

*e-Commerce:
The Third Wave*

By the Technology Strategy Team of EC Cubed

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Welcome to e-Commerce: The Third Wave

EC Cubed believes, and Ontology.Org, CSC, Forrester Research, the Meta Group, and others concur, that application components are the key to unlocking the potential of cross enterprise e-Commerce. At EC Cubed the approach is referred to as Inter-enterprise Process Engineering (IPE). Quoting from EC Cubed's landmark white paper, *e-Commerce: The Third Wave*, "For some forward thinking companies a third wave of e-Commerce has begun. Companies have come to realize that e-Commerce is neither just a buy-side nor sell-side package. The third wave companies have learned that mission-critical business opportunities abound. To them, e-Commerce is an infrastructure for a whole new way of doing business. These companies have learned that if they extend their business processes across company boundaries and integrate them with their suppliers' and customers' business processes something totally new starts to happen."

The component-based business infrastructure described in the *Third Wave* white paper highlights how all four major e-Commerce application categories can be integrated with reusable application components. Going beyond these highlights, EC Cubed has prepared a series of white papers to drill down in each of the categories that form the cornerstone of e-Commerce integration: *Vendor Management Systems, IMarkets, Customer Care, and Extended Supply Chain*. Before reading these application specific white papers, we suggest reading the *Third Wave* white paper to provide background and context. The paper is available at EC Cubed's web site, www.eccubed.com.

A common business strategy theme is woven throughout all of EC Cubed's educational white papers, "IPE does not result in an end state. It is an on-going process that enables virtual corporations to evolve in a continually changing business ecosystem. Organization form and function must be able to sense and respond to change. Agility is the byword of success—an agile business empowered by agile information systems. No longer can software development be on the critical path for organizational and process change. With change being the constant variable, a new software development paradigm—component-based development—is essential to building agile, virtual corporations."

The entire EC Cubed team invites you to read, enjoy and profit from these pages. We look forward to your thoughts and comments as we pursue our vision for the future.

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Understanding e-Commerce

The link between technology and business innovation goes back to the very beginning—it was a technology breakthrough that enabled trade and gave birth to commerce. The development of keeled hull ships by the Phoenicians in 2000 BC made it possible to sail against the winds and go beyond the shores to the high seas of the Mediterranean. By doing something never before possible, the Phoenicians broke the bonds of geography and developed a flourishing trade with other peoples. Today, the Internet has broken the bonds of both time and distance and set the stage for profound, global change. Some business observers have given the event little notice, thinking that doing business on the Internet is simply a fad and will fade—after all, who is actually making money selling their wares on the Web? Furthermore, what fool would open up their business systems to the world, especially considering the perceived lack of security of the Internet?

The signs of technology-enabled transformation are not always clear at first. The British parliament scoffed at the invention of the telephone since the Britons already had enough messengers. In the 1940s, Thomas Watson, Chairman of IBM, turned down the offer to

In July, 1997, the White House released a document declaring a revolution, “... a revolution that is just as profound as the change in the economy that came with the Industrial Revolution.¹”

buy the patent rights to the electronic digital computer with his prediction, “I think there is a world market for maybe five computers.” So much for predicting markets and business impact when disruptive technology first appears. Although the Internet enables a new era of commerce, electronic commerce, the signs of a business

revolution are shrouded with the mist and fog of dawn. Some businesses have already recognized the start of a new era of business, the digital era, and have taken decisive action to change their business models. Competing against these transformed companies will become increasingly difficult, and those who wait for the full light of day before they act will find themselves at a distinct disadvantage.

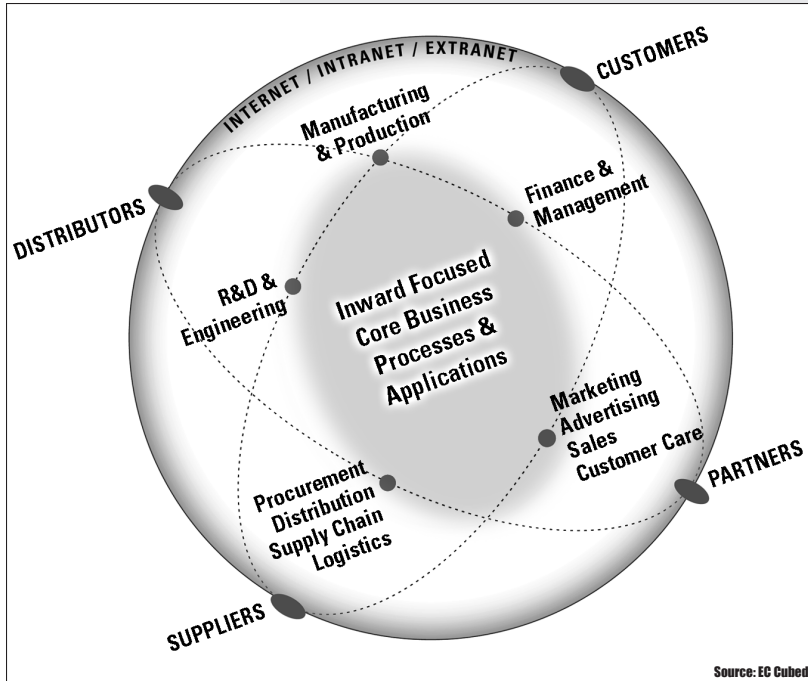
According to the Association for Electronic Commerce, a simple definition of e-Commerce is “doing business electronically.”² Sound fuzzy and ill-defined? It is. According to this definition, using the telephone to conduct business is e-Commerce. In large corporations e-Commerce is often equated to electronic data interchange (EDI) where structured messages representing standard business forms are exchanged over private networks. Perhaps the most common context in which the term is used as of the writing of this white paper relates to the use of the Internet and more specifically the World Wide Web as the infrastructure for conducting commerce. In everyday usage the terms internet commerce or I-commerce, web-commerce and e-business are often interchanged with e-Commerce. So, depending on who is asked, e-Commerce will have a wide variety of definitions and even differing

names. This is not bad since vague definitions and various names help to keep our thinking open.

To better capture the spirit of e-Commerce, we can turn to the definition proffered by the industry consortium, CommerceNet, “e-Commerce is the use of inter-networked computers to create and transform business relationships.”³ CommerceNet elaborates, “It is most commonly associated with buying and selling information, products, and services via the Internet, but it is also used to transfer and share information within organizations through intranets to improve decision-making and eliminate duplication of effort. The new paradigm of e-Commerce is built not just on transactions but on building, sustaining and improving relationships, both existing and potential.” Figure 1 provides a structural context for our e-Commerce definition.

E-Commerce is an infrastructure for extending a company’s inward-focused, unique business processes to customers, trade partners, suppliers and distributors with new, outward-facing applications. These new applications are greater than the sum of a company’s internal computer applications added to the applications of its partners. The interconnections make it possible to do things in ways not previously possible by eliminating

Figure 1. Extending Inward-Focused Processes Outward



Source: EC Cubed

time and distance. Opportunities and challenges permeate the enterprise affecting R&D, engineering, manufacturing and production, supply chains, marketing, sales, and customer care. Because it reaches directly into these core business processes that are the lifeblood of the enterprise, e-Commerce is a mission-critical business issue. From this perspective it becomes clear that e-Commerce is not something a corporation can just go out and buy. Neither is it based on speculation, but rather on the experience of a handful of companies who already are using it to streamline their business processes, procure materials, sell their products, automate customer service and create new wealth. Electronic commerce is turning industries upside down and forcing enterprises to refocus their information systems from the inside out.

e-Commerce: The Third Wave

In its first wave, e-Commerce was little more than "brochureware." The Web has created a global repository for documents and other forms of multimedia. Everyone can be a publisher of information with as little as an HTML-enabled word processor, a free file transfer program, and a \$19 a month account with an Internet service provider. Product and service information can be displayed easily and accessed anywhere, anytime, giving the smallest of businesses a "Web presence." Forrester Research reported that by the end of 1996 about 80% of Fortune 500 companies had established a Web presence compared to 34% in 1995.⁴

The second wave of e-Commerce is well under way giving companies the capability to handle transactions electronically. Perceived and real obstacles had to be overcome before electronic transactions became a widespread means of buying and selling on the Internet. According to the same Forrester

report mentioned above, only 5% of the Fortune 500 companies with a Web presence handled transactions on the Web in 1996. The major barriers included security on the Internet, lack of accepted standards for authentication and payments, non-repudiation, and general fear and uncertainty by consumers. Fortunately, several standards and commercial offerings for handling transactions have appeared including SET for credit cards, Open Buying on the Internet (OBI), Cybercash and InternetBill. Attracted by the dramatic cost savings of electronic transactions and the opportunity to exploit new revenue channels, companies have purchased stand-alone procurement packages to streamline purchasing and stand-alone storefront packages to begin selling on the Web.

Most commercially available e-Commerce packages focus on either the buyer model or the seller model of doing business. As a result, e-Commerce applications

are usually labeled as either “buy-side” or “sell-side,” depending on whether the company hosting the application is buying or selling products or services. A third business model, the broker model, combines buy and sell-side functionality into one site and aggregates both buyers and sellers. These cybermediaries add value for the buyer by reducing the search space for appropriate suppliers, and for the seller by being found more easily by potential customers.

E-Commerce applications are further categorized by the markets they serve, business-to-business or business-to-consumer. The difference is largely that of buying behavior: shopping versus procurement. Consumers do a lot of browsing and price shopping, they are subject to the influence of advertising and merchandising, and many are prone to impulse buying. Purchasing agents, on the other hand, are time constrained to get their tasks done, cannot be distracted with glitzy advertising, do not buy on impulse, and generally order from catalogs where prices have been prenegotiated.

As shown in Figure 2, e-Commerce applications fall into four major categories: Vendor Management, Extended Value/Supply Chain, I-Market and Customer Care.

In the vendor management category, maintenance, repair and operations (MRO) procurement is the most common business-to-business e-Commerce application. MRO procurement is used to reduce costs in the purchasing of office supplies and other non-production materials needed by a business. As an example in the procurement category, GE bought \$1 billion worth of supplies through its Trading Process Network (TPN) in 1997 and expects to be procuring over \$5 billion over the Internet by 2000. Meanwhile, in the extended value/supply chain category, GE Aircraft Engines used its integrated logistics solution to reduce order cycle time by 15 to 30 days and reduced the cost of creating a purchase order from \$100 to \$5. To be successful, buy-side initiatives will have to deliver such breakthrough efficiencies and achieve dramatic cost reductions.

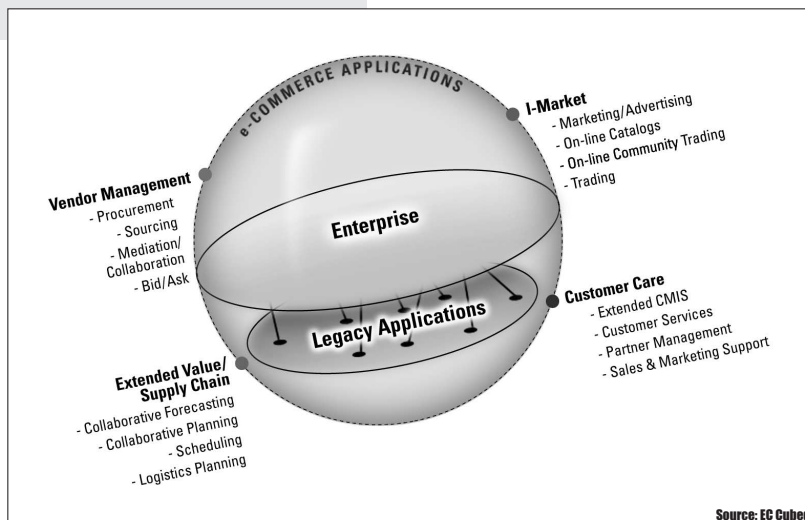
Catalog sales such as Amazon.com’s now famous book and music selling site is an example of an I-Market. McKesson, a \$17 billion pharmaceutical wholesaler, has developed such a comprehensive customer care system on the Web that it has transformed itself from a drug distribution company to a value-added provider in the healthcare industry. In-depth discussions of each of the four categories are available in EC Cubed’s application white papers.

To be successful, sell-side initiatives have to focus on revenue growth opportunities, holistic customer relationship management, engineering consumer processes that delight the user, and building communities of interest. In addition, sell-side initiatives may need to cater to both business-to-business and business-to-consumer markets simultaneously. For example, Office Depot sells to large corporate accounts meeting their procurement needs with prearranged terms and custom catalogs while reaching the retail consumer market as well as those in-between, the small office, home office (SOHO) market space. Designing their e-Commerce systems specifically for the unique requirements of each of these subtly different customers is absolutely essential for Office Depot.

Most companies, of course, engage in both roles of buyer and seller, sometimes simultaneously in a single commerce transaction. Thus extending a company’s existing business processes from the inside out must begin with a thorough analysis and understanding of customers’, suppliers’ and trading partners’ requirements, and designing e-Commerce systems from the outside in.

Whether developing e-Commerce applications in-house or pursuing the package route, a holistic view of e-Commerce initiatives is needed in order to avoid the many pitfalls that result from taking separate and isolated views. Some large corporations already have identified more than 70 e-Commerce initiatives, not just the two buying and selling thrusts. If various lines of business in these large enterprises rushed out to buy their individual point solutions, the compromises of packaged software would be revealed quickly. Trying to realize each of these initiatives individually would mean attempting to tie together and maintain a multitude of business processes and islands of data in the enterprise’s new and existing systems. Rather than weaving a tapestry, multiple stand-alone initiatives would tie their systems

Figure 2. e-Commerce Application Categories



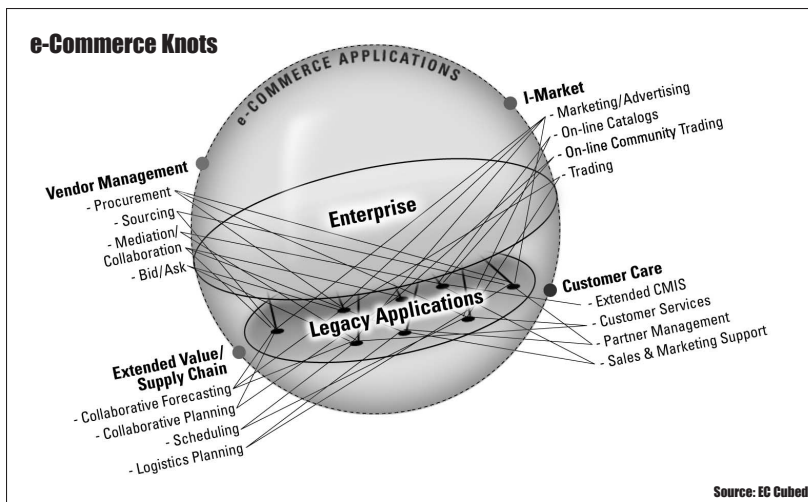


Figure 3. Untying e-Commerce Knots with core e-Commerce Components

and their company into knots as illustrated on the left side of Figure 3. Companies experienced with multiple e-Commerce applications have learned that they need a unified, incremental approach capable of supporting and sustaining multiple and continuously evolving e-Commerce initiatives—they need strategies for e-Commerce integration.

Global 2000 companies have a tremendous asset base in their existing computer systems. These systems embody their unique business philosophy, policies, and processes. Smart companies will seek to adapt, not to obliterate, their legacy applications as they embrace e-Commerce initiatives. Much of the functionality needed to implement multiple and diverse e-Commerce applications is identical or similar and thus can be reused—a key to e-Commerce integration. Core e-Commerce functionality includes user authentication and authorization, user profile management, workflow management, event notification, negotiation and collaboration, and data integration with enterprise data. These core e-Commerce components are illustrated on the right side of Figure 3. E-Commerce integration is the key to sustainable business strategy.

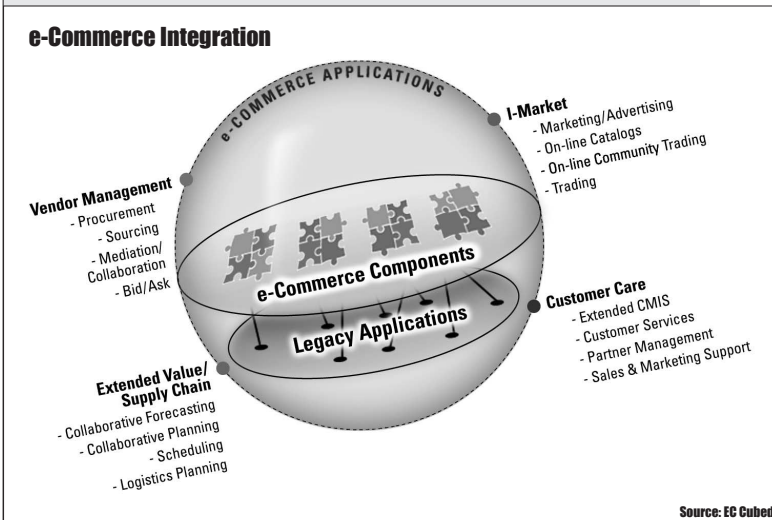
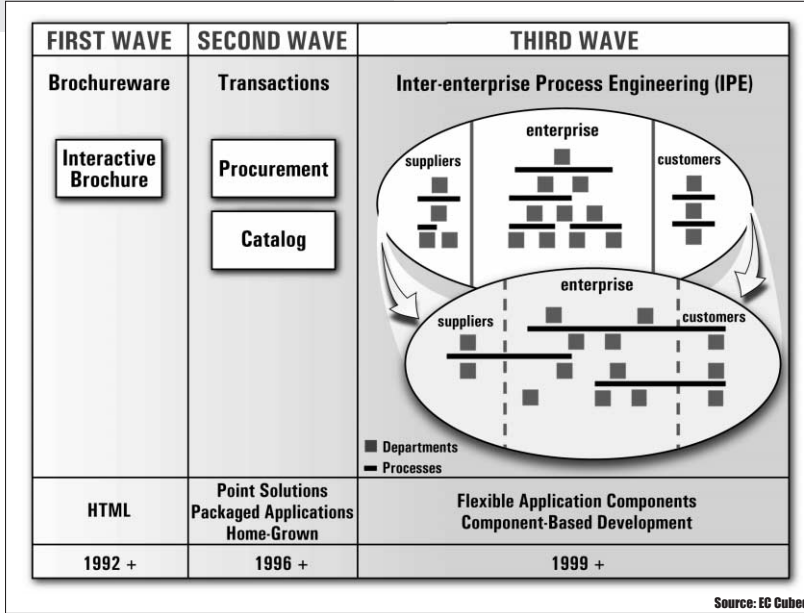


Figure 4 summarizes the three waves of e-Commerce. The first wave was about HTML and brochureware. The second wave is about transactions using home grown or packaged software as point solutions for procurement and online catalog selling. Gabriel Gross, President of Centre Internet European, summarizes the current state of electronic commerce applications as “mainly limited to two functionalities: cataloging on one side and payment facilities on the other side. The [current] electronic commerce world is in practice a lot less sophisticated than real world commerce where several levels of interaction can take place between a potential client and vendor, and several levels of intermediaries can act or interfere.” Existing packaged

applications for e-Commerce fail woefully because they support only simplistic procurement and catalog selling scenarios but have nothing to match the complexity of real world commerce.

For some forward thinking companies, however, a third wave of e-Commerce has begun. With experience as their teacher, these companies have come to realize that e-Commerce is neither just a buy-side nor sell-side package. The third wave companies have learned that mission-critical business opportunities abound. To them, e-Commerce is an infrastructure for a whole new way of doing business. They have learned that if they extend their business processes across company boundaries and integrate them with their suppliers’

Figure 4. Three Waves of e-Commerce



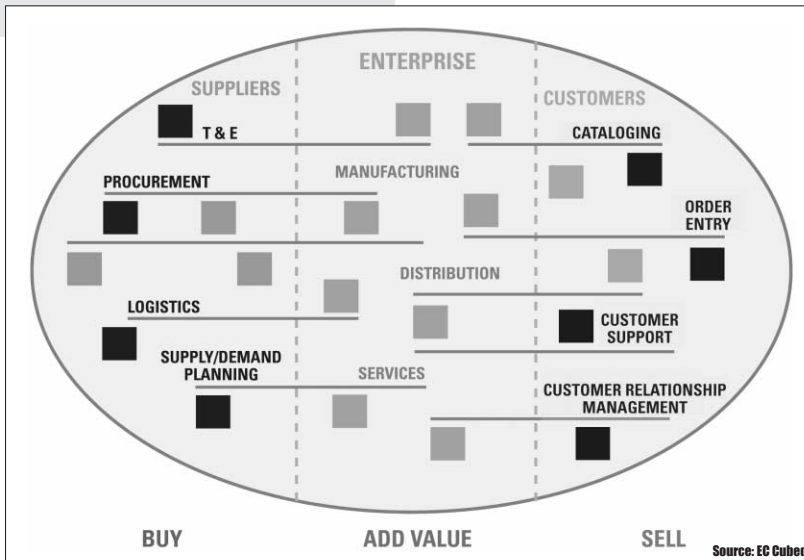
and customers' business processes, something new starts to happen.

Third wave companies are redesigning business processes so that they cross enterprise boundaries to eradicate duplicate processes, ineffective hand-offs and disconnects between and among enterprises. Virtual corporations are being created that have shared business goals, common planning, and performance management tools. Inter-enterprise Process Engineering (IPE) is their competitive weapon

for designing and implementing hyper-efficient business processes that are integrated in real-time and jointly owned by suppliers and customers. Cheaper, better, and faster takes on a whole new meaning in these 21st century corporations.

Drilling down one level, Figure 5 illustrates a small sampling of business processes being integrated electronically across corporate boundaries. These processes apply to all kinds of businesses: manu-

Figure 5. Inter-enterprise Business Processes



facturing, distribution or services. In any industry, an enterprise is located in a value chain where it buys goods and services from suppliers, adds value, and sells to customers. Value chain analysis was pioneered two decades ago by Harvard's competitive strategy authority, Michael Porter. Rather than outdate Porter's work⁶, e-Commerce enables it. E-Commerce provides the business infrastructure for realizing Porter's visions, and IPE provides the methods for competitive value chain engineering. Customer-facing processes include cataloging, order entry, customer support and overall customer relationship management. Supplier-facing processes include MRO and supply chain procurement, travel and entertainment procurement and tracking, logistics, and collaborative supply and demand planning.

Figure 6 shows how clusters of inter-enterprise business processes result in the four major categories of e-Commerce applications. Companies will not attempt to build these applications all at once. Such an effort would overwhelm any enterprise. Instead, e-Commerce initiatives will be launched in the quadrants in an incremental and iterative manner. For example, key inter-enterprise business processes may be engineered and deployed in the vendor management quadrant. Functionality will be added to these processes iteratively, and additional processes will be engineered and deployed incrementally. It is possible to proceed with work in parallel, but resource restrictions and other constraints will prevent companies from attempting too much at one time. *To maintain the cohesion needed in the ultimate digital business, each e-Commerce initiative must be based on a common business and technology architecture designed for inter-enterprise process engineering.*

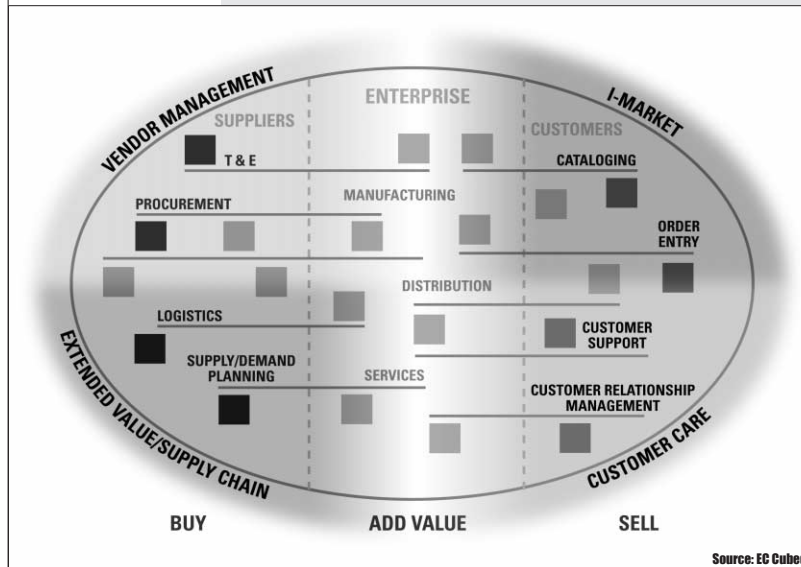
Inter-enterprise process engineering, however, does not result in an end state. It is an on-going process that enables virtual corporations to evolve in a continually changing

business ecosystem. Organization form and function must be able to sense and respond to change. Agility is the byword of success—an agile business empowered by agile information systems. No longer can software development be on the critical path for organizational and process change. With change being the constant variable, a new software development paradigm—component-based development—is essential to building agile, virtual corporations.

Agile Software for Agile Companies

To achieve coherence and manage the complexity and change inherent in multiple e-Commerce applications, an overarching structure is needed—an application architecture. An application architecture rationalizes, arranges and connects elements for a purpose. Ivar Jacobon explains, “The role of architecture is: to conceptualize the design in a form that developers and stakeholders can understand; to guide construction during the first development cycle, and in the future evolution of the system; and to enable management to structure the project and the organization itself around the architectural elements.”⁷ “The results of good architecture will be a cost-effective use of legacy assets and commercially available components, and resilience to change. With good architecture business applications will be scalable and extensible. Architecture provides a decision framework for the difficult build or buy dilemma. The structural elements along with their interfaces that comprise the system allow design tradeoffs based on cost and technological constraints. Buy or build decisions and incorporation of new technology can be determined for the structural elements rather than the overall

Figure 6. Inter-enterprise Process Integration With e-Commerce Applications



architecture. Likewise, companies can upgrade their applications over time while maintaining integrity and interoperability with other enterprise applications.

Distributed object computing is now recognized as the way forward in building enterprise information architectures that can operate in advanced client/server, intranet and internet environments. In essence, using objects to build information systems is like building a simulation with business objects representing the people, places, things and events that are found in the business setting or domain. Business objects reflect the real world and thus greatly enhance understanding and communication among systems developers and business people. And business objects reduce complexity because programmers do not need to know how an object works internally. They only need to know what the object is and the services it provides.

Object technology, however, does have some downsides including a steep learning curve. Business objects, though they represent things in the real world, become unwieldy when they are combined and recombined in large-scale commercial applications. What is

needed are ensembles of business objects that provide major chunks of application functionality (e.g. pre-programmed workflow, transaction processing and user event notification) that can be snapped together to create complete business applications. This approach is embodied in the next step in the evolution beyond objects, software components.

Components are self-contained packages of functionality that have clearly defined, open interfaces that offer high-level application services. Components can be distributed dynamically for reuse across multiple applications and heterogeneous computing platforms. The later characteristic is why Java™ has had such a dramatic impact on enterprise computing and component development, and why the eXtensible Markup Language (XML) is essential for developing a shared Internet file system.

Components take the best features of objects to a higher level of abstraction that is learned more easily by mainstream commercial software developers. Chris Stone, a Novell Vice President and former CEO of the Object Management Group explains, “Components promise to be the Lego blocks of computing. To accomplish this,

components must encapsulate useful, manageable and intuitive solutions to real-world business problems. Components, then, must enable IT professionals to use object technology at meaningful and relevant levels of abstraction,

of business rules and quick response to changing business requirements. And because major software vendors are committed to a component architecture, applications can mix and match best-of-breed solutions.

“ use object technology at meaningful and relevant levels of abstraction, while the system and service providers worry about the low-level object and system interactions ”

while the system and service providers worry about the low-level object and system interactions.⁸”

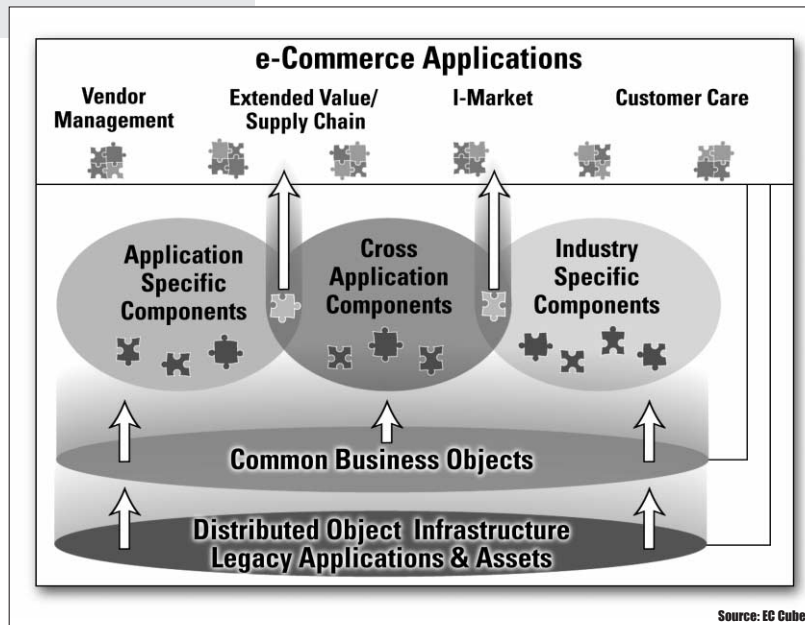
A component-based application architecture provides the business benefits of rapid applications development for quick time to market, enterprise-wide consistency

In his 1986 landmark book, Object-Oriented Programming, Brad Cox forecast a software revolution that would result from taking an engineering approach to programming. Electrical engineers do not design and build hardware from scratch. Instead they create a continuing stream of new and ever more marvelous electronic devices using prefabricated ingredients, integrated chips (hardware ICs). Cox predicted that software factories would fabricate, customize, and assemble software from standard reusable parts—Software ICs. After a decade of advances that took the theory and practice of object technology from a programming construct to a distributed computing infrastructure, Cox’s software revolution is now at full fervor. New de facto and open standards have emerged to make it possible to develop large-scale distributed computing systems with “plug and play” Group’s CORBA 3, Sun Microsystems’ Enterprise JavaBeans, and Microsoft’s DCOM.

The telephone is easy to use while telecommunications technology is very complex. Likewise, a browser is easy to use while Web technology is very complex. Industrial strength server-side components are needed to deal with the complexity of the underlying information systems and distributed computing infrastructures. With components, solution developers can “plug into” standard preprogrammed services such as user authentication, workflow, data interchange, transaction processing, permanent storage of objects, and event handling services. Developers ask for the services without having to know the internal workings of the components that deliver them. The low level systems services call on the actual technology infrastructure that may consist of wrapped legacy systems as well as services provided by native objects.

Components suppress the complexity of the underlying systems technology, meeting Chris Stone’s requirement for a clear separation of concerns: component construction versus component assembly. Plug-and-play business application components can be assembled or “glued together” rapidly to develop complex distributed applications needed for e-Commerce. How important is component-based development to large corporations? Research by the META Group revealed that “By 2001, most Global 2000 companies will use a “software factory” model to implement new application systems, requiring developers to move from a “craftsman” approach to a culture of assembly and reuse. These applications will be component-based, message-enabled, and event-driven, using an n-tier design that will leverage enterprises’ capacity-on-demand capability. “Today components are often thought of as being client-side technology, but the role of server-side component technology will be paramount as companies demand agile software in the face of accelerating business change.

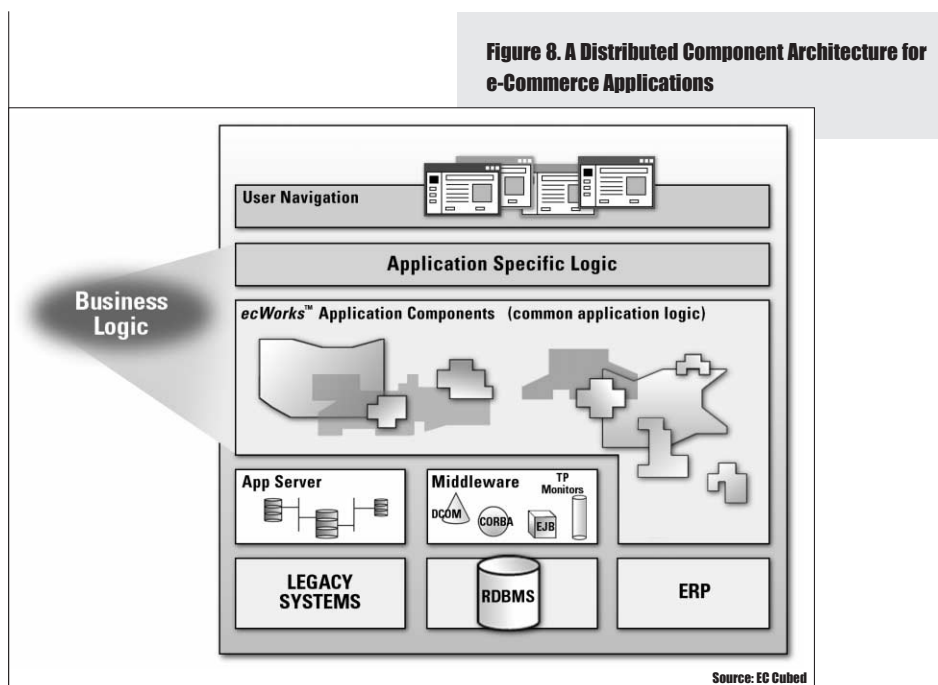
Figure 7. E-Commerce Applications and Component Logical Architecture



A logical architecture for component-based development of e-Commerce applications can be described in layers as shown in Figure 7. The technology infrastructure consists of combinations of legacy applications that have been wrapped to appear and function as business objects, and services provided directly by a distributed object platform (persistence, transaction processing, event services and the like).

Component-based development for e-Commerce applications is a process of assembly and refinement. The process begins with cross-application components that provide functionality common to most types of e-Commerce applications. Typical of such core components are user profile management, authentication, authorization, data management, workflow, negotiation, collaboration, and event notification. These cross-application components can be customized and extended to form application-specific components. For example, in a procurement application, a profiling component will contain attributes for identifying a user's role and buying power. When applied to an I-Market application, the profiling component will be extended to hold information that can be used to track customer buying patterns. In addition to the tailored cross-application components, application-specific components will include best-of-breed search engines, shopping carts, catalogs or other elements required for the application. These may be built in-house or purchased.

Cross-application components also can be extended to develop industry-specific components. For example, in a manufacturing industry a workflow component can be extended to handle work-in-progress and integrate workflows across enterprises to make "just-in-time" a reality. Additional best-of-breed industry-specific components are added to the framework to provide structure and behavior common to companies in a given industry: for example, cost accounting, ware-



housing and logistics in manufacturing industries.

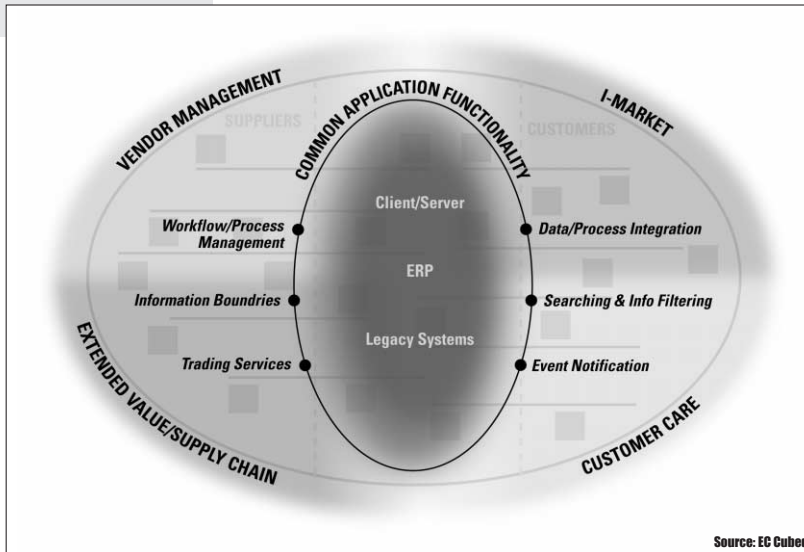
The final step in the component-based development process is the configuration of the components to incorporate the organization's unique business rules and user presentation and navigation. It is in this step that a company's competitive advantage is built on top of best-of-breed cross-application, application-specific and industry-specific components, and embedded in its e-Commerce applications. The user may be a human in which case the presentation and navigation layer is browser centric. The user also may be another computer application, perhaps a supplier's order entry application. In this case the presentation and navigation layer concerns program-to-program interactions and data—a process known as web automation. In modern distributed computing architectures both users and applications can be distributed around the globe.

The position of e-Commerce application components within a distributed computing architecture is shown in Figure 8. Residing on state-of-the-art application servers, application components use standards-based middleware

(e.g. CORBA, COM+, EJB) to integrate e-Commerce applications with legacy applications, existing databases, and ERP systems. The distributed component architecture allows the enterprise to leverage its unique business processes and policies embedded in these systems and refocus them from the inside, out.

These brief paragraphs reveal a breakthrough that has been sought since the beginning of software development—true software reuse! Notice that the common, cross-application components will be used throughout the growing portfolio of e-Commerce applications. The architecture is flexible and meant to evolve. Initially, of course, a company has no components. As it proceeds to build its next generation systems it will make or, more likely, buy the components that will populate a growing repository. When necessary, the architecture allows developers to go directly to the underlying business objects that the components encapsulate or directly to the underlying technology infrastructure or legacy systems. Over time the architecture will accommodate robust and adaptive information systems that embrace rather than cringe at business change. Its overarching structure will allow compa-

Figure 9. e-Commerce Common Application Functionality



panies to grow the software they need to compete for the future.

Joined electronically, third wave companies must share a common foundation for integrating their unique business processes and embrace the component paradigm as the way forward. Their core business processes are embedded in legacy, enterprise resource planning (ERP) and client/server systems. In order to retarget these internal systems outward, common inter-enterprise application functions are needed. As shown in Figure 9, information boundaries, workflow/process management, trading services, searching and information filtering, data/process integration, and event notification

form the foundation for refocusing information systems from the inside out.

The leading IT research firms confirm the approach as shown in Figure 10. The Meta Group identifies seven fundamental components at the heart of their electronic process interchange model: information boundaries, business rules, messaging, workflow, event/process management, interchange protocols, and trading services. Forrester Research reinforces the message as they advise companies to create object wrappers for their legacy applications and snap in new, outward-facing components to build internet commerce applications. They

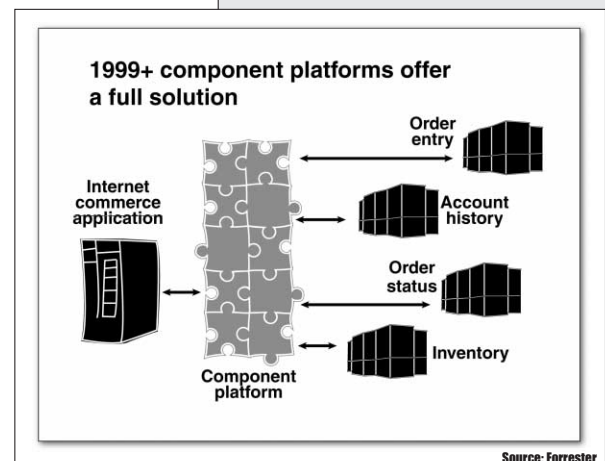
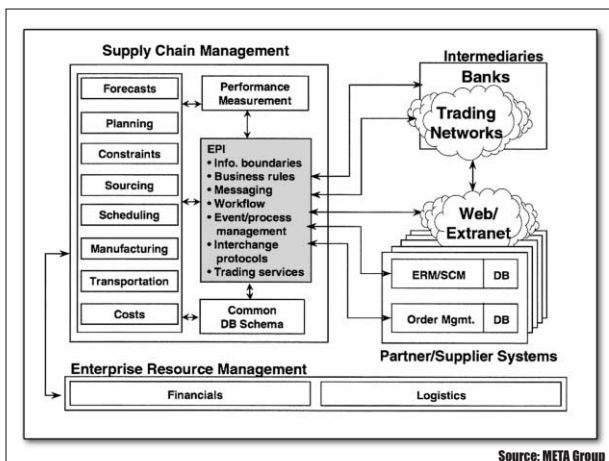
advocate an outward-in replacement of legacy functionality over time.

The essence of e-Commerce applications is that they must define “the rules of engagement” needed for process and data integration with trading partners. These are expressed in business logic that is unique and specific to each organization and application scenario. However, what is not specific to each business are the core e-Commerce components underlying the business logic. These common, cross-application components form the foundation for inter-enterprise integration and implementing the third wave of e-Commerce.

The Way Forward

In the very first line of their classic work, *Reengineering the Corporation*, Hammer and Champy declare “that American corporations must undertake nothing less than a radical reinvention of how they do their work.” Their clarion call to management in the early 1990s ushered in a business revolution and reshaped the landscape of business practice. Their message was to tear down the stovepipes of

Figure 10. Meta’s Electronic Process Interchange and Forrester’s Outward-In Replacement Model



functional management. They dispensed with the wisdom of Adam Smith's specialization of labor and hundreds of years of industrial management "best practice." They tore apart organizations whose specialized departments optimized their individual tasks (often at the expense of the overall customer-facing process) and reunified those tasks into coherent, end-to-end business processes that delivered value to customers. Their prescriptions were not based on magic, they were based on the enabling role of information technology. Herein lies the wisdom of their message. They recast the way a company must think about technology. They assert that a company that equates technology with automation cannot reengineer. A company that looks at and seeks to automate what they are doing cannot innovate, they simply reinforce and speed up old ways of doing things. Hammer and Champy rephrased the technology question: "How can we use technology to allow us to do things we are not already doing?" The focus of this new business reengineering revolution was underway. The focus of the business reengineering revolution was internal, on how the company must reorganize and streamline work.

As the '90s draw to a close it is once again time to ask, "What if you could do something that has never before been possible? What if that something fundamentally alters what it is you do?" The result would be a paradigm shift. The Internet makes it possible to do things that were never before possible. The Internet's distinguishing characteristic is ubiquity (existing or apparently existing everywhere at the same time), an attribute that can transform the very fabric of society and commerce. Déjà vu—it's reengineering all over again, only this time it's on steroids. The Internet calls to us to reengineer not just our business, but to reengineer complete industries. It calls to us to extend our internal business processes to the world outside the corporation: customers, suppliers, and business partners.

And it turns the producer-consumer relationship upside down, placing the consumer in control. It calls to us to reengineer our corporation and shift the focus of business engineering from the inside, out.

Today's forward thinking business leaders recognize the challenge of e-Commerce as a strategic business issue, not just one more technical issue to be delegated to the IS department, perhaps the existing EDI group. They already have looked below the surface of the daily press hype about the internet. What they have seen is nothing short of a business revolution. They recognize the Net not as just another technology, information medium or distribution channel, but as the infrastructure that will cause profound change in the way companies organize work and conduct business, and ultimately in the structure of the economy itself. It's the death of distance and the eradication of time between participants in markets. Pioneers are making mistakes. They are chalking up wins and losses, but they recognize that the winners and losers of the future will be determined by those who are able to capitalize on the Net's capability to inter-network suppliers, customers and partners in a way never before possible—in real-time.

Although a company may already have reengineered its internal business processes and perhaps painfully installed an enterprise resource planning (ERP) system to bring efficiencies to the back office, e-Commerce is about engineering outward-facing processes—inter-enterprise process engineering versus business process reengineering (IPE vs. BPR). It's about redefining industry boundaries, inventing new industries, repositioning, disintermediation (cannibalizing distribution channels), and reintermediation (establishing portals to the Web). It's about 1-to-1 marketing, segmenting the needs of a single customer instead of segmenting mass markets. It's about outsourcing customer service to the customers themselves. It's

about relationship marketing and building communities. It's about honoring the customer not as king, but as dictator who is but one mouse click away from turning his back on you. This is the stuff with which CEOs, not just programmers, must grapple.

Bob Metcalfe, Inventor of Ethernet and Founder of 3COM, explains, "The Internet is the Information Age. Business people know that, even if they don't have a clear idea of what the business model is."¹⁰ What is a business model? It provides an architecture for the product, service and information flows across various business actors who play specific roles and add value along the way. BPR is a tool for analyzing a company's internal business model, disassembling the actors and roles contained in the departmental stovepipes of traditional companies and reassembling them around end-to-end business processes that are seen by and add value to customers. In their classic BPR book, *Improving Performance*, Rummier and Brache use "managing the white space on the organization chart" as the book's subtitle and metaphor for this process. Just as the BPR movement eradicated duplicate processes, ineffective hand-offs and disconnects between departments within a company, the new, real-time interconnections enabled by e-Commerce allow a business to tear down process barriers between its customers, suppliers and partners. While BPR crosses departmental boundaries, IPE crosses enterprise boundaries and is about "managing the white space in the value chain."

Boeing provides a world class example of third wave value-chain management. Boeing designed its 777 in cyberspace by bringing together engineers, customers, maintenance people, project managers, and component suppliers electronically. No physical model. No paper blueprints. The result is the slogan that "the 777 is a bunch of parts flying together in close formation."

Business & Technology Architecture: The Key to e-Commerce Development

Competing for the future with e-Commerce is not just about technology. It is not just about business. It is inseparably about both, and architecture is the key to fusing the two. In his book *Systems Architecting*¹¹, Eberhardt Rechtin paints the picture, "Both architects and business managers live in illstructured, unbounded worlds where analytic rationality is insufficient and optimum solutions are rare.

"Dealing with uncertainty requires that we adopt a 'learning' rather than a 'knowing' attitude toward the future."

Both have perspectives that are strategic and top-down. Top managers, like chief architects, must architect strategies that will handle the unforeseeable, avoid disaster and produce results satisfactory to multiple clients, to boards of directors, customers, employees and the general public. Their common modus operandi is one of fit, balance and compromise in the overall interest of the system and its purposes."

The key components of a business architecture are organization, processes and technology. The arrangement and connections of these components make up the business

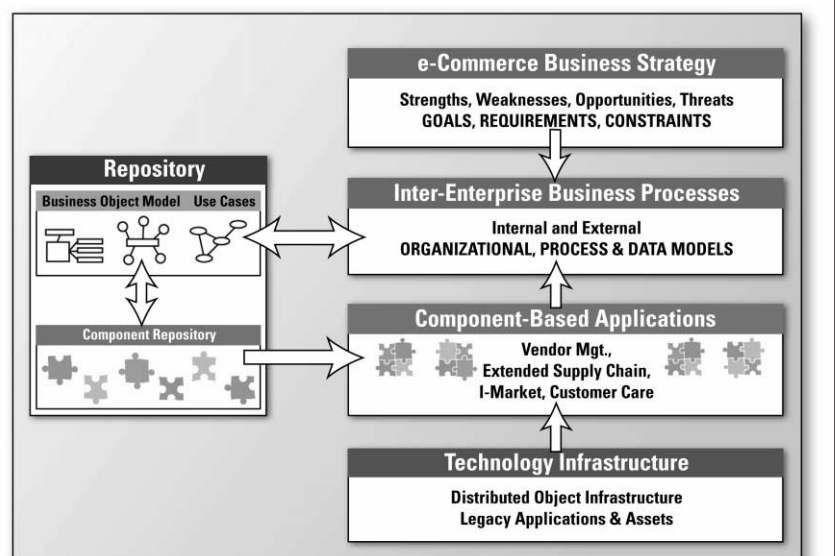
architecture. When a business is simple and small, its architecture is implicit. Without explicit business architecture, however, large complex organizations would move rapidly to a state of chaos. The profound and discontinuous change that is being wrought by the emergence of e-Commerce demands a fresh approach to business design. No longer can a company sit comfortably in its niche in its industry and carry out business planning by extrapolating yesterday's assumptions. And it cannot plan alone since forging new electronic relationships with suppliers, distributors, partners and customers requires direct participation by these stakeholders. A new approach is needed to design a sustainable, changeable business architecture and to build the essential components that must cross company and industry bounds, forming a new business ecosystem. An effective approach to business architecture must include an integrated and seamless method of business engineer-

ing and software development. What is needed are end-to-end, strategy-to-code methods for designing and deploying e-Commerce initiatives as illustrated in Figure 11.

Business strategy is not strategy-as-usual when it comes to e-Commerce. Working directly with the stakeholders inside and outside the business, a shared vision must be developed that allows the players to invent their shared future. Perhaps the greatest challenge is to achieve out-of-the-box, lateral thinking. Vince Barabba of General Motors describes GM's envisioning process, "Dealing with uncertainty requires that we adopt a "learning" rather than a "knowing" attitude toward the future."¹² Alternative futures are many for today's corporation, and building e-Commerce scenarios useful for the decision making process requires a multi-disciplinary effort and participation by all stakeholders involved.

This envisioning process centers on asking the right questions. What are our customers' Internet expectations? How does the Internet allow us to change our value proposition for our customers? How does the Internet as a communication medium

Figure 11. E-Commerce Development Method



Source: EC Cubed

affect our value chain? Should we cannibalize our supply chain? If we do not, who will? If we do, what will happen to our existing supply chain relationships? Which business model do we use to reintermediate: aggregator, open market, or value chain integrator? How can our internal business processes be remapped and integrated with our business partners, customers, and suppliers? What is their readiness for process integration? How does the Internet blur the boundaries of our existing industry? What new goods and services can we aggregate to more fully serve our customers? If we do cross industry boundaries, what is the competitive landscape and how will we differentiate our offerings? If we use the Internet to reach global markets, how do we internationalize our logistics, language and legal frameworks?

The business strategy phase of e-Commerce development identifies “what” to do. The business process engineering phase addresses the “how.” The task at hand is the mapping and engineering of the inter-enterprise business processes. Work activities, steps and hand offs are redesigned using the methods and tools of business process reengineering, only this time the mappings are inter-enterprise. Inter-organizational processes may be loosely coupled as in the case of open markets where pass-throughs are made from the I-Market to individual organizations. Or they may be tightly coupled as in the case of a supply chain where process hand offs are made electronically.

Best practice BPR methods, such as Rummler and Brache¹⁵ or IDEF are suitable for extending process definitions across organizational boundaries. There is no need for a company to change the methods and tools it already uses. What is different, however, are the external actors and resources that will result from modeling inter-enterprise business processes. Also new is the incorporation of emerging standards such as SWAP. The inter-operation of workflow systems is embodied in the W3C’s Simplified

Workflow Access Protocol (SWAP), a standard that allows the execution of external workflow systems rather than the migration of process definitions from one system to another.

Process engineering is a model-based approach to problem solving. As functional requirements are passed through to the process engineering phase, a repository of previously developed models can be searched for processes that match the requirements. A shared repository of the artifacts produced by business and systems modeling serves as a reference architecture. The repository also contains a standard representation of requirements, use cases. Use cases not only serve as a way of capturing the requirements of a system, they also trigger later development steps from analysis through design, implementation and testing. Each step provides further elaboration of previous steps. The use cases bind the steps together providing traceability and thus permit the management of inevitable change. Use cases are a part of the Unified Modeling Language (UML) that has become the standard for modeling business systems. UML is

designed to model components and guide in their construction, assembly and reuse. New and existing components are held in the component repository for reuse.

In summary, a strategy-to-code method of developing e-Commerce systems fuses business architecture with technology architecture. Business strategy involves domain experts who define the initiatives to be pursued based on an analysis of the company’s strengths, weaknesses, opportunities and threats. Business strategy determines what problem is to be solved, generating requirements, goals and constraints. Inter-enterprise process engineering defines how the requirements are to be satisfied through new or modified organizations, processes and data shared among the company’s partners, suppliers and customers. Component-based applications implement the newly designed business processes, leveraging the technology infrastructure. The entire process is guided by an architectural approach that enables rapid development of business solutions through reuse of all elements in a growing repository of models and software components.

Mission-Critical e-Commerce

As e-Commerce becomes the preferred way of doing business it becomes mission-critical; by lowering costs or increasing revenues it directly affects the bottom line. Investments in e-Commerce require the same ROI analysis, risk assessments and solid management as other strategic investments. Understanding the new critical success factors is essential. New opportunities and threats will become routine affairs among the players in this brave new world, and thus agility is the critical success factor. When new opportunities are discovered, rapid response is essential. The ability to change is now more important than the ability to create information systems that underlie e-Commerce. Change becomes a

first class design goal and requires business and technology architecture whose components can be added, modified, replaced and reconfigured. Software solutions must be agile, capable of rapid bundling, unbundling, and rebundling.

Formulating e-Commerce strategy should be at the top of management’s priorities. Today’s successful businesses have developed their unique style, form and ways of doing business. Their legacy assets are the basis of their success and should be leveraged, not obliterated, in the process of developing e-Commerce strategy. A firm’s competitive advantage is embedded in its unique business processes and its communal

knowledge. By leveraging existing mission-critical processes and extending them to its customers, suppliers and partners, a corporation can build bridges to the digital economy.

Something new happens when a company extends its inward facing business processes outward. New value chains can be created and customer processes can be integrated with the company's internal processes. Likewise with suppliers and partners. It is the engineering of these inter-organizational processes that allows costs to be cut, revenues to be increased, time to market to be decreased, and supply chains to be converted to dynamic supply grids—a whole new level of busi-

ness engineering for competitive advantage. A new class of holistic computer applications emerge that are greater than the sum of the parts of the participants' individual business processes. This new class of computer applications, e-Commerce applications, enables not only the next level of efficiency but also a whole new realm of possibility for the corporation to make something where once there was nothing. Management's ultimate challenge is organizational design that not only aligns technology with the business, but fuses the two with inductive, out-of-the-box thinking. Moving forward, e-Commerce should be the centerpiece not only of technical strategy, but, first and foremost, of business strategy. For in the third wave of e-Commerce, the

business is its system.

This paper opened with a brief reference to the difficulty of predicting the business impact of radical technology breakthroughs. Returning to these thoughts, Peter Drucker summarizes and prescribes, "It is not so very difficult to predict the future. It is only pointless. But equally important, one cannot make a decision for the future. Decisions are commitments to action. And actions are always in the present, and in the present only. But actions in the present are also the one¹⁴ and only way to make the future." Using the first principles of business and technology architecture, now is the time to act.

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