1 e-Business -- From Strategies to Applications

1.1 Introduction

Profound changes have been taking place in the business world for the past several years. Increased demands for flexibility, pressures to respond quickly to market conditions, intense local and global competition, and continued business process re-engineering and improvement for enterprise efficiency are the typical characteristics of modern enterprises. Driven by these, and other pressures, companies are using information technologies to fundamentally transform the way they organize work and conduct business.

This chapter gives an overview of strategic issues in e-business (EB) and shows how these strategies translate into applications that are at the core of e-business. For example, to be successful in e-business, companies must have applications that smoothly handle interactions, products, and payments from customers to companies and from companies to suppliers. The objective of this chapter is to give a broad overview of the subject matter and to set the tone of this module by answering the following questions:

- What is the basic framework that ties business strategies to applications (Section 1.3)?
- What are the main ideas of e-business strategy and how to align IT to meet strategic goals (Section 1.4)?
- What are enterprise applications and how do they relate to e-business strategies and applications (Section 1.6)?
- What are typical examples of e-business applications in terms of C2B, B2B, and other common business strategies (Section 1.7)?
- How do different dimensions such as volume of transactions, value of transactions, and number of business partners impact enterprise applications (Section 1.8)?
- How can applications be engineered/re-engineered for e-business solutions (Section 1.10)?

Key Points

- Strategies to adopt e-business must consider the promises as well as pitfalls before massive investments.
- Business strategies, e-business applications, and IT infrastructure are the three essential elements of translating strategies to working solutions.
- e-Business models such as web advertising, online purchasing, virtual stores and e-markets can provide competitive edge through new sales channels but the risks must be understood and managed carefully.
- Tying business strategies with e-business applications aligns IT with business and must be a priority for modern enterprises.
- Modern enterprises use a broad range of applications (e.g., decision support, operational support, real-time) which can operate within departments, within the boundaries of an enterprise, or between enterprises. For e-business all these applications need to work together at all levels.
- Object-oriented, client/server, Internet environments are being used to engineer new and reengineer existing applications and build IT solutions.
- Application (re)engineering = application engineering and/or application reengineering.
- Application engineering/reengineering efforts must respond to business needs by effectively utilizing the IT infrastructure and the embedded legacy systems.

1.2 Case Study: XYZCorp Embarks on Strategic and Application Analysis

1.2.1 Strategic Analysis Project

As indicated in the module preface, the XYZCorp held a two day strategic brainstorming session at a retreat (everyone wanted to go to Hawaii but settled for New Jersey because they have better taste!) and identified several ideas that needed to be explored. It was realized that to compete in the marketplace, XYZCorp needs to cut down the production time to 30%, provide personalized customer service, and reduce customer churn drastically (current churn is 20%, it must be reduced to less than10%). One idea is to do nothing more than to improve the existing internal systems. Another thought is to build and market next generation of software that is intelligent enough to adjust the system to respond to failures and attacks. Yet another idea is to shift

the long range focus of the company from hardware devices (PCs, VCRs, network routers) to applications and services with emphasis on web-based applications. If needed, the company could also start offering consultation and training services. It was emphasized that XYZCorp "field test" most of its services by trying them in-house.

Ms. Jones has been busy lately. She is beginning to like all this (hopes to go to Hawaii). Due to exuberance, she also formed an IT planning committee to establish a company wide IT infrastructure that will allow the company to develop and support the new applications and services. The committee has recommended a major initiative to extend and integrate the applications that support the business processes (payroll, accounts receivable/accounts payable, order processing, marketing information systems, and computerized checkout system), engineering processes (computer-aided design, computer-aided engineering, computer-aided process planning), and manufacturing processes (material requirement planning, production scheduling and flexible manufacturing systems). The committee also has to decide what to do with the existing, including legacy, applications. In addition, outsourcing decisions need to be made.

This is where we enter the scene – as high paid consultants who will help XYZCorp sort all this out.

The Agenda
- e-Business Strategies
- e-Business Applications
- e-Business Strategies To Applications

1.3 Framework for Discussion Revisited

Figure 1-1 shows the simple framework that has been discussed in the Overview Module. It depicts three high level components and their role as drivers and enablers for e-business:

- Business strategies and models
- Business applications
- IT (information technology) infrastructure

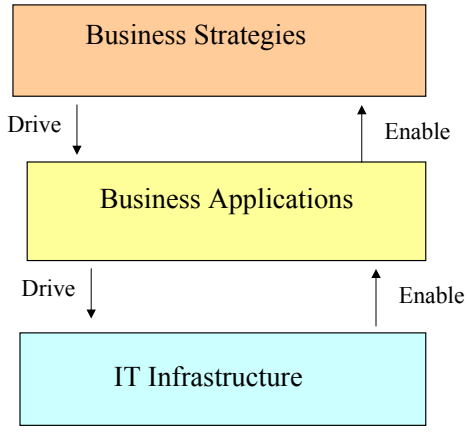

Figure 1-1: Interrelationships Between Key Components -- The Traditional View

Business strategies represent the long range game plan to win in the marketplace. Business strategies align the business products/services, processes, and several other activities to survive and succeed in the marketplace**.** Business strategies are an extensive area of business activity and are discussed widely in the traditional business and information systems management literature (see Section 1.4). For our purpose, we focus on the following components of business strategies:

- **Business models** that show how a company makes money [Turban 2002]. Some companies have very straightforward business models while the others are more complicated. For example, McDonald makes money by selling hamburgers but Yahoo gives free services to users and makes money from the advertisers. Business models are discussed widely in the literature (see for example, [Boar 2001, McNurlin 2002]. We will only concentrate on the aspects relevant to e-business (see the business models for e-business in Section 1.4).
- **Business products/services** that are offered to the customers (e.g., manufacturing cars, repairing PCs, selling hamburgers, providing online banking, supporting customers through help desks, delivering mail to residential and business customers, teaching students etc).
- **Business processes** that support the business products/services and represent the day-to-day business related activities of an enterprise (e.g., manufacturing a car that is sold to the customers, publishing books that are sold to the readers, operating a cable TV company for consumers, managing quality control in production lines, etc.).

Basically, business models determine the business products/services that are directly offered to the customers (e.g., offering loans) and business processes are the procedures and methods needed to support the business products/services (e.g., verification before offering loans). For example, if you want to open a training business, then your business model is to make money through training. The business service, naturally, is training. The business processes needed to support the training business will include advertising, enrolling students, scheduling classrooms, etc. The business strategy in this case would consist of a long range plan to use the business models, services, and processes to succeed in the training business. Business strategies thus establish the requirements and the business drivers for business models, business services, business processes and the lower level technology initiatives. Business services and business processes may be centralized or distributed -- most medium to large organizations distribute business processes among multiple sites (e.g., cars are designed in one place, assembled in many places, and shipped to dealers at several places). We will look at strategies for e-business in Section 1.4.

Business applications are the computer-based information systems that provide automated support to the company business. *Business applications, sometime referred to just as applications in this book, are business aware.* For example, an airline reservation system contains business logic and data that is not the same as a hotel reservation system (business awareness). Business applications also provide business value to an enterprise. Obviously, an airline reservation system provides business value to the airline business. These applications use information technologies to support the enterprise and thus are enablers to the business processes. Modern enterprises use applications such as marketing support systems, automated order processing and tracking systems, e-commerce systems, telecommunications provisioning systems, and real-time manufacturing control systems. These applications consist of a user database (a pool of data), a set of programs to access and manipulate the database, and user interfaces to invoke the programs. A business application may also be centralized (all of its components at one site) or distributed (its components reside at different computers on a network). A business application may work within an organization (***Business To Employee -- B2E --Applications***), support external customers ***(Business to Customer -B2C -- Applications***) or may involve business to business interactions ***(Business to Business --B2B -- Applications***). **e-Business applications** are business applications that support the e-business at B2E, B2C, as well as B2B levels. We will take a closer look at e-business applications later on in this chapter (Section 1.6 and 1.7) and in the next chapter.

The information technology (IT) infrastructure is used to build, deploy and operate the business applications. IT infrastructure, also sometimes known as computer-communication platform, consists of technologies such as computers, operating systems, networks, databases, and transaction managers. *This infrastructure enables the applications and is business unaware.* For example, the same type of networks and computers are used in airline reservation systems as well as hotel reservation systems. The best known

infrastructure is the network that interconnects remote applications, databases, and users. Internet, wireless, and broadband networks are examples of vital network technologies (see the Network Module). An important player is middleware, an increasingly crucial and, at the same time, bewildering component of the modern IT infrastructure. Middleware is needed to interconnect and support applications and users across a network. Middleware services typically include directories, emails, and facilities to invoke software to access and manipulate remotely located databases and applications. Middleware services are typically provided by specialized software packages (for example Lotus Notes is a middleware package that supports groupware applications). However, middleware services may be implemented in a combination of database management systems, computer operating systems, and transaction management systems. Middleware is explained in great detail in other modules of this book ("Middleware" and "Platform" modules). Internet and Web technologies are the most commonly known example of the modern IT infrastructure (see the sidebar "Internet, Intranets, Extranets, and the Web - A Very Quick Scan").

Figure 1-2 refines the simple framework presented in Figure 1-1 and highlights the following key points that are essential for IT managers and practitioners:

- Business strategies provide the requirements that should drive the applications and the IT infrastructure.
- Applications enable the business strategies and IT infrastructure enables the applications. This must be kept in mind while making IT infrastructure choices.
- The traditional view, presented in this figure implies that business strategies and applications *always* drive the IT infrastructure. As we will see in Section 1.4.4, in many cases, the IT infrastructure can lead to new business models, strategies, and applications.
- In some cases, the business strategies are directly supported by the IT infrastructure, bypassing applications. For example, companies regularly use emails and video conferencing to conduct business with business partners and customers.
- Systems need to be engineered/reengineered[1] at all levels and these efforts need to be interconnected. For example, business process (re)engineering needs to drive application (re)engineering which in turn should drive the infrastructure (re)engineering.
- IT infrastructures (this includes middleware), does not add any direct business value. For example, installing a fast network may not help a company unless the network is used effectively to meet business needs.
- IT infrastructure enables applications and, in some cases, the business models directly. If not handled properly, IT infrastructure can disable applications and business processes. For example, networks are used to support 70% of financial transactions. Imagine what would happen if the financial network went down.
- An important role for the IT infrastructure at present is to enable e-business. For example, business activities are typically distributed to support a dispersed business topology (e.g., different branch offices of a business, different business partners). The business activities appear as “nodes” on the business network that need to be interconnected through computer-communication technologies

1.4 e-Business Strategies

1.4.1 Overview

As stated in Chapter 1 of the Overview Module, ***e-commerce (EC)*** is buying and selling over the network (mostly Internet) while ***e-business (EB)*** is conducting business, including buying/selling, over the network (mostly Internet). Thus, EB = EC + other business activities such as conducting meetings, developing software, and managing customer relationships. EB subsumes EC. Moving from e-commerce to e-business (i.e., from buying and selling versus conducting the entire business through IT) is a major step with profound

[1] We will use the term (re)engineering to indicate engineering and/or reengineering.

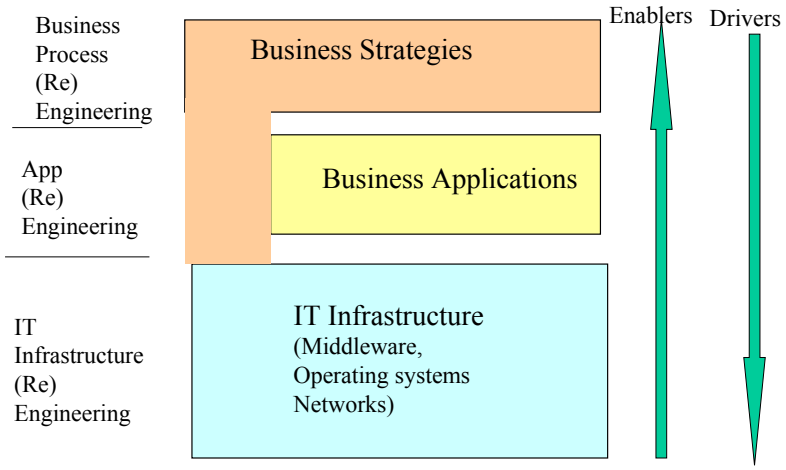

Figure 1-2: A Framework for IT's Role -- The Traditional Approach

implications. Despite the economic slump of 2001-2002, the "e" revolution has streamlined the interactions from customers to companies and from companies to suppliers. This streamlining also includes flow of products and payments. The Internet is a central player in tying customers to companies and companies to suppliers around the globe. For example, you can reserve flight tickets, hotel rooms, and a car through the Internet in a very short time. In many cases, this time is less than the time it takes you to get connected to an airline reservation agent (and listen to the irritating commercials while waiting on the phone)!

To compete in this new world, companies need to develop strategies that focus on time to market and customer service. Customers have many choices in this new economy, as we all know. If your company takes months to deliver a service while your competitors take days, then you simply go out of business. Companies must transform their internal systems and develop effective interfaces with customers and suppliers to be successful. Naturally, information technology plays a pivotal role in this area. This section gives an overview of strategic issues by discussing the business strategies that are vital to e-business, the business models that are at the core of these strategies, and the alignment of IT to support the strategies. Case studies and examples illustrate the key points.

Internet, Intranets, Extranets, Web, and Web Services - A Very Quick Scan

- **Internet** , also known as the "Public Internet", is a network of unrestricted/unregulated networks that are interconnected to give the appearance of a large global network. Technically, Internet is based on the IP (Internet Protocol) stack.
- **Intranet** is a private Internet used by a corporation for its internal use (i.e., an internal IP network). Intranets use the same technologies as the public Internet but the underlying physical network is owned by the corporation. This allows use of Web, email, and other services on a private corporate network.
- **Extranet** is the Internet that is used exclusively for business to business communications. Extranets also use the same technologies as the public Internet but the underlying physical network is jointly owned by the participating corporations. Extranets are popular because the public Internet is not suitable for highly secure business to business activities and large financial transactions.
- **In reality**: Internet = Public Internet + Intranets + Extranets.
- **World Wide Web (WWW),** also known as Web, operates on top of the Internet to support users and applications. World Wide Web is based on the following concepts and technologies:
  - Hypertext Markup Language (HTML) is a language used to create hypertext documents that can be displayed on the browsers. XML (eXtensible Markup Language) is a powerful extension of HTML to describe and exchange information between humans and programs (HTML is only for displays).

  - Web servers house the resources (HTML pages, databases, application programs).
  - Uniform Resource Locator (URL) is an address used by the Web to locate resources.
  - Hypertext Transfer protocol (HTTP) is a protocol used by the Web browsers and Web servers to exchange information.
  - Web browsers are ubiquitous GUI tools, available on almost all computing platforms, that exploit HTTP, URL, and HTML to access the Internet resources in a generic fashion. Web browsers provide universal GUI access to information that may be located anywhere in the world.
  - Web gateways to non-Web resources allow Web users to access non-Web resources (e.g., corporate databases) from Web browsers. These gateways convert Web protocols to non-Web protocols.
- **Web Services**: WWW, defined in the early 1990s, was designed to access HTML documents. Web Services, introduced in 2001, have defined mechanisms for global distributed applications where you can access databases and programs around the globe in a manner similar to accessing HTML pages. Web Services, the foundation of Microsoft .NET, rely heavily on XML and make it easier to market products, deliver services, and support customers/business partners around the globe.

For extensive discussion of Web and Web Services, see the Middleware Module.

What is a Strategy?

According to Webster, "strategy is a plan or a method to achieve a specific goal". In general the goals are long range and important such as succeeding in business, getting ahead in life, winning a battle, or winning a law suit. In the turbulent and highly competitive marketplaces of today, business managers have to develop strategies to win or to help their companies to win. For our purposes, a strategy is:

- a game plan to win,
- concerned with long range issues (short range issues are referred to as tactical issues), and
- focused on the issues that are vital to the company (e.g., making profits, retaining customers).

In this vein, an e-business strategy is the game plan to win in the marketplace through e-business. An e-business strategy combines a business strategy (the business plan to compete in the marketplace) with an IT strategy (an IT plan to help a company win).

1.4.2 Business Strategies – How to Succeed in the Competitive Marketplace

As stated previously, strategy is a game plan to win. But how are business strategies developed? A common approach is based on two factors: products (existing, new) and customers (existing, new). The basic idea is presented in Figure 1-3. To be successful, companies need to consider all four cells of Figure 1-3. Naturally, existing products for existing customers need to be strengthened -- this is a firm's base. However, firms cannot survive without introducing new products and attracting new customers. It is also desirable to expand existing customer base by selling existing products to new customers and also "upsell" by introducing new products to existing customers. The riskiest undertaking is when you are exploring new horizons by introducing new products for new customers. The challenge faced by companies is to understand and exploit the confluence of trends in customers (e.g., speed of service demanded by the customers and appeal of self service), organizational trends (e.g., outsourcing and continued innovation), and technology trends (e.g., integration of user views and back-end systems, broadband and mobile networks, component-based software).

The main question is: which cell should a company focus on? A variety of models have been developed for establishing strategies. See Chapter 1 of the Management Module and [McNurlin 2001] for more details. Perhaps the best known models in this category are the Porter Models that are briefly reviewed here.

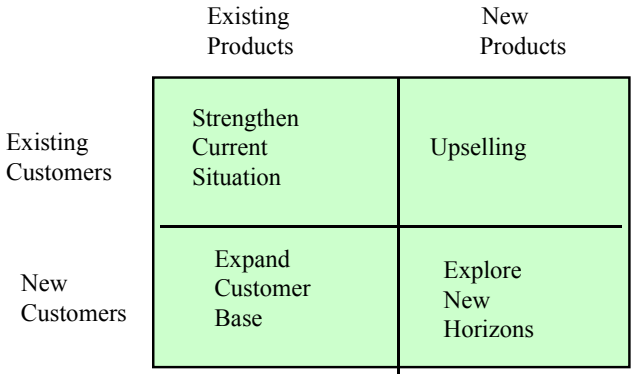

Figure 1-3: Establishing Strategies Based on Products and Customers

Porter Models were introduced by Michael Porter first in 1980 and then later in 1985 [Porter 1980, Porter 1985]. The first model, known as the competitive force model is used most heavily. Porter's basic idea is that companies must contend with five competitive forces: threat of new entrants, bargaining powers of customers and buyers, buying power of suppliers, substitutes for your products and services, and the intensity of rivalry among competitors (see Figure 1-4). He then proposes three strategies to succeed: differentiate your products and services, be the lowest cost provider, and find a niche. Five years after this very simple yet elegant model, Porter proposed a Value Chain model suggesting that to be successful, companies must add value at every step of creation, development, sale, and after-sale. This model also became very popular.

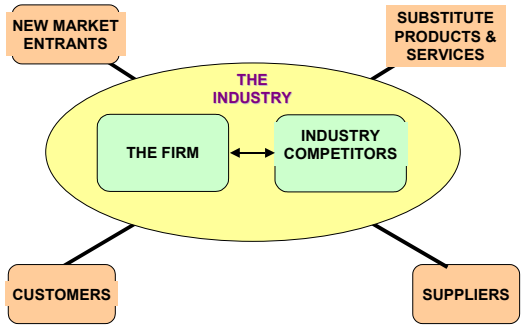

Figure 1-4: Porter's Competitive Force Model

Let us use the following examples to illustrate the Porter's Competitive Force Model.

- The US Post Office Services, circa 1980, had no competition. Federal express was a new market entrant that came up with the overnight delivery services and became a competitor to the Post Office Services. Other entrants such as UPS also became competitors to the Post Office Services. While positioning to compete with the new entrants, the Post Offices had to face a substitute service -- the e-mail. As we all know, e-mail is a substitute for paper mail and even telephone calls. Thus the new entrants and the substitute services cannot be ignored.
- Rand McNally has been printing maps until 1916 and has been the leader in maps ever since. The company publishes a very successful *Rand McNally Road Atlas* that has sold 150 million copies. However, as the digital economy developed at the beginning of the 1990s, Rand McNally's management did not understand the full impact of the new Internet and other computer-related developments. In particular, new startups such as MapQuest came out of nowhere and became a chief competitor in the new on-line map environment. New management was brought in to create a web site

(RandMcNally.com) to put Rand McNally maps and address-to-address driving directions on the Web. Despite several attempts at gaining the online map and end-to-end directions business, Rand McNally has a long way to go to catch up to its more digital-savvy competitors. Thus new entrants such as MapQuest armed with substitute products (online maps) and additional services (e.g., online directions) have successfully competed with a market leader. Obviously, the changes in customer attitudes (many customers are comfortable with the idea of printing maps and directions online) have helped the new entrants.

Companies need to continuously watch out for new entrants and substitute products and themselves develop new products to stay in business. While developing strategies, the following few principles are worth keeping in mind (see [Kalakota 2000] for an expanded discussion of these and other related principles):

1. Technology should not be an afterthought in forming business strategy but a cause and a driver. In fact, "electronification" of current and future systems must be part of a business strategy.

2. Streamlining the flow of information is more important than that of products. This is essential because the information surrounding a product and service is more important than the product itself in this information age.

3. You must be able to overthrow outdated business design to avoid failure and develop new business design that relies on outsourcing to attract and retain customers.

4. Business design of the future should be highly reconfigurable and technology should be used to innovate, entertain, and involve the customer experience.

It is beyond the scope of this book to discuss business strategies in detail. The following sidebars summarize the main ideas from a few of my favorite papers. The sidebar "Porter's Thoughts on Internet Strategy" summarizes Mike Porter's views on the good and bad news associated with the use of Internet for business strategies. "How Home Depot Created a New Market" sidebar shows how Home Depot succeeded in a very competitive marketplace by addressing the needs of homeowners. The sidebar "Disruptive Technologies – When NOT to Listen to Your Customers" presents a very important view by Christiansen on how some companies fail because they keep listening to their existing customers. Several books, such as [Kalakota 2000, Sawhney 2001, Whyte 2001], and journals/magazines such as Journal of Business Strategy, Harvard Business Review, Sloan Management Review, the CIO Magazine, and Information Week should be consulted for detailed insights. In addition, consulting firms such as IDC (www.IDC.com) have published a series of reports on e-business strategies. We will discuss e-business strategic design issues and then present a few examples to highlight the salient points.

Porter's Thoughts on Internet Strategy

Some argue that the Internet renders strategy obsolete. Michael Porter contends that the opposite is true. In fact, Internet weakens profitability and lowers entry barriers for newcomers, thus it is even more important for the companies to distinguish themselves through strategy. The winners, according to Porter, will be the companies that view Internet as a complement to the traditional ways of competing.

Internet is a powerful enabling technology that can be used, wisely or unwisely, as part of any strategy and in any industry. The main question facing the companies is how to deploy the Internet. In general, the companies that succeed will be the ones that use Internet as a complement to the traditional ways of competing and not those that separate their Internet initiatives apart from their established operations. Traditional companies as well as dot coms can benefit from the Internet by making it a tool for distinctive strategies. Thus the Internet makes strategies more essential than before.

Most of the Internet benefit should be measured in terms of the economic value it creates in the real companies. Economic value is the gap between price and cost and reflects the profitability of a company. Creating revenues, reducing expenses, and even new customers is not an evidence of economic value. Reducing cost, for example, does not show profit if you have to reduce prices dramatically to stay

competitive. It is not good to point to the success of Internet tool providers as a sign of success. In fact, in many cases, tool developers do quite well in the periods of experimentations even though the experiments themselves are not very successful.

To determine how the Internet creates economic value, Porter suggests two fundamental factors: a) the industry structure, which determines the profitability of the average competitor; and b) sustainable competitive advantage, which allows a company to outperform the average competitor. For example, the Internet has opened new markets for potential profits but it is difficult to maintain a competitive edge because everyone can enter the new marketplace also

The paper goes through a detailed analysis of the Internet on these two factors and lists six principles of strategic positioning:

- Start with the goal of long term profitability.
- Deliver a value proposition that is superior to the competition.
- It must provide distinctive value chain, i.e., provide value at every step of design, manufacturing, distribution, and sales.
- Products and services should be willing to give up some features to provide added values in others, i.e., tradeoffs must be part of the strategy.
- Define how all the products and services of a company fit together.
- Provide continuity of direction, i.e., do not disrupt services and products without giving them a fair chance.

Source: Porter, M., "Strategy and the Internet", Harvard Business Review (HBR), March 2001.

How Home Depot Created a New Market

Home depot has revolutionized the do-it yourself market in North America. It has become a more than $25 billion company that has created 130,000 new jobs in more than 1000 stores across the United States. Home Depot succeeded in creating a new market by converting home-owners into do-it yourselfers. The main idea is that home owners do not like to wait for contractors to arrive at all odd hours and charge top dollars for jobs that are not well done. Instead the homeowners would like to do things themselves, if possible. Home Depot enabled these homeowners to do their own thing and hired trained staff, many are ex contractors, to help the customers in buying the right products and give "how to" advice.

Source: Kim, W.C., and Mauborgne, R., "Creating a New Market Space", HBR, Jan-Feb, 1999.

Disruptive Technologies – When NOT to Listen to Your Customers

Many leading companies fail to stay at the top of their industries when markets or technologies change. IBM dominated the mainframe market but missed the minicomputers by several years even though minicomputers are much less sophisticated than mainframes. Digital Equipment Corporation (DEC) dominated the minicomputer market due to its Vax machines but missed the smaller PC market Apple computers led the user friendly computers but lagged behind 5 years its competitors to bring its portable computers to market.

The main reason for many of these failures is that the companies stay too close to their existing customers while new customers and products are emerging. For example, Xerox built large copying machines for copying centers. When asked, the copying centers did not see any need for smaller copier machines. Similarly IBM talked to its mainframe customers to see if minicomputers and desktops could be of use to them -- IBM found that these customers wanted more mainframe features instead of smaller machines.

Managers must be aware of the disruptive technologies that do not initially meet the needs of their existing customers. Disruptive technologies such as small copying machines in the era of big copying machines must

be looked at as new products/services for new customers.

Source: Bower, J. and Christiansen, C, " Disruptive Technologies; Catching the Wave", HBR, Feb 1995

1.4.3 e-Business Models – How to Make Money Through e-Business

Business models**,** as stated previously, show how a company makes money and are thus at the core of business strategies. The ***e-business* (*EB) models***, in the same vein, show how companies use EB to make money. Examples of the common EB models being used by companies are (see Figure 1-5):

- **Brick and Mortar**. This is the classical model in which the business is conducted in a physical ("brick and mortar") building. For example, to eat at a restaurant, you go to the restaurant (it is tough to eat spaghetti through email, but you never know!). e-Business in this model is used minimally.
- **Click and Brick (Web Advertising).** This model combines clicks (web-based access) with bricks (buildings). For example, a company may have several physical stores with sales staff but also use web as another sales channel. This is the ***web advertising model*** where company web sites are used to advertise company products and services. Numerous companies use this model. This model does not directly generate revenues but provides another marketing channel.
- **Click and Order (Online Purchasing).** In this case, the order is placed online for purchasing. Known as the ***simple e-commerce model***, it goes beyond web advertising and supports online purchasing. An example is the www.flowers.com where you can select and buy flowers online. This model may also involve a physical site for purchasing. An example is Staples store where you can place orders on the web and then pick up the goods at the store, or just go to the store and buy the needed goods. Several variants of this model exist:
  - Content providers that generate revenue by selling content online. Online subscription services such as TheStreet.com are an example.
  - Online service providers that provide services such as support for hardware and software products (e.g., PCSupport.com)
- ***One Click and Multiple Orders (Virtual Shop).*** This case represents a ***virtual shop*** where a customer clicks once to place multiple orders that may involve multiple suppliers. The web site now represents multiple suppliers and can aggregate the products and services from multiple providers. An example is the well known Amazon.com model. The customer places an order and receives the books from the closest partner through surface mail or a special delivery system (e.g., FedEx). There is no need for a physical building to conduct business in this model. The enterprise may exist entirely on a Web site. e-Business in this model is used for advertising, online purchasing, tracking customers and orders (e.g., web advertising, customer relationship management, supply chain management, etc.). Variants of this model are:
  - Marketplace concentrators that concentrate information from several providers at one point to support comparison shopping before purchase. ShopNow.com and Dealernet.com are examples.
  - On-line exchanges and marketplaces that support auctions, reverse-auctions, and aggregation services between multiple buyers and sellers. eBay and priceline.com are examples.
- **Pure (Mostly) Digital.** This goes beyond click and order and also includes delivery over the Internet. This model represents the real-time corporations, called **next generation enterprises (NGEs)**, where almost *everything* is done over the Internet. General Electric is an example of NGEs where the top management uses a large keyboard and a huge screen display to view the real-time status of business activities and software applications critical to GE's day-to-day operations (see the discussion of NGEs and GE case study in Chapter 1 of the Overview Module). Another example is the now defunct Napster where you bought the music online and it was delivered to you over the Internet. Yet another example is Elance (www.elance.com), a marketplace for software customers and providers. Elance allows software developers from around the globe to bid for the projects that are posted on the Elance site. The consumers and providers negotiate through emails because they are in different locations, and sign contracts. The developers then build the software and deliver the software plus the documentation over

the Internet. In other words, almost everything is done over the Internet. NGEs involve real-time digital operations that may include several organizations tied through a network (virtual or extended enterprises) with support for mobility and self serve customers. Variants of this model are:

- Real-time enterprises such as GE, Intel, and others that monitor business performance across the company electronically and respond to changes and manage risks continuously instead of waiting for end-of-the-month or end-of-the-quarter reports.
- Information and transaction brokers that provide information on products and allow buyers to view rates and terms from various sources. Travelocity.com and Ameritrade.com are examples.
- Virtual communities such as chat rooms and online meeting places. Geocity.com and futurecity.com are examples.

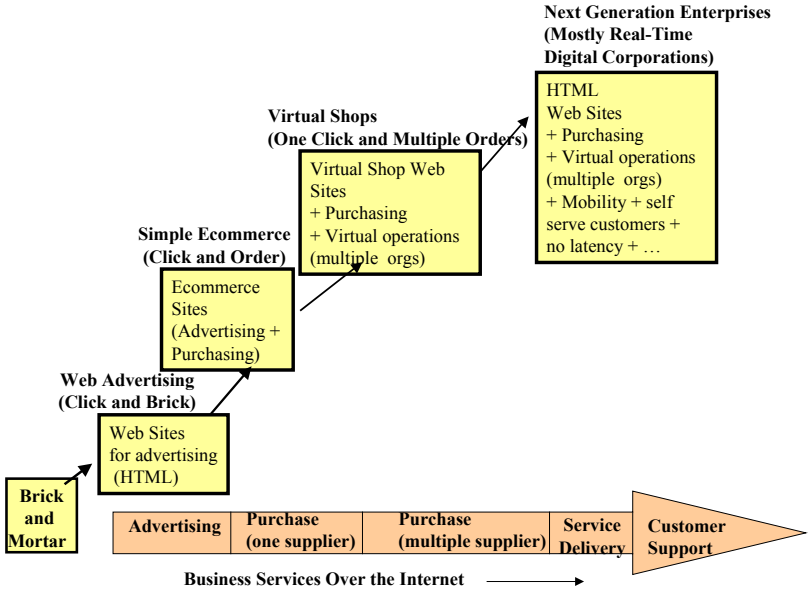

Figure 1-5: e-Business Models

Figure 1-5, a variant of the e-business evolution discussed in the Overview Module, shows how these models rely increasingly on the Internet. Also called EB patterns [Kalakota 2000], these EB models can be used to fundamentally change and restructure business practices for competitive edge in this new economy. This must start with a business strategy and a vision for success (i.e., what do you want to do and how do you get there). A company's strategy may be to use one of the models (e.g., simple e-commerce) or a mixture (e.g., use advertising for one line of products, simple e-commerce for others, and virtual shops for yet another). The main strategic challenge is to choose the right EB model(s) that will provide a market differentiator. In addition, the following questions should be asked before adopting an EB model:

- Will it make money and who will pay for it? For example, will anybody buy the items that we are offering through click and order?
- Will the current business processes have to be changed to adopt an e-business model and how much process integration will be required? For example, if we use the virtual shop or emarket model (one click, multiple orders) then some of our internal business processes may have to be integrated with the external business partners.
- Will we have to adjust our relationships with customers, suppliers, and other business partners to take advantage of digitally enabled business processes? For example, if you choose to rely on electronic supply chains to support an e-business model, then some of your existing suppliers may be left out.
- Do we have the appropriate IT infrastructure for the chosen e-business model? For example, we may need to integrate Internet applications with existing applications and data to support online purchasing.

- What technical skills and employee training will be required to use the chosen model and what measures are needed to protect the security and privacy of customers we reach electronically? Naturally, more reliance on IT implies increased employee training and customer privacy issues.
- Can we measure the success of a particular e-business model? Will the benefits outweigh the costs? Basically, as you go to higher level models, there are more potential benefits but also more costs and risks.

To answer these and other questions, it should be noted that our reliance on the business applications and the underlying IT infrastructure increases dramatically as we go to more advanced EB models. To reap the benefits, we need to engineer new and reengineer the existing systems to improve the time to deliver and to market the products. But at the same time, we also need to reduce costs and improve organizational efficiency (it is much easier to say these things than to do them!). To succeed, it is important to keep in mind the customer view of an organization in terms of the main customer activities such as: search and locate a product in the marketplace, select and buy the needed product, receive the product, start using the product, and get customer support to handle any problems (see Figure 1-6). Different EB models use automation for different activities. Pure digital corporations attempt to automate all activities (product search through product delivery is done electronically -- the customer support is also automated through emails and web sites). To be successful, you need to consider the following factors in each activity:

- Time spent by the customer should be minimal
- Energy spent by the customer should be minimal
- Enjoyment (pleasure versus hassle) should be maximum

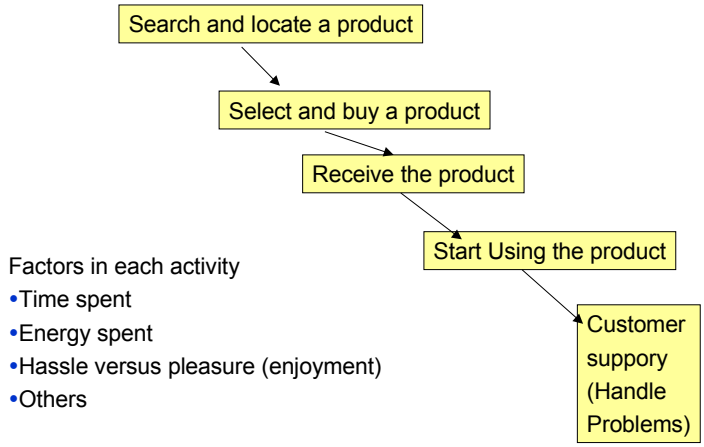

Figure 1-6: Customer View of an Organization - The Customer Steps

While it is important to consider all customer steps, many companies gain competitive edge by zeroing in on one activity. For example, Amazon.com realized that it was very important for a customer to quickly select and buy a book but then wait for actually receiving the book. This is in contrast to the large bookstore model (e.g., Barnes and Noble) where it may take you a while to select and buy a book (you have to drive to the store, park, wander around the bookstore) but once you buy it, you receive it instantly. Similarly Dell Computers concentrated on minimizing the time to start using the delivered PC by pre-installing all the needed software. You just turn it on and you are in business. I remember buying a PC from a PC store in the late 1980s that came with two dozen diskettes to be loaded in the PC before I could use it. Naturally, it sat in the living room for three weeks before I could gather the energy and the time to load two dozen diskettes. Obviously, the reduced time in buying and receiving the PC did not reduce the time before I could actually start using it.

Case Study: How Airlines are Using e-Business

The airline industry has always been extremely competitive, which has systematically led many companies to extinction or financial decay. Airlines compete on price, scheduling, and product. However, over the past several years the airline industry has quickly adopted various e-business models to stay competitive. Here are two short examples.

JetBlue, a low cost carrier, is a fast growing company that has utilized IT to gain a competitive advantage in a very difficult marketplace. In 2001, for example, JetBlue's net income totaled $38.5 million, with revenues of $320.4 million while the airline industry lost $7.7 billion. JetBlue was the first in its industry to implement a paperless cockpit. Each flight crew is equipped with a laptop computer, allowing them to speed up the preflight steps by roughly 20 minutes. Furthermore, they have also built and maintained VoIP (Voice Over IP) lines for 600 at-home JetBlue reservation agents. Aside from promoting online reservations, these VoIP lines create a virtual call center that has greatly reduced JetBlue's labor costs without sacrificing service to its customers. JetBlue uses the electronic bag tagging and the "Open Skies" system, which has enabled average check-in times to drop to less than a minute. The "Open Skies" system integrates electronic ticketing, internet booking, and revenue management tools, and generates timely operational and financial reports. Finally, JetBlue tracks all of its safety-related problems via the company's intranet and uses the BlackBerry wireless service to respond to various operational problems. These innovations help keep JetBlue at the forefront of the industry.

SwissAir was one of the first airline to use the Internet for customer care while reducing operating costs. SwissAir made many enhancements to its initial 1995 Web site and went through several evolutions providing several features for customers with special perks for top customers. Web site traffic soared from 250,000 visitors per month to two million. Besides the customer facing applications, the company Internet-enabled its internal business processes. SwissAir set up corporate intranets for sales, marketing, and human resources and extended elements of these private intranets to its outside suppliers and partners. The marketing intranet allowed marketing staff to exchange meeting minutes and presentations with its Qualiflyer Group, an alliance of 40 independent air carriers. SwissAir and its partners shared information about upcoming marketing campaigns and tried to develop similar themes and promotions. SwissAir's sales intranet provided its salespeople with sales leads, statistics, libraries of best practices, access to incentive programs, discussion groups, and collaborative workspaces. The company's human resources intranet provided employees with updates of corporate policy, expense forms, job listings, and organization charts to help them work more efficiently and generate new ideas. Result of this model was improved customer retention and better marketing and sales.

However, despite a good Internet design, hard business realities of 2002 did not help Swissair. The major problem was that most other airlines also developed similar and even better systems. Thus, the use of Internet did not stay as a strategic advantage very long. Swissair stopped flying on March 31, 2002.

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1.4.4 IT Strategies – How to Align IT with Business Needs

Once a company establishes a strategy then the systems are developed to realize the strategy through effective use of information technologies and other organizational procedures. For example, Dell established and implemented integrated systems with partners that produce a customized PC to minimize the time to start using the PC. Similarly, Amazon.com developed technologies such as OneClick and business partnerships with many bookstores so that the customers could quickly select and purchase books from a very large virtual bookstore.

The first and most important step after e-business strategy is to develop a design of e-business that aligns the company information systems and other systems with the strategy. The design must be developed to keep

flexibility and change as a core requirement because everything is changing. Traditional business design approaches started with core competencies that drove the products/services which were delivered to the target customers. The new model starts with examining customer needs (e.g., the Dell idea of minimizing the time the customer has to wait before using the PC), developing products/services to satisfy these needs, and then relying on the competencies of service providers by outsourcing product development. Both models are shown in Figure 1-7.

This does not mean that the traditional model does not work. In fact, both models work at different times. The trick is to know what model works when. The new model implies a great deal of flexibility because customer needs change very quickly. This model heavily relies on outsourcing because outsourcing gives flexibility (if your business needs change, you get new service providers). It also implies heavy reliance on information technology (IT) to quickly understand and respond to customer needs. Basically, information technology must be aligned with the business needs of an organization. For example, Michael Hammer [Hammer 1990] defines and promotes business process reengineering (BPR) as the use of the power of modern IT to radically redesign business processes in order to achieve dramatic improvements in performance. In essence, IT must enable the organization to survive and prosper in the competitive global economy. While there is a general agreement on the importance of aligning IT with business, the approaches and views differ widely. This short discussion is intended to establish an overall context within which the issues of e-business application engineering/reengineering can be presented.

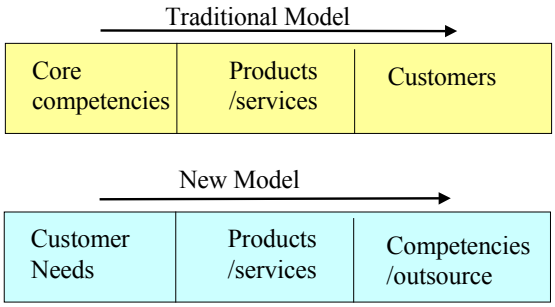

Figure 1-7: e-Business Design (Traditional versus New Model)

Different views and models for aligning IT with business needs have been discussed widely in the management literature [McNurlin 2002, Hammer 2001, Harrington 1997, Ward 1996, Davenport 1998, Davidson 1993, Boar 1994, Henderson 1990, Keen 1991, Keen 1993, Luftman 1996, Luftman 2002, Silver 1995, Teng 1995, Venkatraman 1984]. For example, Peter Keen [Keen 1993] proposes a "fusion map" between the information technology, business processes, people. and management. Keen's basic premise is that top management challenge is to make sure that technology, business processes, and people are meshed together, instead of being dealt with as separate elements in planning and implementation. Keen's "fusion map" describes the steps to enable such a strategy. William Davidson [Davidson 1993] presents a three phase transformation approach to effectively utilize information technology to re-engineer business. His three-phase transformation process starts with structured automation of existing activities, builds on this automation to extend and enhance the original business, and then redefines the business itself (e.g., spawns new businesses).

While the models and approaches differ between IT management scholars, the basic principles of aligning business and IT are the same. Let us discuss a model presented by Henderson and Venkataram [Henderson 1994] to illustrate the key concepts. This model is accepted in the IT management research community and has been used by many researchers as a framework for further work (see, for example, [Luftman 1996, Luftman 2002]). In addition, this model has been adopted by IBM for management training and is used by the IBM Consulting Group. The basic Henderson-Venkataram model views business and IT in terms of strategy and infrastructure (see Figure 1-8). The four closely interacting components of this model are: business strategy, IT strategy, business infrastructure, and IT infrastructure.

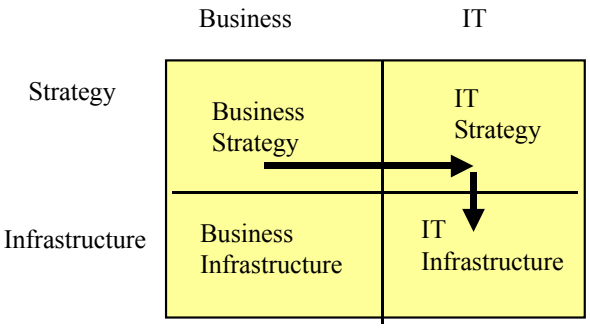

Figure 1-8: Henderson-Venkataram (H-V) Strategic Alignment Model

Henderson-Venkataram (H-V) propose that IT can be aligned with business by involving not less than three components of the alignment model. The effort can be initiated (driven) from any component and then involve the other two. For example, the following scenarios for aligning IT with business processes can be envisioned (see Figure 1-9):

- Business strategy -> IT strategy -> IT infrastructure. In this case, the business strategy drives the IT strategy, which in turn influences the IT infrastructure. This common approach is depicted in Figure 1-9a.
- Business strategy -> Business infrastructure -> IT infrastructure. In this case, the business strategy drives the business infrastructure, which in turn influences the IT infrastructure (Figure 1-9b). This is the traditional BPR model.
- IT strategy -> Business strategy -> Business infrastructure. In some cases, the IT strategy drives the Business strategy, which in turn influences the Business infrastructure. This scenario, shown in Figure 1-9c, is used in cases where organizations initiate new businesses due to their expertise in IT (this is happening in the telecommunications industry where the Baby Bells are entering the Internet market to take advantage of their networking know-how).
- IT strategy -> IT infrastructure -> Business infrastructure. In this case, the IT strategy influences the IT infrastructure which in turn influences the business infrastructure Figure 1-9d).

These scenarios show some of the interactions between IT and business. Naturally, other scenarios and interactions can be envisioned. An extensive discussion of these scenarios with different applications can be found in [Luftman 2002, Luftman 1996].

Here are some general observations and guidelines to move forward:

- Real strategic and sizable business gains do not result from re-engineering only the applications but come from the combination of business re-engineering along with the supporting application re-engineering. See the sidebar " Case Study: e-Business Strategies at Federal Express".
- IT should be used to enable business decisions and processes. Make sure that there are clear business drivers before you get carried away with the technology.
- Many new technologies that claim to eliminate existing N technologies themselves become N+1.
- The life cycle for the reason for undertaking an effort should be longer than the life cycle of the undertaking itself. In other words, if you undertake a two year reengineering effort to save hardware cost, but hardware costs change in 6 months, you may be looking at a very tough year and a half.
- Distribution is not always good. Replacing a mainframe with multiple PCs may be like replacing a horse with 100 chickens to pull a cart. You face similar coordination problems!
- There is a thin line between vision and hallucination. You should know when you cross it.

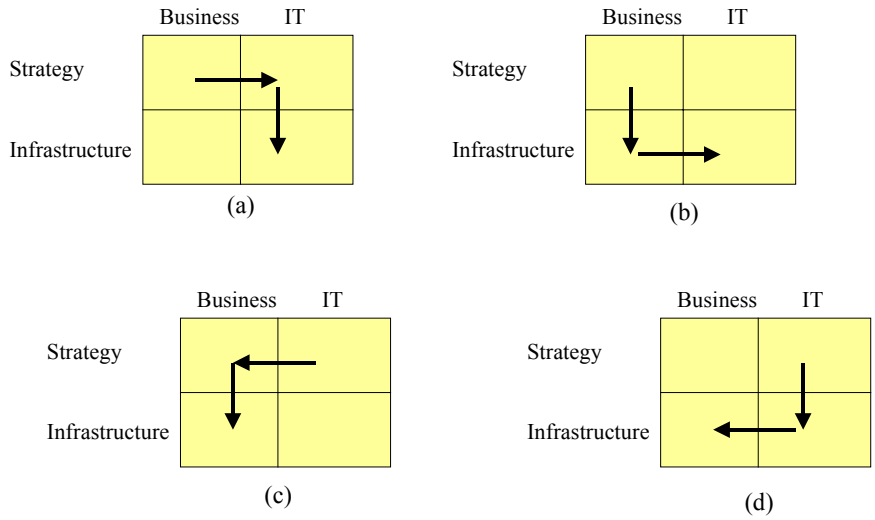

Figure 1-9: Aligning IT with Business - A Few Scenarios

Case Study: e-Business Strategies at Federal Express

Over the years, Federal Express Corporation ("FedEx") has transformed itself from an express delivery company to a worldwide transportation, global logistic, and supply chain solutions company that relies heavily on e-Business. The Optically Recorded Information Online Network (ORION) project at Federal express is an early example of how FedEx utilized new information technologies while reengineering the business processes. As noted later, this trend has continued.

ORION was conceived in the mid 1990s in response to the inability of alternative methods (paper, microfilm, microfiche) to cope with the massive documentation needed for FedEx's more than 90,000 employees at that time. Instead of just an archiving system, ORION virtually eliminated all manual data and allowed secure and instant access to documents worldwide. This was accomplished through systematically combining technological innovation with organizational changes. In particular, the project was conducted as three stages of reengineering which systematically replaced the character -based system with GUI devices. In each stage, the customers, input devices, output devices, indexing schemes, and interconnecting networks were clearly specified. In addition, the workflow was reengineered in each stage and the organizational/staff issues were carefully taken into account. The key factors for the success of this project were:

- Strong sponsorship from senior management
- Information systems group served as enabler and facilitator instead of leader
- Focus on integration with existing systems
- Effective staging of technical and organizational changes
- Constant review and analysis of evolving technologies
- High initial investment on non-technical issues such as end-user training

The company has continued the same approach to adopt e-business in the late 1990s. In 1998, the company built a powerful technical architecture that had the ability to deliver information over the web to all employees, customers and sites in a global economy. It has also integrated its operation with suppliers such as Amazon.com for fast delivery. FedEx, for example, integrated its supply chain with Amazon.com to deliver 250,000 copies of the very popular book "Harry Potter and the Goblet of Fire" in one day! To change its historical image from an express delivery company to an e-business company, it acquired other companies such as Caliber Systems and RPS.. The acquisition of Caliber provides customized, integrated logistics and warehousing solutions worldwide. RPS is North America's second-largest provider of business-to-business ground small-package delivery services. FedEx is growing RPS into a business-to-customer specialty service for the residential delivery business. In 2000, FedEx announced a major re-

organization to allow five subsidiary companies to function independently but to compete collectively. In addition to streamlining many functions, the company announced that it would pool its sales, marketing and customer service functions. The interesting aspect of FedEx is that it has adopted new technologies to deliver business value but also has paid a great deal of attention to organizational and re-engineering/alignment issues.

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1.4.5 Case Studies and Examples of e-Business Strategies

Competing in today's business is like driving in heavy traffic in an unfamiliar neighborhood under changing weather conditions. You have to keep reading signs, keep changing directions, and be aware of all the movements around you. Here are a few examples of how some companies have established strategies and used IT to survive and thrive.

1.4.5.1 Short Examples ("Snippets")

General Electric has become a real-time enterprise where the GE CEO monitors the real-time status of business activities and applications critical to GE's day-to-day operations. The monitoring is done through a screen that flashes a series of green, yellow, and red icons for various GE business units. The goal is to monitor, once every 15 minutes, GE's mission-critical operations such as sales, daily order rates, inventory levels, and other important activities across the company's 13 different businesses around the globe. The icons are checked regularly by agents that feed business status information to the control panel so that the management can respond to changes (e.g., supply chain disruptions) and manage risks continuously. GE estimates that its digitization efforts saved the company $1.6 billion in 2001 and is expected to do the same in 2002.

Microsoft anticipated changes in customer behavior and embarked on a business strategy to attract mass consumer market that goes beyond the typical PC users in office. By using the Microsoft Network (MSN) infrastructure, it reengineered several value chains such as travel (Expedia), real estate (HomeAdviser), finance (Investor), and automotive sales (CarPoint). Microsoft's business strategy is to win a major share of the sales and distribution charges in the huge markets for airline tickets ($100 billion), automobile sales ($334 billion), and retail goods ($1.2 billion)[2]. By entering in these markets, Microsoft has significantly impacted the marketplace.

Nestle, an international food and pharmaceuticals company operating in more than 70 countries, decided to standardize its business processes to compete in e-business. The factories in different countries did business according to local rules and culture. But this did not allow the company to use its worldwide buying power for commonly used raw materials. The company introduced a single Enterprise Resource Planning (ERP) to streamline its material requirement and planning systems and significantly reduced operational costs.

Visteon, a spin-off of the Ford Motor Company, manufactures auto parts. To compete in the fiercely competitive auto parts market, Visteon embarked on a streamlining initiative. The goal of the initiative is to cut product development time from 30 months to 10 months, and to reduce manufacturing time from 5 days

[2] "Microsoft Moves to rule Online Sales", Wall Street Journal, June 5, 1997.

to 1 day. At the core of this initiative is an integrated supply chain management system that links suppliers, designers, and production planners in a uniform manner.

Auto-by-Tel, a web-based auto sales company, started with the strategy that the auto prices for the same car vary widely between dealers and that potential customers cannot visit all auto dealers to find the best deal. Auto dealers bought into this idea because it increased their sales channels. The large auto manufacturers are also responding to the web-based auto sales as a "virtual dealerships" that can sell cars. This is a good example of a solution that addressed an existing problem.

Charles Schwab made customer focus the core of its business strategy to stay competitive. This required that the Schwab brokers have complete and recent information about the customers as well as the investment opportunities (i.e., minimize "I will call you back with more information"). To achieve this, Schwab linked all of its sales and customer service organizations with one another and with all the customer-interfacing parts of the company. A new information infrastructure was needed to capture and integrate information about customers and their behavior.

1.4.5.2 Aligning IT with Business Strategies -- The Human factors

Alignment of IT and business is not strictly a philosophical or technical issue. Instead, many human issues need to be considered for teaming IT with business. Here are a few examples from the CIO Strategy Magazine (www.ciostrategy.com) -- many such examples appear regularly in the CIO Magazine (www.cio.com) also:

- **Bringing Outside Perspective**. To align IT with Kraft business and to create a teamwork environment, Steve Finnerty, CIO of Kraft Foods, exposes his staff continuously to new technology ideas from outside Kraft and outside IT. At regular retreats, for example, Finnerty invites senior business executives to socialize with senior IT staff. At the meetings, top business executives talk about what they want to achieve and what's holding them back. The IT managers then spend the two days to develop a solution. Because the people from outside businesses are invited, it helps Kraft folks expand their thinking. The meetings also give IT managers an opportunity to brief each other on their visits to other companies in other industries. This also generates new ideas. The focus is on increasing profits, not just cost-savings, by effectively teaming IT with business for problems that go beyond Kraft and IT. (Source: Ann Therese Palmer, "How Kraft 'Primed the Pump' for Alignment", CIO Strategy Magazine, July 1, 2002).
- **Same CIO and Business Strategy Planner**. The prospects for Safeco Corp, a Seattle-based insurance company, were grim in 2000. At the end of 2000, Safeco CEO Roger Eigsti and most of his top lieutenants resigned due to company performance. In January 2001, Mike McGavick, a corporate turnaround specialist, was brought in as president and CEO from CNA Financial Corp.. He had turned around CNA's ailing commercial insurance division. He believes that "the most strategic opportunity in business today lies in technology because of what it enables our work force to do and how it helps us learn about our customers' needs and issues". McGavick stressed that technology could drive future profits and made a bold move by naming an executive to be both CIO and chief business strategist. This was a radical and rare move in a generally conservative industry where CIOs have traditionally served at the whim of the heads of finance and marketing. This move has addressed many of Safeco's IT-business alignment problems. (Source: Russ Banham "Safeco's Alignment Strategy", CIO Magazine, July 1, 2002).
- **Teaming IT with Business on Projects.** HCA Inc., a large healthcare provider, was having trouble aligning its business with IT. This created problems on both sides – the business managers felt that many decisions were made by IT without proper input from the business side and the IT managers indicated that the businesses did not solicit their input and just told them what to do with unrealistic schedules. To address this alignment problem, some teams were formed at HCA with five people from IT to work side-by-side with business people to come up with new ways to support HCA's bottom line. The five were relieved of their previous responsibility so that they could learn HCA's business —patient billing, finance, employee services, clinical technology and supply chain operations. The purpose of the teams was to recommend ways IT could help each unit reach its goals. The initial results seemed encouraging. Internal surveys showed an increase in satisfaction among the business units and operational savings. The timing of this alignment synched with HCA's restructuring that centralized

purchasing and stocking medical supplies. The IT-business teams worked on various aspects of this consolidation and developed new systems that greatly reduce the risk that doctors and nurses won't have the supplies they need. In addition, the supply chain group collected ideas from hospital workers and administrators on ways to cut supply costs. (Source: Victor D. Chase, "How HCA Brought Business, IT Together", CIO Insight Magazine (www.cioinsight.com), July 1, 2002).

1.4.5.3 General Motors Leverages Web Technologies

Engineering automobiles is a daunting and costly task requiring highly cooperative efforts within the company, as well as with numerous outside suppliers. In the mid 1990s, GM's cars and trucks took as long as four years to get to market, mainly due to the collaboration needed between its many internal divisions and more than 9,000 outside suppliers. In 2002, this time has been reduced to 18 months thanks to aggressive outsourcing and Web-based collaboration. With its new technology upgrades, GM will produce new or redesigned models every three weeks between 2003-2008. This is a dramatic gain in the automaker's ability to bring a car or truck to market. In addition, GM used to build 70 cars and crash them for safety testing in the early 1990s. Now, it only needs to crash test only 10 cars – other tests are conducted through virtual crashes over the Web.

How did GM do this?

The main difficulty all automakers face is that no single department handles all the engineering issues of an automobile. Separate teams, in different geographical locations, develop components such as the engine, the chassis, and suspension system. Thousands of companies, also located throughout the world, provide the needed parts. Over the years, GM engineers have used computer-aided design (CAD) to complete their pieces of a project. GM then relied on each piece from the different teams to perfectly fit together, to create a safe and high quality product that could be sold to consumers. The main issue GM faced was that each division had its own separate CAD system and did not share drawings. Each work-in-progress obviously had very particular and intricate details which needed constant sharing during the prototype development. The result was a very long development process and the need to create as many as 70 models for physical crash tests to make sure that all separately built components safely worked together. At a cost of up to one million dollars per prototype, this undertaking was both expensive and time consuming. The crash testing also added to the development time leading to an overall 4-year period before a car or truck could go from the drawing board to the driveway.

The transformation of GM began in the mid-1990s with increased Internet bandwidth for sharing large design files. The faster network was also shared with key suppliers. Then GM's 7,000 legacy IT systems were reduced by half. For example, before 1996, GM had 23 disparate CAD (computer aided design) systems in use. The engine people could not share drawings electronically with the suspension people or the sheet-metal people, making design integration a long and difficult process. To reduce the amount of time needed in the early stages of the development process, GM decided to use a more centralized CAD system by adopting Unigraphics, a Web-based service created and offered by Electronic Data Systems (EDS). Unigraphics allowed 3-D drawings to be shared amongst 18,000 GM designers and engineers over the Web and across the globe. It also gave access to around 1,000 suppliers. This provided much more information and knowledge to each group involved in the tedious design stages.

With Unigraphics, the engineers had the opportunity to see how their parts fit into the big picture of the final product. They could alter specifications more easily and make adjustments earlier, as opposed to having to wait and see the results of the crash tests. Other technologies that have cut down development time and costs include Microsoft's NetMeeting and eVis, from EDS. These technologies reduce the time necessary for the vehicle review process and in some cases, change the way the process is handled. Utilizing new Web technologies, GM has the ability to do real time review with testing teams in various geographical locations. The engineers can now crash cars virtually over the Web. Due to this, GM performs ten physical crash tests, a huge reduction from the seventy or more required in the past.

GM rapidly altered the way that it thought about its early development phases. By employing Web technologies, GM significantly improved sharing of engineering drawings and design documents and doing real time vehicle reviewing among widely dispersed groups. Because of this new approach, GM can create

new or redesigned models of automobiles at an astonishing rate of one every three weeks. Thus, GM has many more quality options in choosing what types of cars or trucks it actually wants to put into production, giving the company a competitive advantage.

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1.4.5.4 Case Study: Kmart Looses Due to Lack of Attention to e-Business

Kmart is the largest retail company in the United States ever to file for bankruptcy. The company is a large chain of retail stores across the United States that sells a wide range of items that includes clothes, household and kitchen items, make-up, car tires, and others. Numerous problems with its business model have been cited, even prior to its filing for bankruptcy. Multiple factors contributed to Kmart's decline but Kmart's improper use of the Internet for business is the biggest reason for its economic downfall. Kmart really did not pay any attention to the role of IT in its business and maintained a very small IT department that was continuously cut. In contrast, its biggest competitor Wal-Mart dramatically increased its IT spending and implemented systems that tied suppliers with their stores through satellites. During the same time period, companies such as GE embarked on major e-business initiatives (see the case study discussed above). Finally in 2000 and 2001 Kmart spent over $1 billion to overhaul its IT systems, but it was too late because competitors such as Wal-Mart had already gained significant market shares initially held by Kmart. In January 2002, Kmart announced that it obtained a $2 billion financing package to fund its turnaround and continue investment in "critical technology, standardized information technology platforms, merchandising opportunities and supply chain enhancements", according to the Kmart CEO Charles Conaway.

Kmart has failed to establish a consistent IT strategy and then deploy it due to several reasons. First, Kmart had trouble with its Chief Information Officers (CIOs) -- it has had five CIOs between 1994 and 2002. A high turnover in this position has not allowed the company to plan and implement the proper information systems required to keep Kmart competitive. Second, it had to change major directions to cope with market conditions. For example, Kmart's e-commerce division, BlueLight.com, disappeared and Kmart.com became the on-line shopping site for the company in the mid 2002. Without a coordinated vision and leadership to see the project through, Kmart fell far behind its biggest competitors Wal-Mart and Target. Third, Kmart's inferior distribution and inventory systems placed it at a huge disadvantage against its competitors. On the supply side, the suppliers complained that it was very difficult to connect to Kmart's distribution systems and getting data from its point-of-sale and inventory systems. They compared this experience with Wal-Mart's easy to interface systems. On the customer side, customers of Bluelight.com often complained because there weren't enough items offered for sale. The main problem with Kmart has been that it uses quick fixes and patches instead of fully integrated systems that follow an overall strategy.

Despite the past failures, Kmart is hoping that its most recent IT activities will help gain a competitive advantage over their competitors. The current Kmart management team is focusing on improving the customer experience at checkout and better communication between their suppliers and merchandisers. The recent roll-out includes a wide range of technologies that include state-of-the-art scanners and faster cash registers for faster service; a new business-to-business collaboration, planning, forecasting and replenishment system; and a new system for buyers to track and manage inventory for real-time inventory management. The final results of this latest IT push will possibly have a major impact on Kmart's future.

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Realities of Modern Business -- Some Personal Observations

Here are my own informal observations based on years of practical experience:

1. Today's strategic edge becomes tomorrow's cost of doing business. In the late1990s, having a web site provided a strategic edge to companies. At present, having a web site is cost of doing business -- just like electricity and air conditioning are costs of doing business. If companies gain competitive advantage due to something, then everyone does that thing, eventually making it a cost of doing business.

2. Technology is a necessary but not a sufficient condition for success. Solid technology is necessary to satisfy the organizational needs, but numerous training sessions, organizational changes, one-on-one discussions, and handholding meetings are needed to make sure that the technology is actually used successfully. Many organizations have found this to be true while introducing ERP and CRM systems because these systems change the way people do their work (see, for example, the CRM and ERP case studies of Honeywell and Owens-Corning in Chapter 5 of this Module).

3. Most technology waves last about three years. First year is typically the 'honeymoon" period when companies decide to use it, the second year involves some experimentation, and the the results become known in the third year when it is time to jump to the next wave.

4. Roughly 20% of claims made about a new technology wave are true -- the other 80% are hype. Thus the Pareto's Principle of 80-20 rule lives on. The good news is that 20% per each technology wave does make a significant difference over a decade (about 60% real gain!).

5. Almost every new technology that claims to replace the existing N technologies itself becomes N+1. Consider, for example, Java. Instead of replacing existing, let us say 10 programming languages, it has become 11th. The implication is that the bundle of technologies keeps growing -- very few things completely die and disappear in this filed.

6. Absence of thought is the recurring theme in business failures. This is somewhat cynical but there seems to be very little thinking in major business decisions (my own observations). I have seen numerous marketing and new product studies that show numerous charts, graphs, and diagrams but say absolutely nothing. The presenters and the listeners are greatly impressed by all the information that has been gathered. Nobody asks "so what?".

1.5 XYZCorp Case Study: Suggestions About e-Business Strategic Analysis

Let us visit the XYZCorp case study introduced in Section 1.2. For strategic analysis, the discussion in Section 1.4 is a good starting point. In particular, you should cast the few ideas generated by the brainstorming session into the cells of Figure 1-3 There should be some discussion of the cells that are not covered in the brainstorming session and why. You should also introduce new strategies that might have not been discussed in the brainstorming session. In addition, this project should :

- Rank the strategies based on investment needed, risk analysis, core competencies, etc.
- Decide how to align the business strategies with IT (you can use the Henderson-Vankataram Model shown in Figure 1-8 for this purpose.

Let us now work through some details. Possible strategic ideas generated in the brainstorming session were:

1. Cut down the production time to 30%.

2. Provide personalized customer service.

3. Reduce customer churn drastically (current churn is 20%, it must be reduced to less than10%).

4. Do nothing more to improve the existing internal systems.

5. Build and market next generation of software that is intelligent enough to adjust the system to respond to failures and attacks.

6. Shift the long range focus of the company from hardware devices (PCs, VCRs, network routers) to applications and services with emphasis on web-based applications.

7. Start offering consultation and training services.

For analysis, these ideas are cast into the customers-products cells of Figure 1-3. The results are shown in Table 1-1. It can be seen that no idea was presented to expand existing products to the new customers. In addition, no attention seems to be paid to possible new entrants and substitute products (ala the Porter Model). Ms. Jones is not happy about this finding. She feels that equal efforts are needed in all four cells (each cell will be funded at 25% of the next year's budget). So this table will be revised based on future brainstorming sessions (lots of storming, no brains!).

Table 1-1: Analysis of strategies in terms of Customers and Products

	Existing Products	New Products
Existing Customers	Ideas 1, 2, 3, 4	Ideas 7, 5
New Customers		Ideas 6, 5

The discussion is also revolving around core competencies. Should XYZCorp use its core competencies to get new customers or assess customer needs to develop new products and adjust competencies (see Figure 1-7). The company should use the traditional approach for the existing products and the new approach for new products and services.

To align IT to business needs, the company may want to stay with the scenario represented in Figure 1-9a. This will help in cutting down production time and reduce customer churn.

The case studies presented in 1.4.5 (e.g., Airlines, Federal Express, GE, Kmart) will give you additional insights. It is also a good idea to search for additional case studies to help XYZCorp (that was consultants do -- they use extant knowledge to solve problems at hand) You should also review Section 1.10 for additional ideas. You may want to consult the book by Sawhney, M., et al, "The Seven Steps to Nirvana: Strategic Insights into e-Business Transformation", McGraw-Hill Professional Publishing, 2001. The book [Kalakota 2000] also has many interesting ideas in this area.

Time to Take a Break
- ✓ e-Business Strategies
- e-Business Applications
- e-Business Strategies To Applications

Suggested Review Questions Before Proceeding

- What are the interrelationships between business strategies, business models, business processes, and business applications
- What exactly is an e-business strategy? How is it related to business strategy?
- List the main e-business models. In your view, which have succeeded and which have not
- What appear to be the best approaches to align IT with business? Why is it so important?
- How can the business design (traditional versus new) models be related to the H-V model.
- What are the key lessons learned from the case studies discussed in this section?

1.6 e-Business Applications – Enabling the Business Strategies

Now we come to the issue that is of central importance to us in this book -- e-business applications. These applications are a crucial aspect of e-business because they can enable, and if not handled properly, disable business strategies and business designs. For example, to be successful in e-business, companies must integrate applications that support customer purchases, payment systems, and interactions with suppliers. This section defines the application concepts and gives a traditional taxonomy of enterprise applications in terms of decision support, operational support, and realtime applications. The next section gives several examples of applications in terms of business patterns.

1.6.1 What is an Application?

According to Webster, an application "puts to use especially for some practical purpose". For the purpose of this book, we are concentrating on computer applications that put to use computers for the practical purpose of supporting businesses. Specifically, we are only interested in the class of computer applications that are business aware, i.e., *we are interested in business applications*. Thus Microsoft "applications" such as Word and Powerpoint are excluded from this class of applications because they are business unaware (in fact, we consider them to be part of the IT infrastructure). Thus, for our purpose, we define an application as follows:

Definition: An application system, commonly referred to as application in this book, is a business application that uses computers to support businesses, thus it is business aware and represents the business aware functionality and data.

Business in this context could mean any type of business such as manufacturing, aerospace, healthcare, finance, or telecom. Examples of such applications are airline reservation systems, inventory control systems, financial planning systems, material handling systems and the like. These systems are used by organizations to gain/retain competitive edge, reduce costs, and improve management decision making. From a business point of view, systems such as email, word processors, text editors, operating systems and Web browsers are not applications because they are not business aware.

An application consists of several "components" that are assembled to satisfy business needs (we will define these components formally in a later chapter). For the time being, let us assume that these components are of three types:

- **Application datasets** D = (d1,d2,...) which contain the information needed by the enterprise activities. Examples of this information are customer information, payroll information, design data, product information, and corporate plans. This data may be physically stored in flat files, relational databases, object oriented databases, or under any other database management system. More and more applications are beginning to store enterprise "knowledge" in the form of rules in databases. In addition, some real-time databases may be stored in main memory for fast access.
- **Application programs** P = (p1, p2...) to perform business operations (e.g., bookkeeping, credit checking), engineering/scientific functions (solid modeling, simulations, animations, drawings), manufacturing operations (e.g., robotics), and/or expert systems inferences. The programs code the business rules, also known as business intelligence, that represent the functional logic unique to the user organization (not the data, not the user interface).
- **User presentation processors** U = (u1, u2...) to process the user access to the application data and programs. The user interfaces may be simple text command/response systems, pull-down menus, graphical user interfaces, speech recognition systems and video systems with a pointing device (mouse). With the expected growth of multimedia applications, the user interfaces are beginning to include sophisticated combinations of voice, text, and video on the same screen.

Figure 1-10 shows five different application "patterns" that show how applications can be configured in terms of data, processing logic, and user interface components. The components of an application may be centralized or distributed. In a distributed application, the application components (user interface, user data, and programs) reside at different computers on a network. On the other hand, all application components of a centralized application are restricted to one computer. In this book, we are primarily interested in e-business applications that span multiple business units and businesses. In these applications, the user interface processing typically resides on Web browsers and the user data typically resides on remote data servers (many of them belonging to trade partners). The application logic can reside on the data server, Web browser site, web server site, another "middle tier" machine, or some combination thereof.

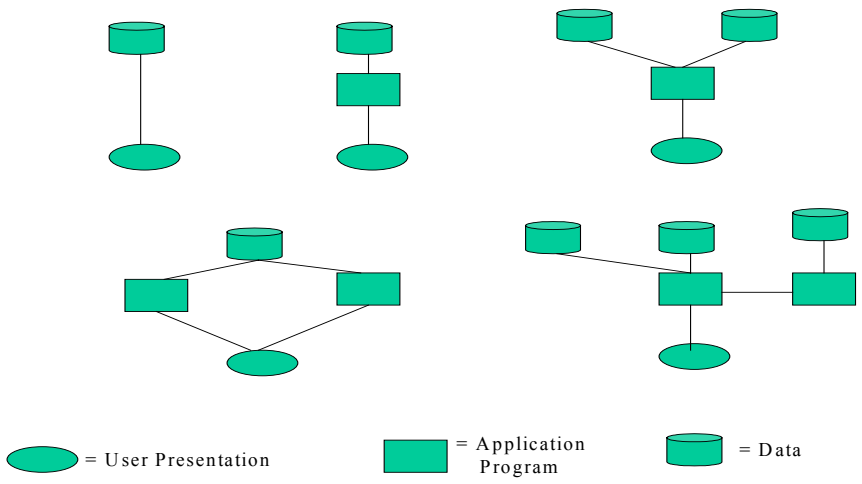

Figure 1-10: Five Sample Application Patterns (from simple to complex)

1.6.2 Classification of Applications

Applications in modern enterprises are multidimensional and complex. The traditional e-business applications view, shown in Figure 1-11, is to think of these applications in terms of:

- **Business to Customer (B2C) applications** that are used by the customers. Examples of these applications are online-purchasing and web advertising.
- **Internal (Business to Employee) applications** that can be further decomposed into:
  - **Individual (departmental) applications** are intended for a small group or a department. These applications may support, for example, sales activities of a department.
  - **Enterprise applications** are designed to satisfy the needs of an entire enterprise and are used commonly throughout an enterprise. For example, a human resource (HR) application is an enterprise application. Most ERP (Enterprise Resource Planning) applications are also enterprise applications.
- **Inter-enterprise (B2B) applications** that are used between businesses. These applications are used to exchange orders, products, and payments between companies in B2B trade. Examples of these applications, as expected, are B2B applications such as supply chain management and emarkets.

It is not enough to consider applications in terms of B2C, B2E, or B2B. We need to think of another dimension of applications -- their type (see Table 1-2). Application types, for the purpose of our discussion, are subdivided into operational support, decision support/retrieval, and real-time applications.

This two dimensional view of enterprise applications will help us in determining the most appropriate strategies for engineering of new and reengineering of existing applications. Why? Mainly because there is "no one size fits all" approach. Some approaches and tools work well for decision support applications while the others work for operational support applications. In addition, some technologies work quite well for small departmental applications but not for large inter-enterprise applications of the same type. We will present a methodology later that will allow us to systematically deal with the wide range of issues related to engineering/re-engineering of applications of different types at different span.

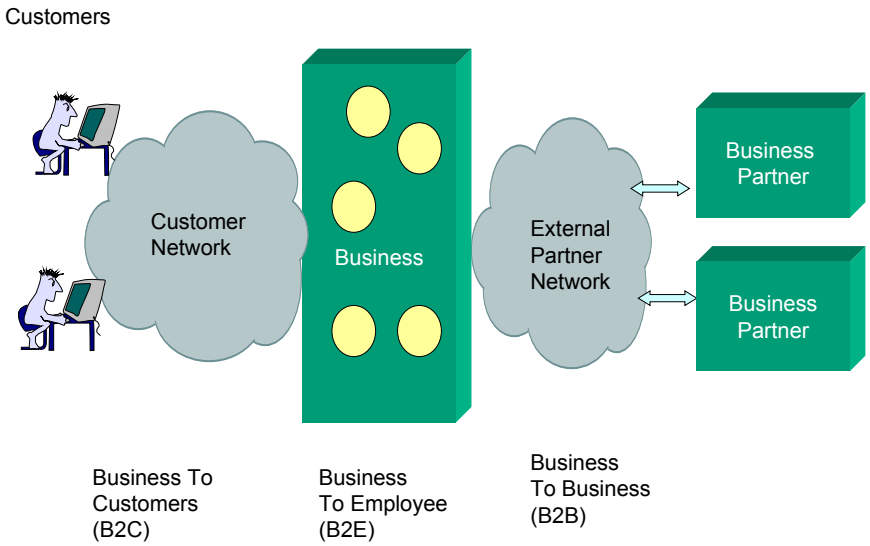

Figure 1-11: e-Business Applications -- High Level View

Operational support applications support the day-to-day operational activities of an organization. A large number of operational support applications are categorized as OLTP (on-line transaction processing). As the name implies, these applications support on-line users and require robust transaction processing facilities such as logging, integrity control, and backup/recovery. OLTP applications are typically involved in the day-to-day operational activities such as order processing, purchasing, shipping, and inventory control. As a

result, they tend to update data frequently and require immediate response. Examples of the operational support applications are shown in Table 1-2. The major characteristics of these applications are:

- Operations are performed on current values of data
- Data is updated frequently by a large number of users
- Operations on data are predictable (non-discovery and not ad-hoc)
- Majority of users are line workers and clerical staff
- Data integrity and concurrency requirements are high (usually hundreds of concurrent users need to access the most current information)
- Stringent response time requirements (usually sub-second)
- Detailed, and usually small, amount of data is accessed

Table 1-2: A Classification of Applications

TYPE / LEVEL (SPAN)	Operational Support (Transaction Processing)	Decision Support ((Browsal and Analysis)	Real Time (Embedded in Real Life)
B2E-- Group/Departmental	Example: Regional inventory control	Example: Regional marketing information system	Example: Video conferencing within a group
B2E--Enterprise-wide	Example: Enterprise wide cash management systems	Example: Corporate data warehouses	Example: Enterprise-wide desktop video conferencing and network management
B2C -- Business to consume	Example: Online purchasing	Example: FAQ (Frequently Asked Questions) Databases	Example: Internet telephony
B2B -- Inter-enterprise	Example: Electronic commerce over the Internet and "Extranets" (business to business transactions over Internet)	Example: Databases to support browsing for Communities of Interest	Example: Voice over IP and distributed multimedia over the Internet

Decision support (retrieval) applications are primarily intended for a class of users known as "knowledge" workers and managers. A large body of management literature on decision support systems has accumulated since the mid 1980s (see, for example, the textbooks by [Sauter 1997, Turban 2000). Decision support applications focus on informational data to drive the business and not on operational data to help in the day-to-day operation of a company. Examples of decision support applications are data warehouses, marketing information systems, executive information systems, and business planning systems. The characteristics of these applications are:

- Operations are performed on archival data
- Data is not application captive, instead it is integrated across different applications (enterprise data)
- Data is queried frequently and updated very infrequently
- Queries are ad-hoc and used in a discovery and browsing mode
- Users are typically decision makers and knowledge workers
- Data integrity and concurrency requirements are low (for example, data can be slightly outdated for long range planning)
- Response time requirements are typically not stringent
- Large amounts of data (typically joins between very large relational tables) are processed

Real-time applications are embedded in real life activities such as manufacturing processing. While the operational support and decision support applications provide information to users, the real-time applications are part of a real life process. Due to this, these applications impose stringent requirements for performance (sub-second response time) and availability (continuous and often fault tolerant). Examples of real-time

applications are voice applications over the Internet, manufacturing control systems, real-time market data monitoring and analysis systems, command and control systems, and telecommunications network managers. The main characteristics of real-time applications are:

- Application processes are closely tied to real life
- Response time and availability requirements are "hard" (must be met)
- Most data is kept in main storage to improve performance
- Data integrity requirements are low (data changes several times per second, so if you do not like the current value - wait for a second!)

These applications can be used at different span levels: group/departmental level, enterprise-wide, and inter-enterprise. The group/departmental applications are developed and used within a workgroup or a department of an enterprise. These applications are typically developed around LANs and can use latest technologies (e.g., C/S, OO) effectively. The enterprise-wide applications are used throughout an enterprise. These application use the LAN as well as WAN technologies and are typically heterogeneous because they span across a diverse array of computers (PCs, Macs, UNIX, Mainframes), networks (LANs, WANs), database managers (Informix, Oracle, DB2), Utilization of new technologies for large enterprise networks is more challenging. However, the use of Internet within organizations (known as "Intranets"), is spreading rapidly. Inter-enterprise applications are also being used between enterprises. Supply chain management and emarkets are good examples. Another example of these applications are the Communities of Interest that are being formed between vertical industry segments (e.g., health industry participants) to share common information.

The role of real-time applications is changing quickly as the ***"real-time digital enterprises"*** gain popularity. In these companies, the entire enterprise is viewed as a collection of real-time applications that monitor and configure themselves in real-time to respond to business activities. In a real-time enterprise, as discussed in Chapter 1 of the Overview Module, all of a company's departments, channels, and partners are connected electronically so that all communication in any and every direction throughout the supply and demand chains is instantaneous. This allows a real-time exchange of business information such as items purchased online, changes in customer demand, inventory, profitability, and competitive situations.

1.6.3 e-Business Applications Versus Enterprise Applications

The notion of enterprise applications became popular in the 1990s to represent the wide range of applications that are used to support the enterprise and not just one department or user community. For example, human resource applications support the entire firm while a sales projection application of one department supports only that department. Naturally, enterprise applications need to ties many departmental applications. With the advent of e-business and emphasis on B2B trade, businesses need to go beyond enterprise applications – they need inter as well as intra enterprise applications. We thus define:

> ***e-Business applications*** are the business applications that support inter as well as intra enterprise business processes -- thus EB applications include enterprise applications.

This focus on enterprise and inter-enterprise applications is important. Why? It simply is not enough to have one or two individual applications work very well if they do not work with other applications to provide an overall organizational benefit. It is essential to have applications work in harmony at enterprise as well as inter-enterprise levels to compete. For example, a wide range of e-business applications -- some old and some new -- are needed to support e-business. Figure 1-12 shows a sample of typical applications that are vital to the operations of a typical manufacturing company. Let us just list the names of a few (we will discuss many of them later):

- Order processing system
- Payment and billing system
- Purchasing system
- MRP (Material Requirement Planning) system
- MRP II (Manufacturing Resource Pplanning) system

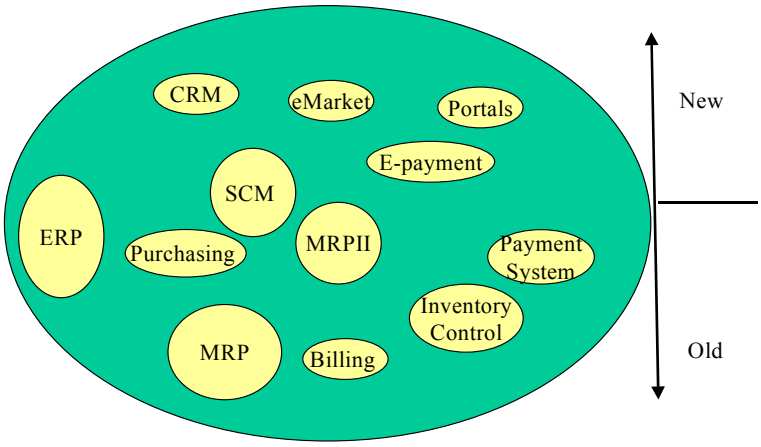

Figure 1-12: Typical e-business Applications

- Inventory management system
- CRM (Customer Relationship Management) system
- ERP (Enterprise Resource Planning) system
- SCM (Supply Chain Management) system

Some of these applications are quite old. For example, billing and payment systems have been around since the 1970s. But many are relatively new (e.g., CRM). Because of their vintages, these applications use different technologies. Table 1-3 illustrates the technology landscape used by these applications in terms of its vintage and use. The core challenge faced by most businesses is to mesh the wide range of applications that are based on very different technologies introduced over several decades.

Table 1-3: Typical Internal Business Application Technologies

Time Frame	Presentation	Programming	Data storage	Middleware	Network
2000	Web, WAP, multi-media, Desktops	C, C++, Java, Cobol,	DB2, Oracle, IMS, Some OODB	Web, XML, C/S middleware, CORBA, EC Middleware, EJB	TCP/IP
1990s	Desktops, Web, 3270s	C, C++, Java, Cobol	DB2, Oracle, IMS, Some OODB	Web, C/S middleware, CORBA	TCP/IP, SNA
1980s	Teletype, 3270 screens, some desktops	C, Cobol, PL1, Assembler	DB2, Oracle, Sybase, Informix, IMS	Home-grown, CICS, IMS-DC	SNA, Decnet. Novell Netware
1970s	Teletype, 3270 screens	Cobol, PL1, Assembler	ISAM, VSAM, IMS, IDMS	Home-grown, CICS, IMS-DC	SNA, Decnet

1.7 Examples of e-Business Applications – The Business Patterns View

Business patterns (BPs) represent business situations that capture common business/technical practices in those situations. For example, C2B is a business pattern that represents a common EB situation in which customers interact with business online typically through web technologies. Thus if a company uses C2B

pattern, we can infer some business decisions (e.g., support customers online) as well as application types (e.g., online purchasing based on the Web technologies). Thus BPs represent a convenient way of classifying EB applications. In general, p*atterns* are reusable abstractions that can be documented and logged in a pattern repository. They range from detailed algorithms to business architectures (see the sidebar "What are Patterns?"). Figure 1-13 shows the business patterns (BPs) that suggest a classification of e-business applications that we have already talked about:

- Business to consumer (C2B) applications such as online buying and web publishing.
- Business to employee (B2E) internal business applications such as enterprise resource planning (ERP).
- Business to business (B2B) trade conducted between partners directly (e.g., supply chains) or through an intermediary (e.g., an emarket).
- Other BPs that represent consumer to consumer (e.g., collaborative computing) and consumer to data (e.g., e-business intelligence) applications.

We briefly discuss e-business applications in terms of these BPs for illustrative purposes. Details are given in the next chapter. Extensive information about BPs for e-business can be found at the IBM web site (http://www-106.ibm.com/developerworks/patterns/).

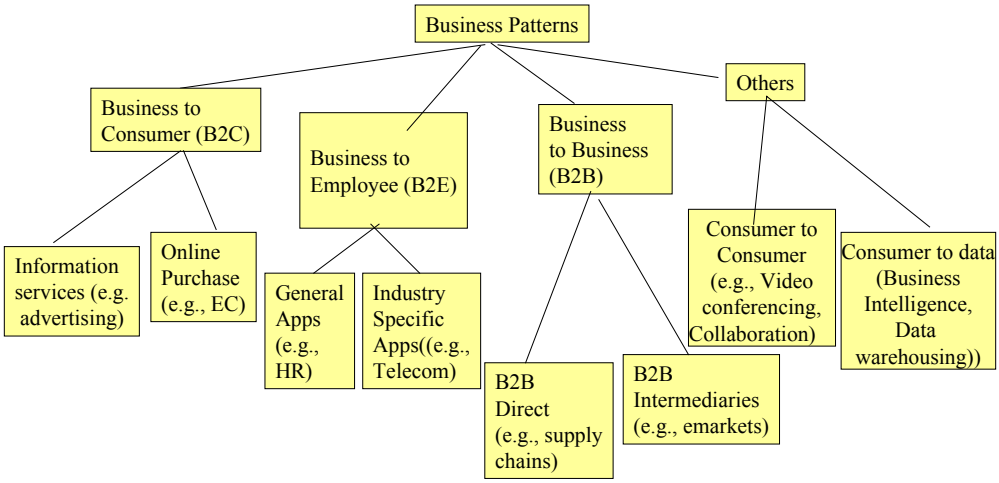

Figure 1-13: Business Patterns in e-Business

What are Patterns?

An early definition of patterns is offered by Alexander:

- "Each pattern describes a problem that occurs over and over again in our environment and then describes the core of the solution to that problem in such a way that you can use this solution a million times over without ever doing it the same way twice" Alexander, "A Pattern Language", 1977.

A DARPA Working Group developed the following definition in 1997:

- "*Patterns* are reusable abstractions of best practices that can be documented and logged in a pattern repository. They range from detailed algorithms to enterprise architectures and to other fields like conventional architecture".

Initial focus of patterns in computing has been on technical areas such as design patterns, architecture patterns, and pattern languages but now some attention is being paid to business patterns. An example is the IBM's Patterns for e-business -- an extensive web site with a great deal of information on this topic (http://www-106.ibm.com/developerworks/patterns/).

Why worry about patterns? Patterns are useful because they represent a common library that experienced professionals are likely to see over and over again. They can also be used to cluster similar things and also

make inferences based on the similarities.

Selected References on Patterns:

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- Pattern-Oriented Software Architecture, Volume 2, Patterns for Concurrent and Networked Objects, by Douglas Schmidt, Michael Stal, Hans Rohnert, Frank Buschmann, 2000, Wiley.
- Analysis Patterns : Reusable Object Models (Addison-Wesley Object, Technology: Addison-Wesley Object Technology Series), 1996.

1.7.1 Consumer to Business (C2B) Applications

Consumer to Business (C2B) business patterns include the general case of internal and external users interacting with enterprise transactions and data. These activities are particularly relevant to enterprises dealing with goods and services that can be listed and sold from an online catalog. It covers two parts: consumer information services and consumer online purchasing.

1.7.1.1 C2B Informational Services (Web Advertising and Customer Relationship Management)

This essentially covers user-to-business interactions that do not involve any purchasing. Example are web-based advertising ("web publishing") and customer relationship management (CRM). Figure 1-13 shows a simple C2B information pattern.

Web advertising is one of the oldest applications of the Internet that became popular in the mid 1990s. This type of application is the foundation of many corporate web sites. The web sites are used to display/advertise company products and services. The customers have to separately order the products that they select by browsing through company Web sites.

Another example of this business pattern (BP) is Image processing applications. Specific examples of

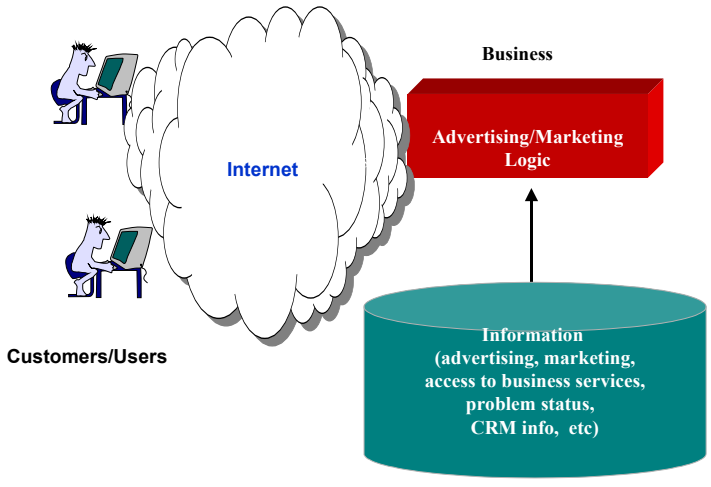


Figure 1-13: C2B Information Services

applications in this BP include sending and processing of images such as X-rays in the medical industry, photographs used in claims processing for the insurance industry, proofs and advertisements in the publication industry, and visualization of systems dynamics in the aerospace industry. These images may be sent between users to businesses as well as business to business.

Customer relationship management (CRM) enables organizations to identify, attract and increase retention of profitable customers, by managing relationship with them. CRM systems are an outgrowth of the traditional customer care systems that concentrated on customer loyalty through improved service and communication. At present, CRM has evolved into a collection of methodologies, software, and Internet capabilities that help an enterprise manage customer relationships in an organized way. CRM applications -- often used in combination with call centers, data warehousing, and E-commerce applications -- allow companies to gather and access information about customers' buying histories, preferences, complaints, and other data so they can better anticipate what customers want and need.

1.7.1.2 C2B Online Purchasing - E-commerce

This business pattern represents online buying/selling through a catalog using a shopping cart, electronic wallet, or similar tool. It includes both consumers purchasing goods and online buyers purchasing goods from a supplier. It can also include links to back-end systems for inventory updates and credit checking. As shown in Figure 1-14, this BP involves the large number of Web based purchasing systems that allow users to search company catalogs for certain price ranges and then place orders for chosen product(s). For example, the flowers.com web site allows you to select, purchase and send flowers to a person of your choice. Similarly, the Chrysler Web site allows customers to search the site for several specific models of cars, at different price ranges, in different colors, and sorted in different ways. Each time, the user is instantly presented with a Web page that includes all the cars requested. This BP also includes electronic shopping malls that allow Web users to shop and purchase products over the Internet. For example, the Internet Shopping Network is a start-up company that sells several thousand computer hardware and software products over the Internet. These systems combine the catalogs and legacy data access.

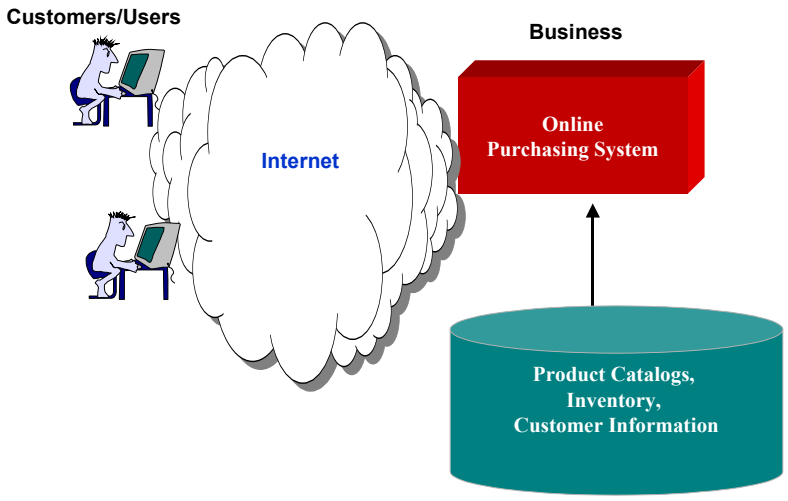


Figure 1-14: C2B Online Purchasing

1.7.2 B2E Internal Business Applications – The ERPs (Enterprise Resource Planning)

The business activities, such as flow of purchase orders between various business units of an organization represent an interesting business pattern (BP). This BP requires linking together of applications within a business. A common example of this BP is Enterprise Resource Planning (ERP) systems that support back-office operations. ERPs support inventory management, order processing, and financial reporting applications. Traditionally, enterprise resources have been managed by a multitude of independent applications in human resources, payroll, order processing, inventory control, billing, and accounts payable/receivable systems. The basic idea of modern ERP systems is that they provide an integrated database approach to manage and operate enterprise resources such as employees, materials, and services.

ERP is not one application – it is a collection of applications that can be further categorized in terms of the enterprise resources they manage (see Figure 1-15):

- The basic ERPs manage the core resources that are common to all organizations. Examples of these resources are people, costs and assets (e.g., building, furniture, etc). Several ERP systems are designed to manage these resources. ERP systems of this type are available from suppliers such as Peoplesoft, SAP, and Oracle.
- "Vertical" ERPs concentrate on managing resources in specific industry segments. The oldest examples of ERPs in this segment are the ones that manage manufacturing resources such as materials, finished goods, bill of materials (i.e., the materials used in building a finished product), and inventories. These ERPs also integrate order processing applications with manufacturing materials and inventory management systems for integrated operations. SAP has developed an extensive suite of ERP applications for manufacturing. Another area of ERPs in vertical markets is the ERPs in telecom markets that manage telecom resources. These ERPs are known as Operation Support Systems (OSSs) in the telecom marketplace. At present, many OSSs are homegrown and developed by the telcos. However, established ERP vendors such as SAP are also beginning to provide OSSs

In general, the current trend in ERPs is to manage *all* enterprise resources that include the core, vertical, and service resources in an integrated manner. This includes human resource, general ledger, payroll, order processing, inventory control, and other "classical" business applications.

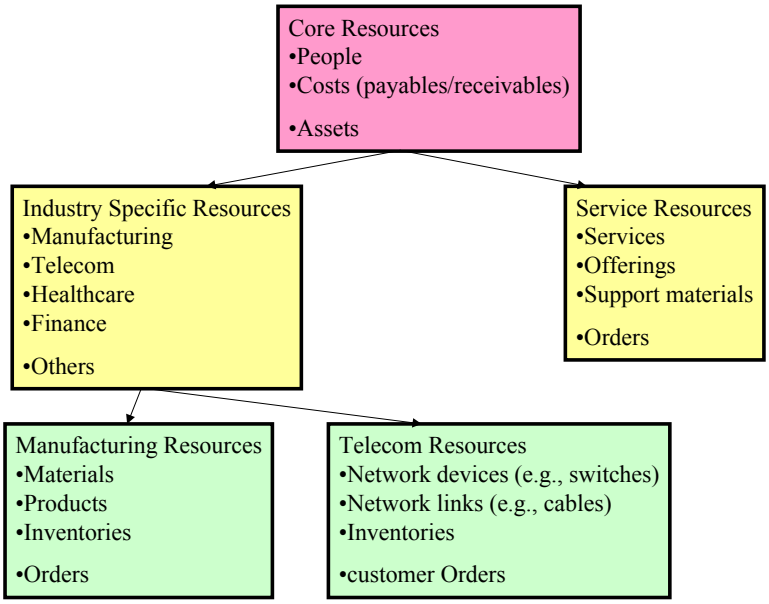


Figure 1-15:ERP Categories

1.7.3 Business-to-business (B2B): Supply Chains and eMarkets

Business-to-business (B2B) activities (purchasing plus informational) are vital to e-business. These activities fall into two broad categories: a) B2B direct where the business activities are conducted directly between trading partners and b) B2B indirect in which the trade partners use emarkets as intermediaries,

1.7.3.1 Business-to-Business Direct (Supply Chains)

This characterizes business activities directly between trading partners -- it is assumed that an agreement between the trading partners exists. An example is supply chain management between suppliers of parts and corporations. The main idea is that interactions between partners form a shared process, or potentially multiple distinct shared processes (Figure 1-16). Partners need to retain organizational independence, and so processes are categorized as either public or private. Public processes are shared between businesses and private processes are not shared -- they are fully under the control of the individual partners. A good example of business-to-business direct is supply chain execution in which automated processes work across a supplier network. Supply Chain Management (SCM) is an enterprise wide infrastructure for managing a network of facilities and distribution options such as procurement of materials, transformation of these materials into intermediate and finished products, and distribution of finished products to customers.

There are several successful examples of multi-national corporations that reap benefits and maintain their competitive edge due to efficient SCMs. Some representatives of industry practitioners include Procter & Gamble, Wal-Mart, Coca-Cola, Hewlett Packard, Cisco, IBM, Sun Micro Systems, Compaq Computers, Dell and 3COM. The market for SCM is growing due to mergers among corporations, new e-commerce virtual enterprises, change/expansion in company focus, new customer demands and global competition.

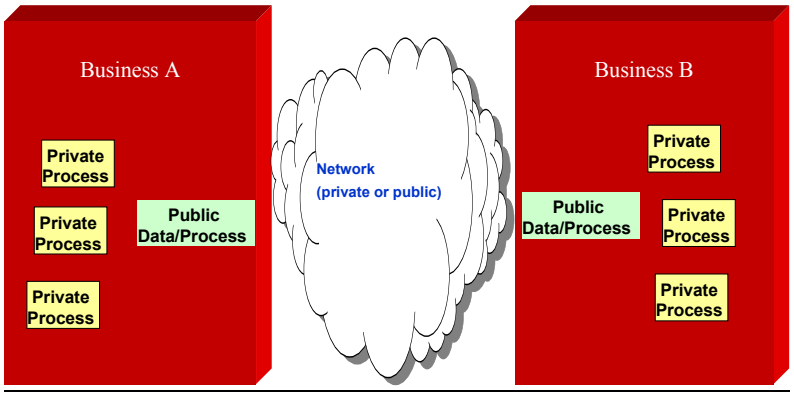


Figure 1-16: B2B Direct

1.7.3.2 Business-to-Business Indirect (eMarkets)

In this case, the trade partners use emarkets as intermediaries. The emarkets support multiple buyers and suppliers for auctions, reverse-auctions, and brokerages. B2B operations through intermediaries such as emarkets bring together buyers and sellers to provide efficient electronic trading of goods and services. An emarketplace is an electronic gathering place that brings together multiple buyers and sellers. An emarketplace provides its members with a unified view of goods and services and lets its members perform transactions electronically (see Figure 1-17).

Emarkets bring together multiple vendors "under one roof" and provide a single point of access for brokering financial transactions and information exchange across a large community of buyers and sellers. They offer a powerful means for purchasing based on vendors, price, terms, order, payment plans, etc. The participation of diverse suppliers and auctions/reverse auctions differentiate emarkets from Web-storefronts and virtual shops. A large number of emarkets (EMs) are being developed at present. An interesting example

of emarkets is www.Verticalnet.com that provides several marketplaces in a diverse array of segments. Current EMs are beginning to consolidate a wide range of intermediaries such as the following:

- Clearing houses that provide a common point for traders (e.g., catalog clearing houses)
- Trading hubs that allow customers to trade goods and services (e.g., BandX for bandwidth trading)
- Brokerages that provide brokers that act on your behalf (e.g., shopbots that shop on your behalf for certain items based on your needs)

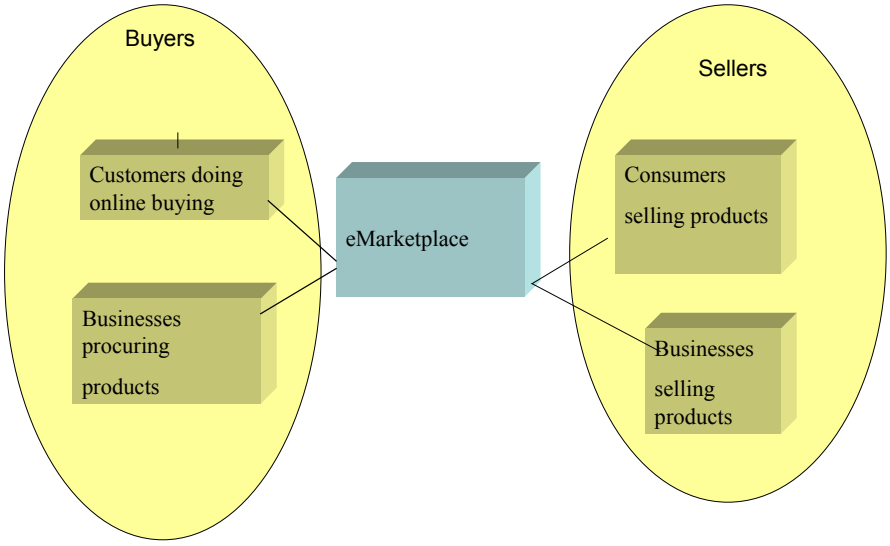


Figure 1-17: B2B - eMarkets

1.7.4 Consumer to Data (C2D) Applications – Business Intelligence

This business pattern represents the applications where the consumers directly interact with the databases for business intelligence. A specific example of this BP is data warehouses that are used to support business intelligence through data mining and other processes. Data warehouses have been established in many organizations to provide access to operational data by creating a repository for decision support. Data mining tools are increasingly playing a key role in data warehousing because they utilize statistical analysis and pattern recognition techniques to answer business questions. These tools exploit a combination of AI and statistical analysis to discover information that is hidden or not apparent through typical query and analysis tools. The availability of massive amount of corporate data in data warehouses has provided a rich field for data mining. Data warehouses -- typically large relational databases-- are widely accessible from Web. The users of the warehouses employ Web browser based tools for querying and analysis. Figure 1-18 shows a conceptual view of data warehouses.

1.7.5 Consumer to Consumer (C2C) Applications - Collaborative Computing and Groupware

This business pattern (BP) represents situations in which consumers directly interact with each other. Specifically, this BP includes computer supported cooperative work (CSCW) that allows people and processes in different parts of an organization to work together. Within this somewhat broad and vague umbrella, many application areas ranging from computer assisted instruction to business process automation have emerged. Some areas such as groupware, collaborative learning, and workflows have especially gained momentum. Let us talk about a few briefly.

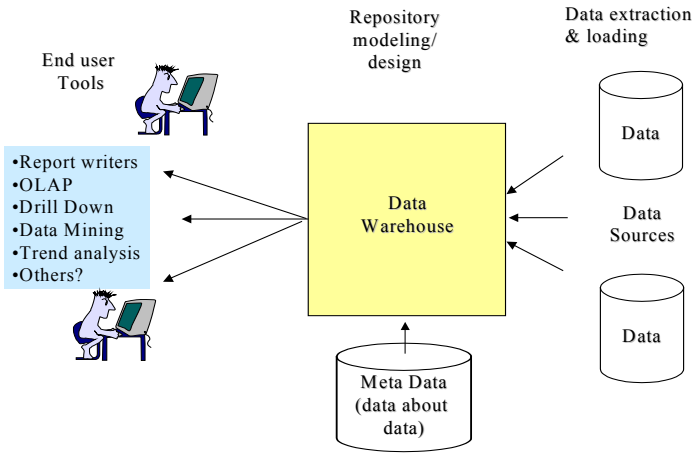


Figure 1-18: Data Warehouse – C2D Pattern

Groupware systems allow users to interact with each other by supporting document preparation and file/email exchanges. More recent systems use Web browsers to exchange voice, data and video for numerous office applications. For example, new teleconferencing systems display text, pictures, and video/voice on different windows of a workstation. Collaborative computing applications go beyond the computer conferencing and groupware software to cooperatively solve problems. These systems may include high definition TV and "artificial life" animations. An example is the extensive "decision support systems" which allow location independent teams to work cooperatively as if they were in the same room (talk, see each other, review each other's documents, etc.). It is important to provide all these facilities through one common user interface (i.e., the Web browser).

An example of groupware is IBM's Lotus Notes. It consists of one or more Notes Servers that are connected to the Notes Clients over an enterprise network (see Figure 1-19). The Notes Server houses the Notes building blocks: databases (collection of Notes documents), documents (text and graphics files), views (list of documents), forms (description of document structure), and fields (predefined fields in a form). The Notes Server manages the repository of information for the workgroup members.

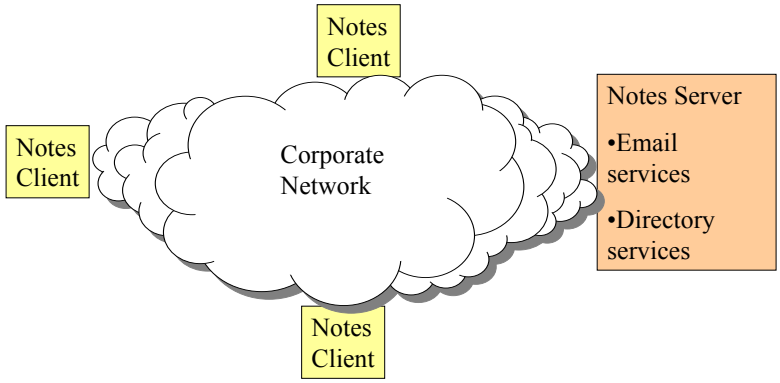
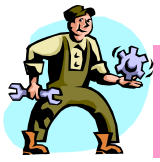


Figure 1-19: Conceptual View of Lotus Notes

Another example of a C2C business pattern is Communities of Interest (COIs) which allow users from the same community to exchange messages, transfer files, send mail and exchange XML documents to conduct business over the Internet. For example, the real estate COI users access real estate documents and databases through Web browsers. COIs have become more sophisticated with incorporation of workflows and multimedia presentations.

Very interesting collaborative learning and multimedia applications are being developed for higher education by the NSF (National Science Foundation) funded **Internet2** project (www.internet2.org). Examples of

these applications include virtual laboratories, digital libraries, and distributed instruction (see the Internet2 web site for more details).



Time to dig a little deeper.

1.8 Analysis of e-Business Applications -- A Multidimensional View

e-Business covers a broad spectrum of applications involving interactions among producers and consumers at C2B, B2B, C2D, and other levels. Within this broad classification, several types of application configurations can be identified depending on the usage scenarios, the parties involved (e.g. retailers and end customers as opposed to wholesalers), and a number of other attributes. Consider, for example, the following situations:

- An online purchasing system for 10 users is very different from the one for 10,000 users. To handle higher *volume of transactions*, you will need faster and more reliable computers and networks. In addition, a purchasing system is affected by the *value of transactions* it handles. For example, a purchasing system that handles several thousand dollars per purchase needs a much higher level of security than the one with less than $100 per purchase.
- A supply chain management system changes significantly if it has to handle 5 versus 50 business partners. In addition, the supply chain system can be configured differently if it has to handle a large volume of transactions.

Is it possible to capture these variations in terms of some key attributes such as volume of transaction, value of transaction, number of partners, etc. [Umar and Missier 1999] introduce a set of attributes that define a reference multidimensional space in which various EB applications can exist. This analysis then can be used to map various EB applications such as online purchasing and supply chain management to regions in this space. With each attribute, a set of discrete values {Low, Medium, High} are associated, based on an informal, qualitative estimation. Our initial set of dimensions includes the following (see Figure 1-20):

- **Business volume,** expressed as the typical number of transactions per unit of time. The volume can range from the tens of transactions a second, to the tens of transactions a day. Volume tends to correlate with the roles of the participants, in that an EC business involving many end consumers typically entails a higher transaction volume than a business among providers.
- **Business value of a transaction** This value can span a wide range. In traditional transactions, i.e., based on credit cards, the limiting factor is represented by the cost of transferring money between accounts, and in general by the cost of performing an update on one or more accounts. Because of the combination of high costs and relatively low demand, merchants and credit institutions are normally not equipped to handle very low-value transactions (i.e., a few cents). However, the increasing number of low-value goods, for instance one-pagers of information, that are available to a very large consumer population, creates an incentive to design low-cost payment schemes for microtransactions. Research on micropayments, however, is still in its infancy. **Transaction value** is correlated to the trust model that an EC infrastructure can support. From the consumer's perspective, the risk of an individual micro-transaction resulting in a loss of money remains low even for a relatively high probability of fraud. However, for consumers to embark in high value transactions, the underlying trust model must provide with a sufficiently low probability of fraud. The consumers' confidence in the marketing model changes in time and can be difficult to estimate.
- **Number of participants** involved in a single typical transaction, and **the depth of delegation** in case of a supply chain. While both attributes can range to tens of participants and several levels, one single transaction rarely exceeds a few participants, possibly belonging to two or three levels of delegation. This also includes **number and type of boundaries** between different administrative domains and organizations involved in the transactions. Typically, but not necessarily, boundaries are crossed at each

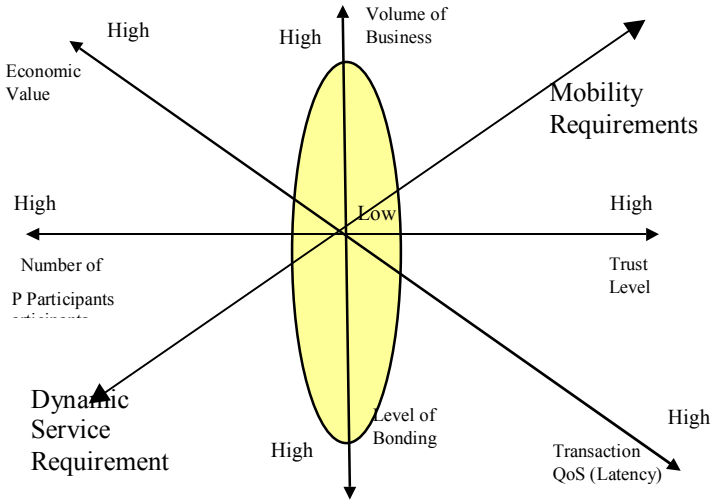


Figure 1-20: Multidimensional View of E-business

delegation step in a supply chain. When this happens, common conventions and standards, as well as inter-organizational laws and regulations, become relevant.

- **Transaction turnaround time (QoS, Latency).** The time it takes to deliver electronic goods and services is comparable with the transfer time of the corresponding data (plus overhead, service order negotiation messages etc.) over the network (seconds or minutes). Notice that this does not prevent delegation chains that can be several steps deep, provided the indirection occurs over a network. So we can argue that there is a class of services for which delegation is still possible, and yet the turnaround time remains low. This mode of operation is unique to EC, in that traditional commerce does not normally allow for indirection and low turnaround times at the same time. For consistency with our set of values, we use the equivalent QoS (Quality of Service) variable defined as the inverse of turnaround time (a direct measure of efficiency). This dimension may also include latency requirements which indicate the need to support zero latency in EC. A specific example of this requirement is the **zero latency supply chain** management where any changes in the supply chain are detected instantaneously.
- **Mobility requirements**. EC sites increasingly utilize mobility of users, suppliers, employees, platforms, data, and software. This dimension indicates the mobility requirements (low, medium, high).
- **Dynamic service requirements**. This dimension indicates the need for dynamic services, i.e., need to create new services dynamically and disassemble them quickly when not needed. This is a very desirable feature of virtual enterprises.
- **Trust model** underlying the transactions and **lifetime** of trust. A number of trust models have emerged in the EC literature [Ketchpel et al. 96, Ketchpel et al. 97, Steinauer et al. 97]. In some of these models, two or more untrusted participants may engage in a business transaction through the mediation of one or more brokers. Pairwise trust is assumed between each participant and its broker, as well as between brokers. Payment schemes involving brokers with limited trust ensure that payments are actually made if and only if the corresponding goods are delivered, and that orders are non-repudiable. Current proposals focus mostly on the definition of who must trust whom and to what extent. One aspect of trust that is often neglected is its *lifetime*, that is, for *how long* a particular trust model needs to be enforced. We are also interested in the **cost** of using a particular trust model for a given time (i.e., the cost of using brokering services). We can thus define a temporal "trust window" within which specific assumptions about participants are true, enabling a trust model to be enforced. In many cases, providers as well as consumers are interested in establishing long-term trust. However, several factors make this often difficult to achieve, for instance the reluctance of potential consumers to volunteer personal information, or the still limited popularity of personal certificates. By explicitly introducing a parameter to express the stability of the trust model, we can differentiate among these EC scenarios. Low and High here refer to short-lived and long-lived trust, respectively. It is useful to distinguish trust by type of partners,

namely: a) between customers and provider; and b) between main provider and sub-providers in a supply chain. The models for the two types of interactions can be different, e.g. short-lived for customers, but long-lived for business partners, etc.

- Level of **bonding (collaboration)** among business partners. This indicates the amount of information sharing that has to occur among providers in order for them to carry out a productive interaction. The following are only some of the indicators used to assess the level of bonding:
  - The extent of data sharing and the amount of joint responsibility in data maintenance. For systems that can interact using a common protocol and message format, with no implication on the respective transactional environments, the level of bonding is low. Information is exchanged when needed but is not co-maintained (it is not an asset common to both parties). Conversely, for systems that share data, e.g. common customer profile for the purpose of personalization and customization, joint maintenance of common data indicates a higher level of bonding than simple data transfer.
  - The duration of data sharing. Bonding is low when data needs to be shared only temporarily, say for the duration of a user session, high if the share is permanent.
  - Extent of inter-process coordination. Processes running on independent systems may have to coordinate to some extent in order to participate in a global workflow. In a specific case, bonding can reflect the extent of transaction scope for a global transaction manager.

Figure 1-20 illustrates some of these dimensions. Existing EB applications cover a region in the diagram and are represented as circles/ellipses. For example, the region shown in the figure indicates an EB application with high volume of business and high level of bonding between the partners (all other variables are low). For each dimension, the {L,M,H} ordering is defined by locating the "easy case" at the center, in such a way that outer regions naturally come to represent more challenging areas. For instance, transaction volume is Low at the center and High at the outer edge, and so are deeper supply chains (High number of indirections) and a High number of inter-organizational boundaries.

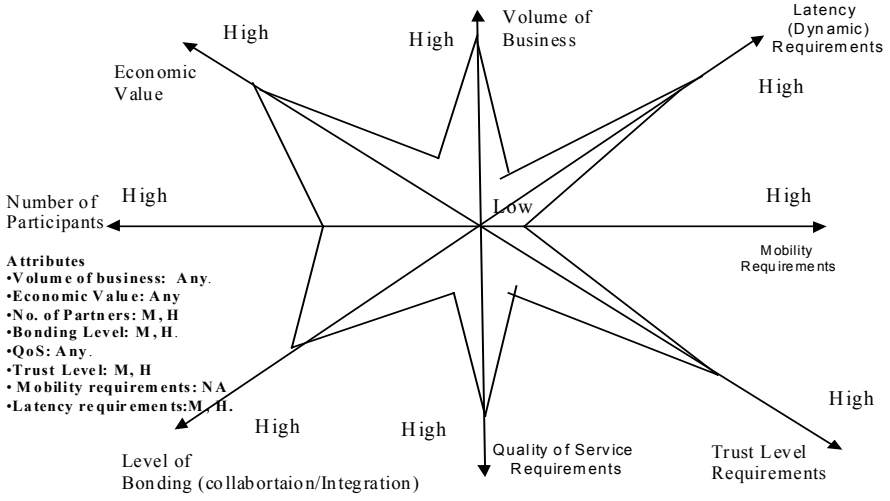


Figure 1-21: Multidimensional View of Amazon.com

The dimensions outlined above can be used to define ***"business architectures"*** chosen by an organization, rather than the technologies adopted to implement them. The dependency between these business strategies and corresponding technology options is discussed elsewhere [Umar 2000]. We have used these ideas in evaluating the EB infrastructure and suggesting architectural configurations. In particular, we can define several EB organizations in terms of these dimensions. Figure 1-21 shows how the Amazon.com purchasing

system can be represented in terms of this model[3]. Similarly, NGEs can be represented by using this model (see the sidebar "Next Generation Enterprise in Terms of Dimensions"). As part of our research, we have developed a library of representations for different industrial examples. We can also assess management and support issues within the context of this multidimensional view. Many difficult management and support issues arise as we reach the outer circle. For example, how to support an online purchasing system with large transaction volume, transaction value, and number of partners.

Next Generation Enterprise in Terms of Dimensions

The multidimensional can be used to represent the various stages of EB evolutions and consequently an NGE. Basically the real-time, mobility, and digital features of an NGE can be modeled by using the following values for the dimensions as shown in the following diagram:

- Latency requirements are high to reflect the zero latency (real-time) operations
- Mobility requirements are high to reflect need for mobility support
- Collaboration (bonding) is also high to represent tight coupling for monitoring
- QoS requirements are high to represent high need for reliability and availability
- Other parameters can be low, medium, or high

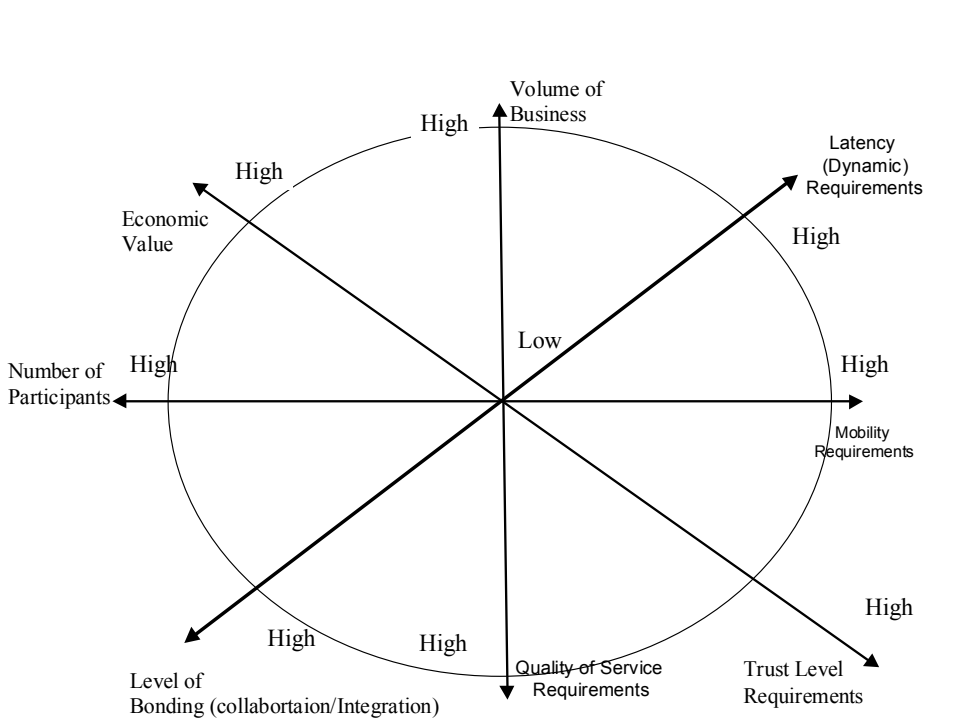


Figure 1-22: Multidimensional View of NGE

[3] These multidimensional diagrams may remind some of the "old timers" of the Kiviat charts that were introduced in the 1970s to represent computer performance attributes such as CPU utilization, disk storage utilization, average response time, etc. Kiviat charts are still being used. I saw them recently being used to represent LAN performance.

1.9 XYZCorp Case Study: Suggestions about e-Business Application Analysis

Let us again visit the XYZCorp case study introduced in Section 1.2. To perform EB application analysis, the discussion in Section 1.6 is a good starting point. The examples discussed in Section 1.7 are also directly relevant. This project should:

- Identify the type of applications (i.e., operational, decision support) and the levels of applications (individual, enterprise, inter-enterprise) that will support the strategies. The material discussed in Sections 1.6 and 1.7 is of direct value here.
- Build a dimensional model of XYZCorp applications in terms of the volume of transactions, value of transactions, etc as discussed in Section 1.8.

For the XYZCorp strategies discussed in Section 1.5 above, most applications will be operational with few for decision support (mainly data warehouse and data mining for customer relationship management). To cut down on production time (reduce to 30%), the company needs to pay a great deal of attention to internal business systems and also to the supply chains. For a multidimensional view, the current corporation resembles the Amazon.com model as shown in Figure 1-21 (low to moderate transaction value, high transaction volume, many business partners, etc.). We will discuss EB applications in detail in the next chapter. That discussion will give you additional insights.

Time to Take a Break

- ✓ e-Business Strategies
- ✓ e-Business Applications
- e-Business Strategies To Applications

Suggested Review Questions Before Proceeding

- What are applications? What are different types of applications in organizations ?
- How are e-business applications related to enterprise applications and how are the e-business applications categorized?
- What are e-business patterns? How do they effect an understanding of e-business?
- Represent an e-business model of a company in terms of the multidimensional view presented in this section (you can use the case studies in this chapter, in chapter 5 of this module, or the case studies discussed in the Overview Module). Does this model help in understanding e-business? Can you suggest additional dimensions? What and why?

1.10 e-Business Strategies to e-Business Applications

1.10.1 Overview

So far we have talked about strategies and applications to support the strategies. The fundamental challenge is: *how to build working solutions from the e-business strategies by using these applications*. In other words, how to translate the business strategies to engineering/re-engineering of applications and services that are delivered to the users. As stated previously, real strategic and sizable business gains do not result from establishing strategies alone but come from the smooth transition from strategies to applications and then to the deployment and management of these applications by using the IT infrastructure.

Determining and designing business applications in the old days was easy. The applications developed in the 1970s and 1980s used the terminal host model where all business logic and data was restricted to one machine (typically a mainframe). These systems, still prevalent, are not flexible enough for the changing business needs of today. In particular, the next generation of real-time digital corporations impose additional adaptability requirements. The life of IT personnel in the old days was also quite good[4] -- they focused on new application logic because most of the IT infrastructure issues were non-existent (after all, you used whatever was available on the mainframe!), the business needs and end-user expectations did not change quickly, very few off-the-shelf applications were available, and the issues of dealing/interfacing with existing applications were virtually non-existent.

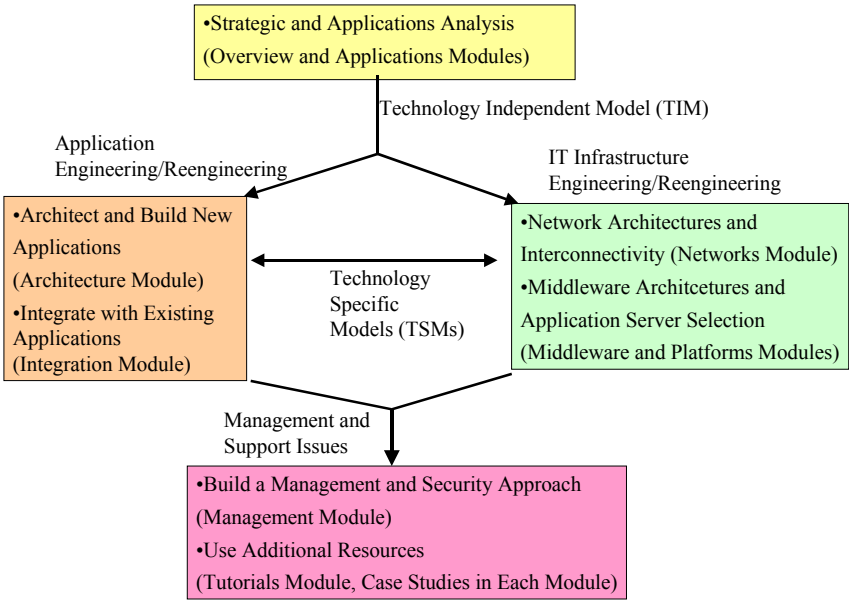


Figure 1-23: IS Solutions for e-Business

The situation is considerably more complicated nowadays as illustrated in Figure 1-23 (we introduced this view in Chapter 1 of the Overview Module). First, business strategies must be cast into the business applications to support the strategy. This results in *a technology independent model (TIM)* that feeds into the application architecture and integration (application engineering/re-engineering) activities. These activities translate the TIM into a *technology specific model (TSM)* through several iterations by using knowledge of the existing or future IT infrastructure. Of course, the entire process has to be managed and supported.

[4] I really enjoyed working on the mainframes in early stages of my professional life.

Each building block shown in this approach is quite difficult and requires many decisions. The different modules of this book address the relevant issues as shown in Figure 1-23. The complications are due to several reasons: a) changing business needs and high user expectations that complicate the task of establishing strategies, b) increased pressures to run the business as a real-time enterprise to compete in the marketplace, c) numerous choices in what needs to be engineered and/or re-engineered (applications or the infrastructure), d) a significant embedded base of existing applications that may partially satisfy business needs, e) an almost unlimited number of off-the-shelf packages and applications, f) a very large number of platform options (i.e., large number of middleware and networking options), and g) an ever increasing list of tools and standards. The following sections present a quick tour of the main issues and approaches.

1.10.2 e-Business Strategies and Applications Analysis

This activity concentrates on establishing a strategic approach and then identifying the applications that support the business strategy -- the main focus of this module. The chapters of this module introduce the reader to strategic analysis, discuss the key applications that support the e-business strategies, and introduce a systematic methodology that describes how to plan and execute the application (re) engineering efforts at an enterprise level. The enterprise application planning process, explained in Chapter 3 of this module, is presented in Figure 1-24. Based on the results of the planning iteration, and any other relevant information, an initial important decision is made: given a business opportunity, should a new application be developed (application engineering), should existing applications be re-engineered, or should a mixture of engineering/re-engineering be used? In addition, buying off-the-shelf packages and/or outsourcing through ASPs (application service providers) need to be considered. This decision may be revised in later iterations as we develop a better understanding of the problem and the various trade-offs. The module concludes with a brief overview of the IT infrastructure that is used to build, deploy, and support the applications -- this infrastructure enables the e-business strategies.

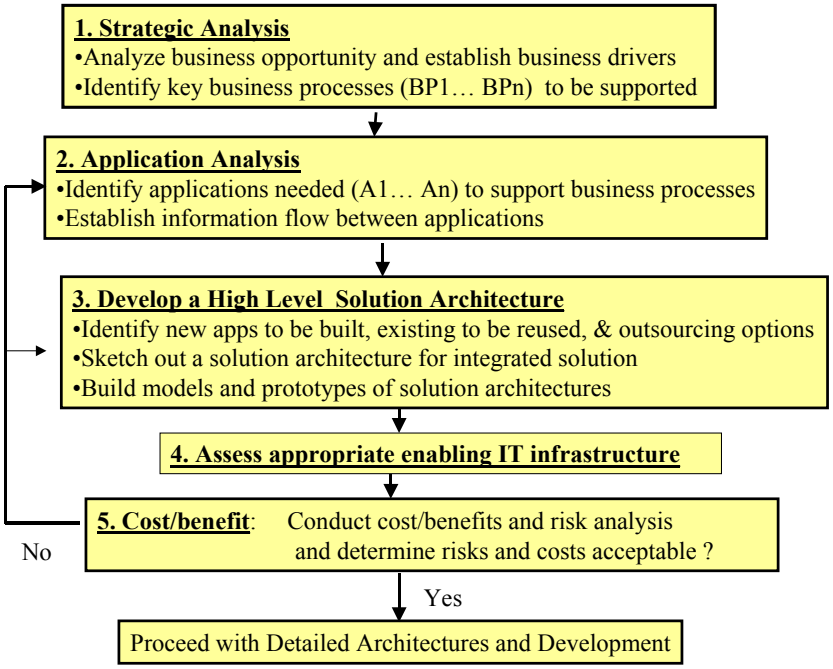


Figure 1-24: Overall Application Planning Procedure

After the strategic and application analysis, the contemporary enterprises need to further pursue two key application-related questions:

- **Application engineering**. What new applications are needed and how can they be architected and developed by using the most appropriate technologies (i.e., how do the existing/new IT infrastructure capabilities help me in developing new EB applications)?
- **Application re-engineering**. Can the existing applications be used, enhanced or integrated to satisfy the business needs? In addition, how can the new applications, if any, be integrated with existing applications, and when/how/if the existing applications should be transitioned?

This book addresses both of these questions in the Architecture and Integration Modules, respectively. In addition, questions about the engineering/re-engineering of the IT infrastructure must be answered (i.e., is new infrastructure needed or can the existing one be enhanced and used). The IT infrastructure issues are dealt with in the Networks, Middleware and the Platforms Module. Naturally, some management and support, including security, issues arise – these are discussed in the Management Module.

Let us first focus on application engineering/re-engineering. Figure 1-25 shows a refinement of Figure 1-23 and illustrates a high level approach for e-business application engineering/re-engineering that is discussed in this and Architecture and Integration Modules. The main idea is that after strategic and application analysis, existing and new applications are consolidated to meet business needs. For example, suppose you want to improve customer access to your financial applications for mobile users. Then you may need to develop a new mobile application that handles needs of mobile users. In addition, you will probably need to re-engineer and integrate the existing financial applications or databases with the new mobile application. A common example of application re-engineering at present is the melding of the Web, distributed objects and mobile computing technologies with the existing applications and databases. Let us highlight the main aspects of this approach.

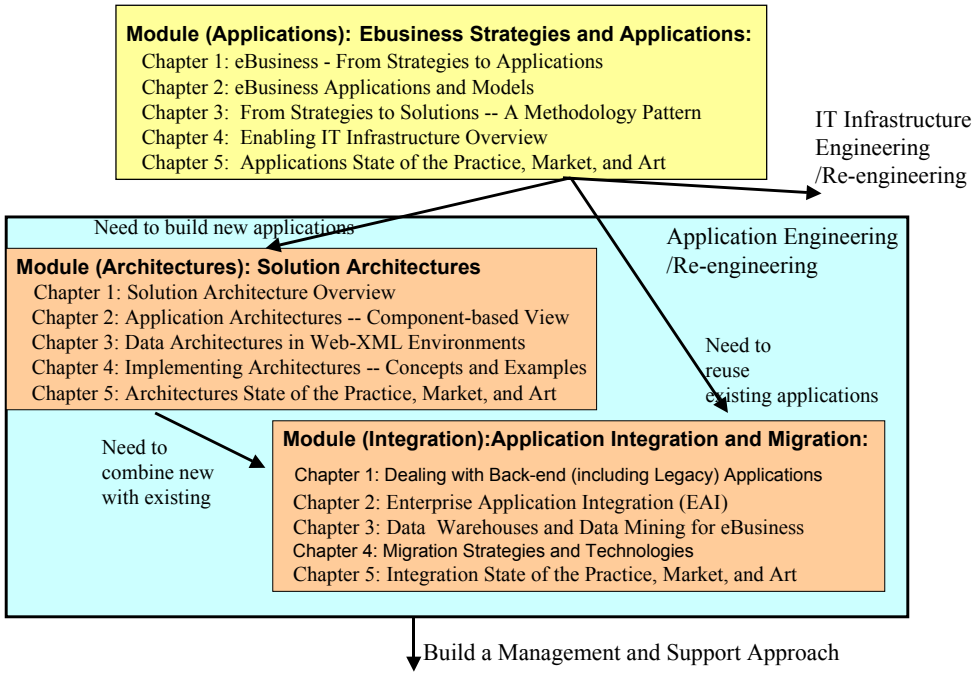


Figure 1-25: General Approach of Building Working Solutions

1.10.3 Application Engineering – Building New Applications

Simply stated, application engineering is concerned with architecting, implementing, testing and deploying all components of an application (i.e., databases, business logic, and user interfaces). Engineering of new

applications is an important area for e-business because many new applications are being developed at present. Chapter 2 of this module discusses many of these applications such as online-purchasing, portals, emarkets, CRMs, supply chain management, ERPs, M-commerce, and others. Most new applications are being developed by combining three core technologies:

- **Client/server**. This technology allows communications between computing processes, typically at different machines, that are classified as service consumers (clients) and service providers (servers). Simply stated, client/server environments allow application processes (business aware programs and subroutines) at different sites to interactively exchange information (e.g., transfer funds, query a database, purchase and ship items online).
- **Object-orientation**. Object-oriented technology is currently being widely used to develop reusable software. The basic idea is to view software systems in terms of "natural" objects such as customers and sales regions that can be easily created, viewed, used, modified, reused, and deleted over time. The goal is that the users view applications in terms of objects through graphical user interfaces, programmers develop code that perform operations on objects, and database managers store, retrieve, and manipulate objects.
- **Internet**. World-Wide Web over the Internet allows access to resources located around the world. For all practical purposes, the Web provides a GUI interface, called the browser, that can access information by pointing and clicking through hypertext linkages that chase unique resource identifiers, called the Uniform Resource Locators (URLs). Most of the Internet work at present is document-centric -- however, Web gateways provide access to corporate databases and applications through Web browsers.

Newer systems such as Web Services -- the foundation of .NET – combine these three OCSI (object-oriented, client/server, Internet) technologies. Figure 1-26 shows a simplified view of an OCSI application that allows customers in New York, Singapore and many other cities to place orders through a multitude of programs and databases that are widely distributed. This example illustrates the following key points:

- Web browsers are used to access remotely located objects or databases over HTTP that may be located anywhere on the network.
- The application programs are typically OO, written mostly in OO programming languages such as Java and C++. These programs appear as objects that can reside anywhere in the network and communicate with each other by using remote object calls such as CORBA, SOAP, or DCOM (we will define and discuss these later).
- The databases are largely relational databases that are accessed from remote programs typically through remote SQL software such as ODBC (Open Database Connectivity).
- Client/server paradigm is used in many situations between consumers and suppliers. For example, the browser acts as a client to the order processing systems, which in turn acts a client of the inventory manager to determine if items being ordered are available.
- The browsers, programs, and databases may be accessed across wired or wireless networks.

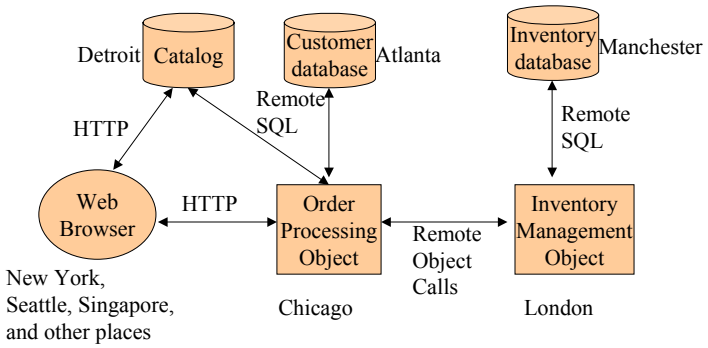


Figure 1-26: Ideal View of Object-Oriented Client/Server Internet Applications

OCSI applications provide many benefits to IT by allowing the various computing activities to be dispersed across a network to maximize flexibility and availability. Given a suitable IT infrastructure, IT planners and

architects can configure the applications by using mixtures of mainframes, microcomputers, and minicomputers to meet different business requirements and to respond to competitive pressures quickly. The new application support environments such as Microsoft's .Net (dot net) and Sun's J2EE are good representations of OCSI.

If new application software needs to be developed, then we can assume that this software will use object-orientation, C/S, and Web technologies. In particular, the notion of "business components" is being used widely. In essence, a business component is a large object that represents a business entity. Establishing component-based software architectures of such applications is a non-trivial task with a very wide range of options and trade-offs. For example, the architect has to divide the application logic between various components, determine the communication paradigm to be used between clients and servers, decide on a two versus three-tiered architecture, and select appropriate infrastructure services. The Architectures Module of this book discusses the component-based application architectures in detail.

1.10.4 Application Re-engineering – Dealing with Legacies

Application re-engineering, also written as application reengineering, is concerned with restructuring (i.e., interfacing, integration, migration) of existing application components (i.e., databases, business logic, user interfaces). Many of these applications can be "legacy" applications that are old, unstructured, and monolithic. According to Webster, "legacy is something *of value* that is passed along to the next generation". Dealing with legacy applications has been a dominant concern of IT management for a while. If possible, the IT management would like to keep the legacy systems intact because they provide vital services (e.g., billing) that are very risky to disrupt. However, something must be done about these systems because these systems are inflexible and are becoming increasingly expensive to maintain and operate especially in the futuristic real-time enterprise scenario. The core of the application re-engineering challenge is: how should the existing (mostly legacy) databases and/or application software be used to satisfy the ever evolving information needs of modern businesses. After analysis of the business and technical requirements, specific choices to deal with legacy applications, as shown in Figure 1-27, are:

- Combine and, if possible, integrate existing (including legacy) applications with new (mostly Web based) applications and tools by using access in place
- Provide "shadow" systems (e.g., develop data warehouses)
- Migrate the system to new platforms

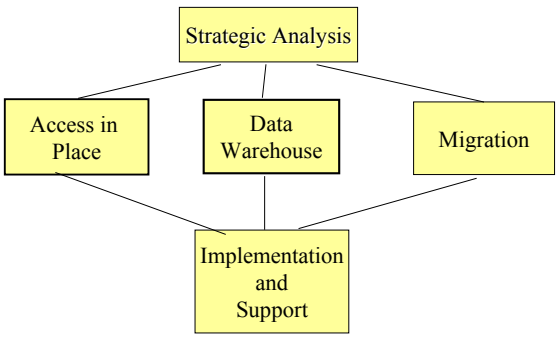


Figure 1-27: Choices in Application Re-engineering

Access/Integration of Legacy Applications. In this approach, the existing system is not modified -- it is interfaced with new by using wrappers or gateways. Interfacing and integrating the existing databases and applications with new object oriented client/server Internet-based applications is a very desirable strategy for many business situations. This coexistence of old with new leverages the enterprise investment in existing systems and takes advantage of new technologies. For example, many new Web-based applications and tools need information that resides in existing (in many cases, legacy) databases. Providing Web access to the existing databases through "Web gateways" is an area of a great deal of activity at present.

Data Warehousing. A data warehouse, as stated previously, is a repository of information (data) for decision support. Data warehouses provide a viable approach to access legacy data, i.e., instead of using gateways to access legacy data, the needed data is extracted and loaded into a data warehouse. For example, instead of using gateways to access customer information that may reside in dozens of systems in different formats, the customer data could be extracted and loaded into a "customer data warehouse". The activities involved in designing a data warehouse are in principle similar to the database design activities. The differences are in determining the level of detail to be stored in the warehouse and the frequency with which the warehouse data is synchronized with the original data.

Migration. In several cases, it is a good idea to migrate the systems to a new platform. This is especially true in cases where the existing legacy system needs constant upgrades that are extremely expensive and time consuming due to the "unfriendliness" towards flexibility. In these cases, it is best to migrate and restructure the existing legacy system. A commonly used approach is to replace the existing legacy systems with ERP (Enterprise Resource Planning) systems, if possible.

Chapters of the Integration Module of this book discuss these options in great detail with an analysis of the strategic and technical issues.

Suggested Review Questions Before Wrapping Up

- How can the strategies be translated into working solutions? What are the main steps and decisions?
- What is application engineering? When is this necessary? What are the main activities of application engineering?
- What is application re-engineering? When is this necessary? What are the main activities of application re-engineering?
- What are the cases when application engineering or re-engineering are not needed? Why not?

1.11 Summary

In this chapter, we have given an overview of strategic issues in e-business and shown how these strategies can be translated into the enterprise applications that are at the core of e-business. We have defined e-business applications and given a few examples of e-business applications in terms of C2B, B2B, and other common e-business patterns. The chapter concludes by introducing a solutions approach for e-business that will be covered in later chapters of this module and other modules of this book.

It should be noted that most of the EB applications being developed at present and in the near future will be based on the object-oriented, client/server, Internet (OCSI) paradigm which combines Web technologies with distributed objects and SQL-based middleware to deliver business value. The focus of this module is on how to build (i.e., engineer) new applications to take full advantage of this paradigm and how to deal with (i.e., re-engineer) existing (legacy) applications. In this chapter we have presented a broad overview of the subject matter and have attempted to set the overall tone for the rest of this module.

1.12 Review Questions and Exercises

1) Scan the literature and discuss three examples of companies that have used innovative business strategies in e-business. Also find at least company that has failed in this area.

2) Access emarketer.com and find the latest statistics on EC/EB growth and decline.

3) Go to fedex.com and find information about recent EC/EB projects at FedEx.

4) Access Startupfailures.com and identify the main causes and lessons learnt for dotcom failures.

5) In your view, what is the main strength of combining OO, C/S and Web to deliver business value? What is the main weakness (risk)? Give three specific examples to illustrate the OCSI applications.

6) How are the business patterns presented in this chapter influenced by the Henderson-Venkataraman Strategic Alignment model scenarios where IT drives the business strategy?

7) Suppose that you have been asked to develop a two day management training program in building IS solutions in the modern e-business environments. What topics will you cover in this program?

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