Achieving Competitive Advantage through Supply Chain Integration

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Table of Contents

Overview ..... **page 4**

Changing Nature of Competition ..... **page 4**

Shrinking Product Lifecycles ..... *page 4-5*

The Internet ..... *page 5*

Cooperative Supply Chains ..... *page 5-6*

The Role of Information ..... **page 6-7**

The Vitria Solution ..... **page 8**

BusinessWare Components ..... *page 8-9*

A New Breed of Integration ..... **page 9**

Multiple Applications ..... *page 9-10*

Application Integration Problem Matrix ..... *page 10-11*

One Size Does Not Fit All ..... *page 11-12*

Supply Chain Integration Scenarios ..... **page 12**

Supply Chain Monitoring ..... *page 13*

Order Promising ..... *page 13-14*

Automatic Procurement ..... *page 14-15*

Executive Dash Board ..... *page 15*

Conclusion ..... **page 16**

Introduction

A supply chain is the set of business processes and resources that transforms a product from raw materials into finished goods and delivers those goods into the hands of the customer. Supply chains are undergoing a degree of change that rivals the transformation that occurred in the industrial revolution. Is your company ready to accept and excel in this new world?

Changing Nature of Competition

Historically companies leveraged a variety of factors to differentiate themselves from their competition, including:

- Product features
- Price
- Quality
- Product availability and
- Customer service.

In today's dynamic market companies can no longer exploit the same drivers, or must exploit them differently, in order to remain competitive. The nature of competition has forever changed, and more significant change will occur going forward. The confluence of several factors is driving this change.

Shrinking Product Lifecycles

Product lifecycles continue to shrink as products are brought to market faster and more frequently, and are obsoleted even more rapidly. Nowhere is this more evident than in the high technology market space, where rapid technological advances have compressed product lifecycles for computers and computer components to six months or less.

Products become obsolete in the time it previously took to roll out a new product. This has several implications:

- Short product life cycles mean that product features provide, at best, a short-lived competitive advantage. Technology that is cutting edge today will be obsolete several months later.
- You can no longer require several months to "work out the kinks" when rolling out a new product. The manufacturing and product issues must be worked out immediately to leverage any short-termed competitive advantage the product may provide.
- Engineering change orders occur much more frequently than in the past.

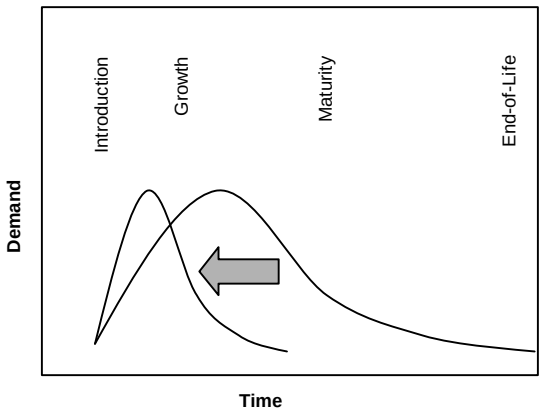

Figure 1. Shrinking product lifecycles

- You must be agile in how you manage your inventories. If you build up too many inventories ahead of time for anticipated demand that never materializes, then you face inventory obsolescence. If you underestimate customer demand , you may miss a revenue opportunity provided by an early and short-lived competitive advantage.

The Internet

eBusiness, conducting business over the Internet, is and will continue to drastically change the way in which companies procure, manufacture, sell and distribute products. The ready availability of information provides a great tool to run your business more efficiently. It empowers your customers as well.

The Web-based economy drives the market towards perfect elasticity. A perfectly elastic market is one in which customers have full information regarding product price and availability from all suppliers, and are free to purchase from any supplier. In addition to allowing a customer to quickly compare products and prices from a variety of suppliers, the Internet is giving birth to a variety of value-added portals such as *www.pricewatch.com* that compile and present price comparisons to a shopper. Clearly, competing solely on the basis of price is risky. Doing so leads to thin margins, and the increasingly mobile market demand will quickly shift to your competitors as soon as they drop their price.

Direct selling through the Web is opening major opportunities, even for products that have never been sold via mail order. For example, General Motors recently launched its BuyPower site, which merges multiple data sources in real time. Customers can now view information about product availability and features, financing options, and test-drive dates from the Web page.

The Internet is affecting how companies sell products, and also in how they share information with their partners and suppliers. Boeing's Rocketdyne unit, which manufacturers rocket engines, has reduced the cost to develop an initial version of a new engine from $1.4 million to $50,000, and compressed design time from seven man years to less than one man year, by enabling an electronic exchange of information with suppliers. Boeing's extranet yielded a free-flowing creative process that it could closely monitor.

However, this technology enabler is a double-edged sword. While effectively reengineering business processes to better leverage the Internet's capabilities may result in a significant competitive advantage, failure to effectively leverage the Internet may hinder your position in the market.

Cooperative Supply Chains

Companies historically have considered information an asset to be hoarded and protected, rather than shared. Sharing information with suppliers, for example, weakens negotiating positions. Such mentality also led to large vertically integrated

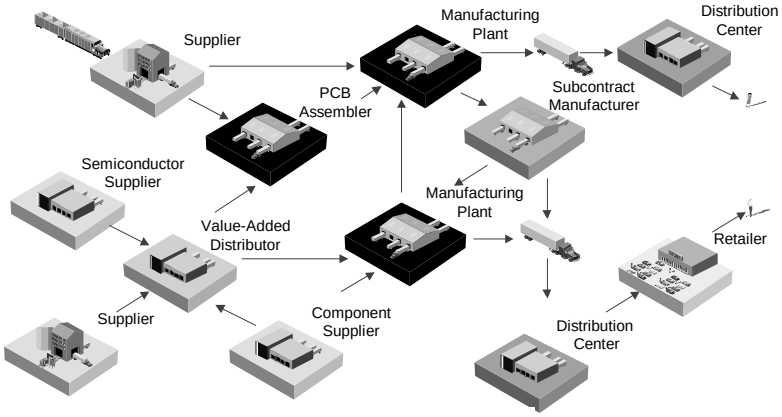

Figure 2. Cooperative supply chains

corporations that allowed a company to work closely with a few internal suppliers without having to leave the boundaries of the company.

A fundamental shift in the ways in which companies compete is driving a new way of thinking. Today, rather than companies competing against companies, supply chains compete against supply chains. Effective information sharing means that you no longer have to own all the pieces of the supply chain to effectively operate as a single entity. And the ability to form the appropriate partnerships in a timely manner and effectively operate as a single entity allows some supply chains to thrive while others fail.

Rather than promoting an adversarial relationship, companies must learn to trust their partners. Supply chains that facilitate the rapid, secure, and free flow of information can better understand and react to the needs of the customer and to the changes in the market. Dell Computer's meteoric rise in the personal computer market space has been fueled as much by its high customer service as by the price or technical superiority of its products. Dell has effectively leveraged the Internet to quickly and consistently deliver customer-configured computers into the hands of its customers. And Dell has used the Web technology to share information bi-directionally with partners about defect rates, engineering changes, product enhancements and future demand. This information sharing benefits Dell's suppliers as well as Dell, allowing them to minimize obsolescence and maximize capacity by ensuring that they're building, stocking and shipping the right parts. Lance Van Hooser, director of E-commerce at Dell, says, "Inventory is a security blanket. The only reason companies build up inventory is because they don't know about events that are going to happen. The more you know, the less inventory you will have to carry."

> *"The adversarial relationship between retailers, manufacturers, and suppliers is going away. Instead, we are forming partnerships and working toward a common goal of reducing inventory. That's the future."*
> – Terry Reuland, Thomson Consumer Electronics

With effective partnering, companies can realize the benefits of a vertically oriented supply chain without the burden, time or capital required to build it themselves. In fact, cooperative supply chains have advantages over supply chains owned by a single company because they are able to form those partnerships more quickly to take advantage of emerging market opportunities, and divest of those partnerships when those opportunities are no longer attractive. In effect, why buy when you can rent?

The Role of Information

Today's world-class companies are dominating their market spaces by providing exceptional customer service. Companies can no longer compete by designing, manufacturing and selling a single product, and manufacturing that product in advance to handle anticipated demand. Today's sophisticated customers demand products specifically tailored to their needs, when they need them. Responsiveness to customer needs requires a high degree of coordination and information sharing between partners in a supply chain.

> *"Supply-chain management is all about having the right product at the right place, at the right price, at the right time, and in the right condition."*
> – Roger Blackwell, Ohio State University

Such a revolutionary change in the supply chain requires a new set of business processes, or that technology is employed to facilitate and accelerate existing business processes.

- Companies must execute their business processes more quickly and frequently. Planning factory production must be performed on a daily, hourly, or even continuous basis to assemble and deliver customer-specific products with short lead-times. Responding to a customer quote must be performed in a matter of seconds or the customer will navigate to a different Web site to place their order. Companies that measure inventory supply in hours or days instead of weeks or months must generate and transmit replenishment signals in real-time or near real-time—or risk stockouts.
- Companies must have full visibility and receive immediate feedback to respond to evolving business situations with agility. Rather than relying on summarized reports that are weeks or days old, companies must know immediately if the marketing campaign is generating new demand or cannibalizing from existing demand. The customer service representative needs to know exactly where in the pipeline a customer's order lies. The master scheduler needs to know immediately the impact of a late purchase order or machine going down. The master planner must be able to compare current demand with forecasted demand.
- Information Technology (IT) organizations must be able to react quickly to evolving business environments. Analyst firm AMR predicts that the "Ability to collaborate, partner and disengage in a timely manner will emerge as an important competency." The IT staff must be able to put in place new integration with a supplier's applications to enable a seamless information flow with a new strategic partner. Entire new enterprise applications must be integrated to facilitate an acquisition or merger. Frequent product and service introductions may require the creation or expansion of existing supporting applications.

In many cases, your investment in existing applications is significant. Supporting this accelerated business environment is a matter of making your existing applications work better together. A new type of integrated solution is required to enable the rapid flow of information, thereby reaping additional return on investment from your existing applications. For example, consider how much more valuable you existing applications would be if:

- The advanced planning and scheduling (APS) application continuously planned production based on the latest transactional updates sent from the enterprise resource planning (ERP) system in real time.
- The configurator sent newly configured orders to your ATP server and your ERP system.
- The ATP server was based on up-to-the-minute material and capacity availability.

The Vitria Solution

Vitria is pioneering a new category of software platform for real-time eBusiness. Our product suite BusinessWare, enables customers to deploy sophisticated eBusiness solutions within and across their extended enterprises. BusinessWare automates business processes that link partners and customers, and integrates the underlying IT systems that must work together to support these processes.

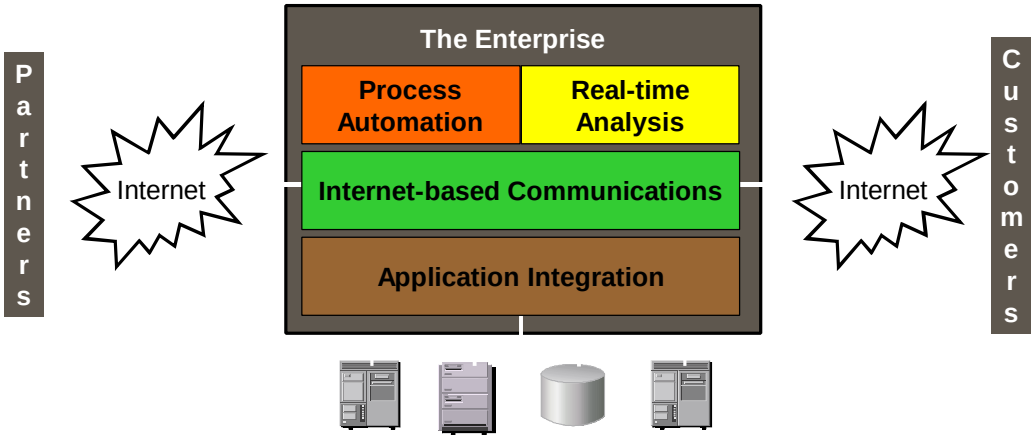

Figure 3. BusinessWare solution

BusinessWare® Components

BusinessWare Modeler.

The Modeler is BusinessWare's process modeling component. Business managers use the Modeler to create graphical models of their business processes using a point-and-click interface. These process models provide an intuitive visual representation of interdependent processing steps. Users can add business rules to each processing step to provide additional modeling flexibility. Once specified and saved in the BusinessWare Repository, process models can be directly executed by the BusinessWare Automator. The Modeler supports advanced modeling constructs that allow users to define and manage complex, real-world business processes. The Modeler supports Unified Modeling Language, the industry standard for business process modeling and automation.

BusinessWare Server.

The BusinessWare Server provides the host environment for five functional components: Automator, Analyzer, Communicator, Connector and Transformer. The BusinessWare Server is designed to provide a set of common services that are shared by each of these components:

- Security: provides rigorous support for authentication, data encryption and access control.
- Transaction management: ensures the integrity of business processes and related updates to underlying IT systems.

- Persistence: provides automatic recovery in the event of system or network failures.
- Repository: stores and manages all BusinessWare metadata, such as process models.

BusinessWare Automator.

Automator is BusinessWare's process automation component. It executes the business process models defined by users in the Modeler and stored in the BusinessWare Repository. Automator automates business processes by coordinating the flow of information among the underlying IT systems.

BusinessWare Analyzer.

Analyzer selectively gathers and analyzes business and process information throughout the extended enterprise. Analyzer provides real-time visibility into key business metrics, that business users need to manage their business effectively. Analyzer also helps companies to rapidly identify processing bottlenecks, thus providing them with the information they need to support their continuous process improvement efforts. Analyzer's results can be automatically fed back into Automator to change business processes in real time.

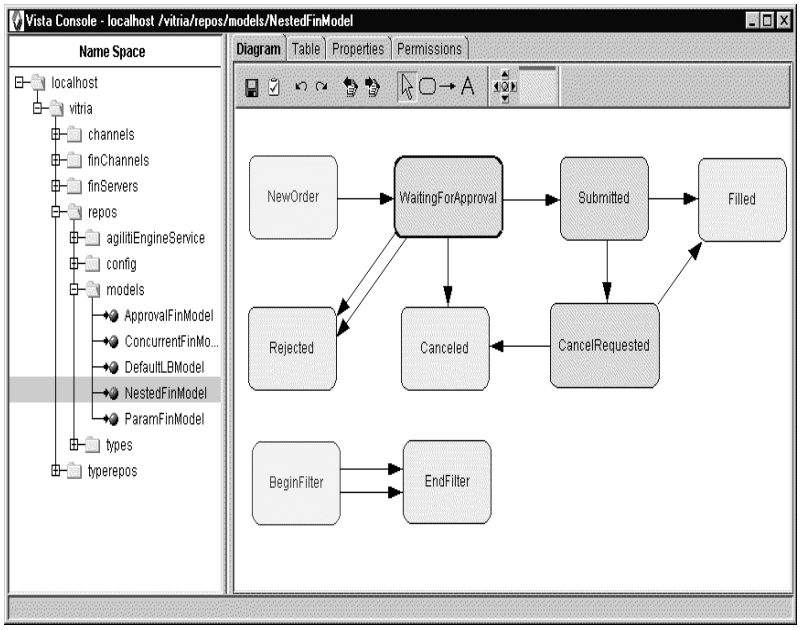

Figure 4. Example of a process model for order fulfillment

BusinessWare Communicator.

Communicator provides the communications backbone that ties together all of the BusinessWare components and the IT systems that they integrate. Communicator provides fast and secure information delivery with multiple quality of service options. Communicator supports Internet standards, such as HTTP and XML. Communicator is designed to interoperate with third-party products, like IBM MQ Series and Microsoft MSMQ.

BusinessWare Connectors and Transformers.

Connectors and Transformers together provide BusinessWare's application integration functionality, enabling heterogeneous IT systems to exchange information.

- Connectors translate business information to Internet standards, such as XML. We provide off-the-shelf Connectors for a number of popular packaged applications, messaging systems and databases. We also provide a toolkit that enables customers to rapidly develop Connectors for custom or legacy systems.

- Transformers map data structures from one IT system to another. In addition to our own transformation components, customers have the option to augment their BusinessWare solution with transformation products from third parties.

BusinessWare Administrator.
Administrator is BusinessWare's graphical systems management and monitoring component. Administrator allows systems administrators to perform local and remote administration from any BusinessWare server.

A New Breed of Integration to Enable eBusiness
Most companies have built their eBusiness solutions by incorporating incremental applications around stable business processes. Typically, instances of application integration for eBusiness within the supply chain have focused on one-of-a-kind point solutions with "hardwired" business processes and policies. Many of these solutions are data-centric: data is periodically extracted from a database environment, and then transported and imported into a target application via a batch operation. Such a solution is adequate only for a specific set of simple integration problems. Today's environment is becoming increasingly complex. Going forward, such point solutions will support a shrinking subset of eBusiness problems.

Multiple Applications
While Enterprise Resource Planning (ERP) applications continue to present themselves as the backbone of enterprise systems, a new generation of best-of-breed applications is growing at an even faster rate. Those best-of-breed applications include solutions from companies such as:

- Supply Chain Planning: i2 Technologies, Manugistics, Paragon
- Configuration: Trilogy, Concentra, Selectica
- Warehouse Management: HK Systems, McHugh Freeman, EXE
- Order Management: IMI, Descartes, Tecsys
- Sales Forecast Automation: Siebel, Vantive

New tools are required to make these disparate applications work together while avoiding the spaghetti-like chaos that typically results from building a myriad point-to-point integrations. Research analyst firm Forrester suggests that most ERP systems must be integrated with 16-20 third party applications.
As business processes become increasingly complex and time-critical, the underlying application integrations become complex as well. These applications, combined with custom-developed legacy applications, translate into integrations that tie together two, three or more applications. Integration tools that focus on transporting data from point A to point B in batch mode fall down when trying to address integrations that require a process flow across multiple applications. For example, managing the process of publishing an electronic catalog to 100 various

suppliers, or tying together an order entry front end with a configurator and ERP system for real-time synchronous integration would be extremely cumbersome and difficult to maintain with a tool that focuses on data only.

The BusinessWare Automator provides a graphical modeling environment in which to define complex process flows that can encompass multiple disparate applications. Automator provides a framework to enable eBusiness integration at a higher, semantic level by integrating at the business process level. Both business processes and their integration are expressed as models that can be directly manipulated by domain experts.

eBusiness Problem Matrix

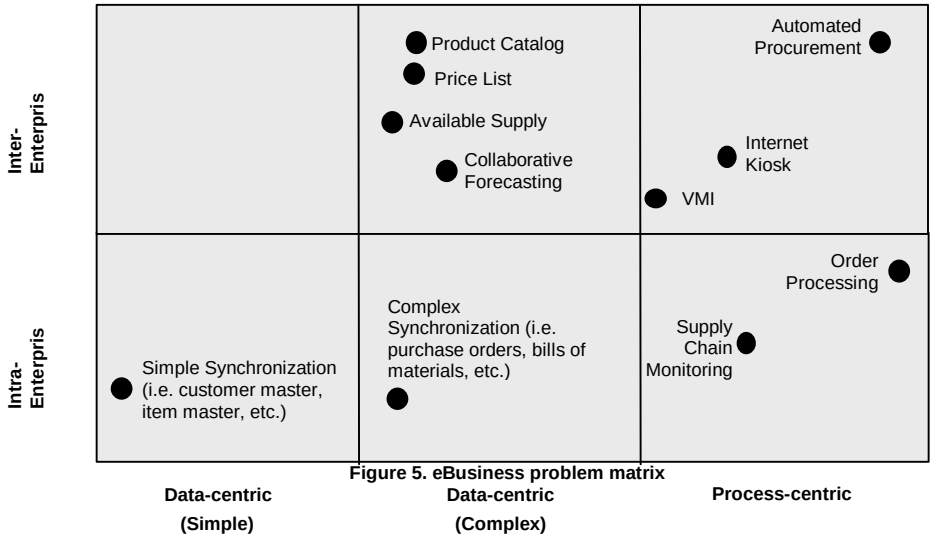

Figure 5. eBusiness problem matrix

The eBusiness problem is actually many different problems. The eBusiness Problem Matrix shows one way to segment the space. While most companies will initially tackle problems in the lower left corner of the matrix, the overriding trend is toward solving the problems identified in the upper right corner of the matrix. As companies strategically partner to form cooperative supply chains, the supporting applications must integrate not only with a company's internal applications, but also with their partner's applications. To operate efficiently, companies within a cooperative supply chain must share large volumes of information regarding future demand, product availability, catalogue and price information, and forecasts. The Internet, combined with EDI-based value-added networks, provide a ubiquitous backbone for inter-enterprise collaborations. BusinessWare Communicator provides an ideal framework to enable such inter-enterprise communication. Communicator supports SSL security to ensure safe transmission of data. Communicator's publish and subscribe capability facilitates a loose as well as tight coupling of process flows. For example, with Communicator you can publish product inventory to all your distributors who subscribe to availability information. In addition, you can

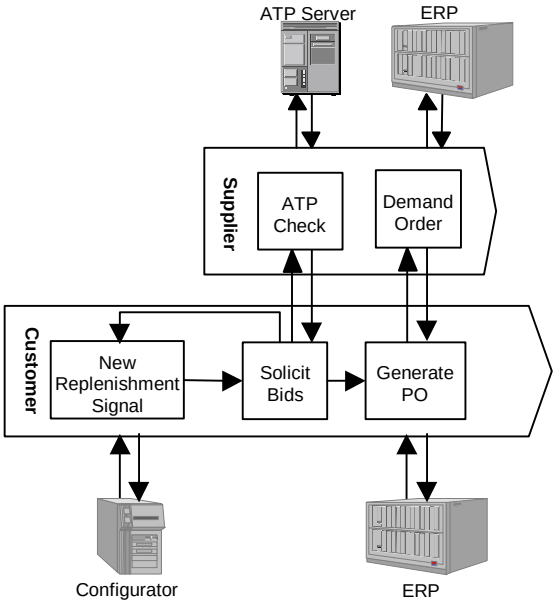

Figure 6. Using BusinessWare to manage the inventory replenishment process

send a specific replenishment signal to a specific supplier and receive a confirmation back.

BusinessWare Automator enables inter-enterprise collaboration. Automator enables modeling of business flows, both within an enterprise and across enterprises. Just as in business, business process flows represent a continuum that extends within and across corporate boundaries. Automator supports process flows that incorporate activities both within an enterprise and across multiple enterprises.

One Size Does Not Fit All

No two companies are alike, and the business processes of companies likewise vary greatly by industry, application

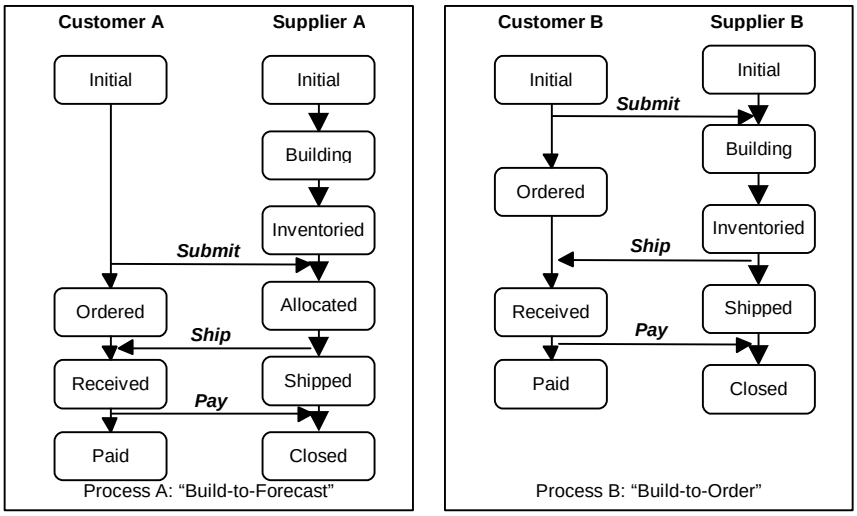

Figure 6. Build-to-Forecast and Build-to-Order manufacturing processes.

base, and company policies and objectives. Even among familiar processes there are many variations. Consider the Order Fulfillment process, perhaps the most studied and best understood process in business computing. This can be thought of as consisting of two subprocesses: an ordering subprocess initiated and executed by a customer and a demand fulfillment subprocess executed by the supplier. Even though these are the most fundamental of business processes, there are many variations. The following diagrams show three major manufacturing modes: build-to-forecast, build-to-order, and reservation-based. Although the modes are based on a common set of steps (e.g., order, allocate, build, ship, etc.), the sequence and occurrence of steps differ among them. Within each mode, there is an abundance of minor variations.

Corporations will not have the resources, the time, or the desire to re-engineer their business processes. Moreover, even if re-engineering was an option, which company's processes would be re-engineered? Can a common process satisfying all partners be found? Even so, a common process would stifle innovation, eliminate competitive advantages that were enjoyed by specialized processes, and prohibit or at least hinder participation in other partnerships using a different model. Moreover, companies must be able to change their business processes over time, react to customer needs and take advantage of market opportunities.

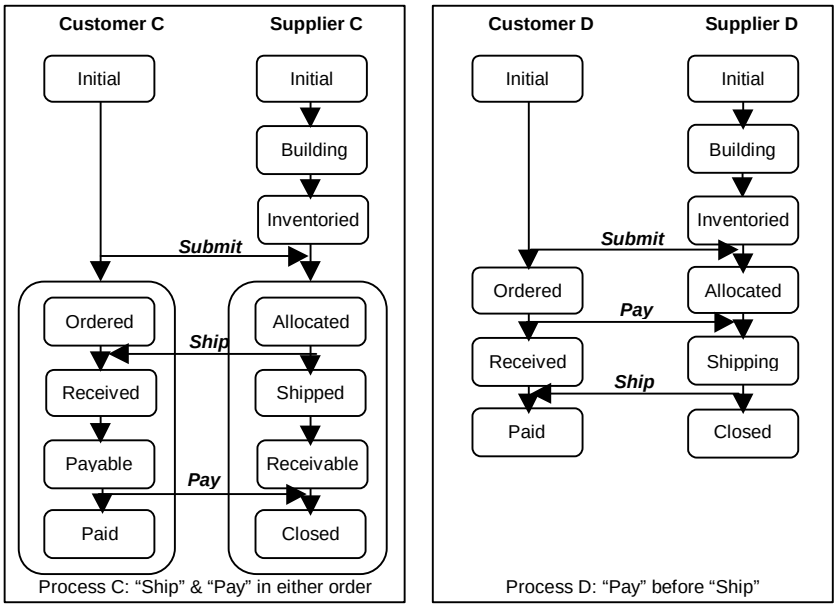

Figure 7. Resolution based manufacturing processes

Integration solutions that attempt to "black box" the process logic are bound to fail because of their inability to adapt to the variety of business processes. The BusinessWare Automator solution provides a graphical modeling environment that allows a domain expert to easily modify and adapt existing integration templates to unique business process flows. The Automator tool allows you to modify and enhance business processes over time to respond to your changing needs.

Supply Chain Integration Scenarios

The following scenarios illustrate ways in which BusinessWare enables qualitatively superior processes that solve a variety of business problems.

Supply Chain Monitoring

The ACME Company is a major customer of yours, and they are mad. Their order is late, and they're on the phone demanding to know where the order is and when they can expect delivery.

Previously, this would have been a tedious process. You would have had to log into one of four different applications to determine where the order is – order configuration, the ERP system, the warehouse management system, or the transportation system. Meanwhile the customer is getting angrier by the minute.

With the BusinessWare supply chain monitoring solution, you can enter a single user interface, find the order in question, and drill down to immediately determine that the order is on a truck which has hit a major traffic jam east of Tulsa, and is due to arrive later that afternoon.

Order Promising

You work for ProComp, a company that manufacturers personal computers. ProComp has an outstanding product – consistently ranked in the top two or three when reviewed by "PCWorld" and other industry magazines – and

ProComp's prices are very competitive. Yet ProComp's market share continues to decline. After much research, executive management has concluded that ProComp is losing deals because of poor customer service. A recent survey of your customers concluded:

- Customers typically had to wait three weeks to receive a custom-configured personal computer. Your competition can do the same in four days.
- Promised dates were often inaccurate. A customer might receive the unit a week or more later than the date they were quoted.
- Customers want to be able to determine order status through a self-service system.

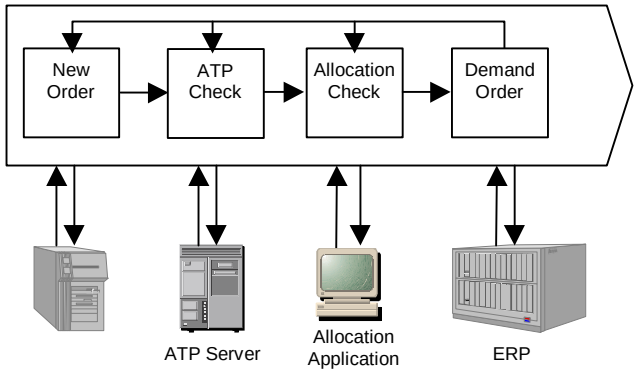

Figure 8. Order promising process

Executive management has issued an edict that ProComp provide a Web-based ordering system that allows customers to place orders for customized computers. Furthermore, management wants to be able to build and ship 90% of all customer orders in two days, and that promised delivery dates be met or exceeded for 95% of all customer orders. And they've tasked you with making this happen.

You've already purchased or built a variety of application systems, including:

- A Web-based configurator to enter and configure new orders
- An Advanced Planning and Scheduling System that will serve as the Available to Promise (ATP) server
- An ERP system and
- A custom-built allocation application that matches ProComp's supply of computers to demand that will maximize profits. ProComp doesn't sell computers on a first-come, first-serve basis. Like the airline industry, ProComp segments its demand into various classifications and maps supply to the demand segments.

Clearly your challenge is not in building new applications, but making the applications you already own work together. You need an event-based tool that can capture and execute the semantics of the quote-to-order business process. You need a tool that allows you to upgrade or swap application components without requiring a rewrite of hardwired business logic.

With Vitria BusinessWare, you can define a process flow to accept an order via the configurator, check the availability of the material and capacity in the ATP server, then, depending on the result, check the allocation business rules against a home grown allocation application. If it passes all those conditions, consume capacity in the ATP server, consume the allocation in the allocation application, add the order to the ERP system, and mark the order as demanded in the configurator system. And all this is done automatically in seconds. Because BusinessWare

has complete visibility of the status of each order, customers can now determine their order status through a self-service Web page.

Automatic Procurement

You are the purchasing manager for a large Fortune 100 company. Your challenge is to secure the best price for the raw materials you procure. In addition, in its drive to increase inventory turns, your company is moving towards generating more orders for smaller amounts – you need to be able to reduce the administrative cost per order while reducing the cycle time to generate and transmit such orders.

Today the process of generating a new purchase order involves many manual steps. A purchasing agent must cross-reference the internal part number to the vendor's part number, contact each vendor individually to secure a promise date and price quote, and generate a purchase order, and trigger that the new order be sent via mail, fax, or EDI to the vendor of choice. While you've negotiated with several key vendors to reduce some of these steps, you'd like to work with an increasingly large array of vendors to ensure that you are securing the best price. Each manual step and re-keying of information is an opportunity for the supply chain to break down.

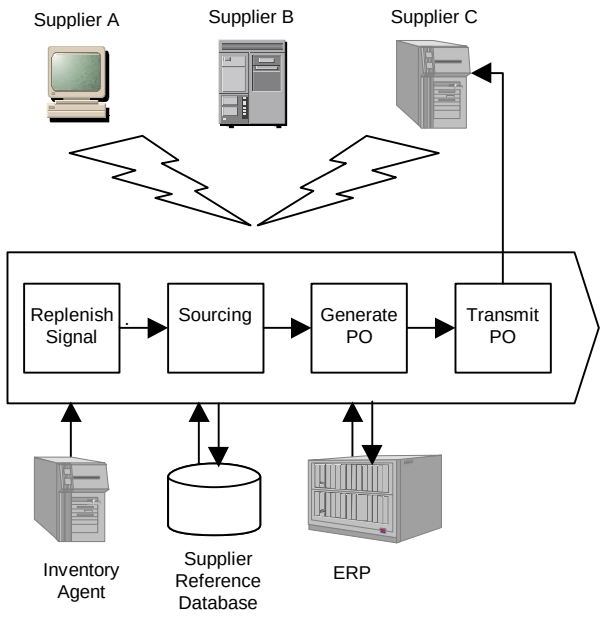

Figure 9. Automated procurement process

With BusinessWare, you are able to architect an automated procurement process. When an automated inventory agent or the MRP's min-max process triggers a replenishment signal, your automated procurement process flow is triggered. First the process automatically queries your supplier reference database to determine the list of possible vendors, prioritized based on existing contracts and supplier metrics. The supplier reference database also translates the part into each vendor's specific part number. BusinessWare then publishes the request for quote to the selected vendors. Each vendor has a pre-defined time limit in which to respond. BusinessWare then selects the vendor of choice based on the rules that you define. The purchase order is automatically generated in the ERP purchasing module, and sent via EDI or the Internet to the vendor of choice. And all of this occurs without re-keying of data, and in a fraction of the time it took manually.

Executive Dash Board

You are an executive at a manufacturing company tasked with improving customer service – specifically, reducing the time it takes from receipt of a customer order until the goods are in the hands of the customer. The actual manufacturing time is relatively short – a robot can assemble a product in less than a minute. And yet, it currently takes three weeks from the time an order is entered until a customer receives the goods.

Clearly there is opportunity to improve, but where do you start? You need to know which business process is the bottleneck so that you can determine where to focus your re-engineering efforts? You need to know:

- Which orders are in what stage in their lifecycle and how long they have been in that stage
- The history of each order and
- Whether or not the company is doing better or worse than last week or last month.

Figure 9. Supply chain monitor

Previously, you could have asked your staff to talk to the various departments within your company to gather the data. Those departments would run reports, or provide anecdotal evidence if the reports were not available, to perform this analyses. The results were of varying accuracy, and typically took a week to gather. Managing on an on-going basis to determine trends over time is too cumbersome to be feasible.

With BusinessWare, you can graphically view the number of orders at each stage in the quote-to-cash lifecycle. You can drill down on any stage to see metrics, such as the average cycle time for orders in that stage, or to query a specific order in that state. You can now determine where the bottlenecks exist, and monitor this information on a real-time basis going forward.

Conclusion

Vitria's model-driven software for eBusiness can help you gain end-to-end visibility and control of business processes that operate internally to your enterprise or collaboratively with your partners. Vitria BusinessWare solutions are driven by graphical business process models -- with embedded business rules -- that allow business analysts to control and coordinate cross-application information flows without programming. By combining first-in-class process automation components with best-in-class messaging and application connectivity components, Vitria BusinessWare reduces the time and cost of integrating disparate applications, and provides the flexibility companies need to continuously adapt processes and supporting systems to constantly changing business conditions. With BusinessWare, information becomes your competitive weapon.

About Vitria

Vitria Technology Inc. is a provider of a new category of software platform for real-time eBusiness. Vitria's product suite, BusinessWare, combines business process automation and analysis, application integration and Internet-based communications in one comprehensive platform. BusinessWare, enables customers to rapidly deploy sophisticated eBusiness solutions within and across their extended enterprises. BusinessWare automates business processes that link partners and customers, and integrates the underlying IT systems that must work together to support these processes. BusinessWare is designed to provide business managers with an infrastructure that gives them end-to-end visibility and control of their business operations, enabling them to reduce time to market, rapidly respond to change, and manage the growing complexity of business interactions across the extended enterprise.

Vitria is a privately held, venture-backed company based in Mountain View, California. For more information, call 650/237-6900, visit our Web site at www.vitria.com, or send email to info@vitria.com.