can exist among and between security services and network intelligence, thus increasing security effectiveness and enabling a much more proactive response to new types of threats. This effectively mitigates security risks by broadening threat recognition capabilities and addressing threats at multiple layers of the network. This includes behaviour recognition, application awareness and network control technologies.

The integration principle means that every element in the network acts a point of defence. This means that the switches, routers, appliances and endpoints incorporate security functionalities. These functionalities include, but are not limited to, firewalling, virtual private networking, and trust & identity capabilities. In addition, the 'integration' principal incorporates technologies inherent in the secure operation of network devices, examples of which include control plane policing and CPU/Memory threshold management.

The Demand-Driven Supply Chain of the Future

'Back to the Future' is an expression that fits right in the manufacturing supply chain story. In 1984, Eliyahu M. Goldratt and Jeff Cox wrote 'The Goal', a book about excellence in manufacturing. The book espoused the mathematics and philosophy underlying the Optimised Production Technology (OPT) System for planning and scheduling manufacturing operations. Essentially the book described the 'cause and effect' relationships between actions and results, identifying the critical role of bottle-neck resources.

In their book, entitled 'Creating Demand-Driven Supply Chains', first published in September 2001, Jim Langabeer & Jeff Rose described 'How to profit from demand chain management'. In summary the book stated:

"One of the most recent yet well established concepts that has emerged in the last few years is the notion of a demand chain - the chain of processes that occur to completely satisfy the target market. The demand chain focuses on finding the right customer market and then creating a collaborative sequence of inter-organizational plans and activities to pull the demand from the customer."

Now, with the capabilities to provide secure, rapid connectivity, across global networks and involving companies of all sizes, the opportunity to use demand-driven supply chain strategies is greater than ever before. Improved information flows can be used to achieve more flexibility and responsiveness in operations, delivering better customer satisfaction, whilst reducing inventories and complying with regulatory bodies. Intelligent networks enable visibility of the whole supply chain in real time coupled with the ability to act collaboratively with supply chain partners to respond to issues and opportunities. Information is power, and the network infrastructure of today is the reality in operation of the theories of yesterday.

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