

A Proposed CIS Curriculum to Support Implementation Framework for e-Business Solutions

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Abstract

Since commerce on the Internet began in 1993, the number of organizations conducting business over the Internet has exceeded most market projections and expectations. However, the track record of implementing successful e-Business solutions has been spotty at best. To achieve successful results on a consistent basis, companies need to rely on a robust framework to guide the design and implementation of their e-Business strategy. Closely tied to these concerns is the issue of staffing and human resources. It is common knowledge that the Information Technology industry is currently experiencing a severe shortage of IT personnel, especially in the e-Business development area. How do we prepare professionals for this information technology environment? What skills do these professionals must acquire to have a successful career in the new computing paradigm? What role(s) can academic institutions, particularly departments offering information systems and computer science curricula, play in preparing the workforce for the e-Business based IT world?

This paper first discusses issues pertaining to the design and implementation of e-Business solutions with an objective of suggesting a possible framework. Based on this suggested framework, and along with the data gathered from professionals in the IT industry, the paper will next examine and assess technology skills that are essential to support the suggested implementation framework. Finally, the paper will suggest an IT curriculum that in all likelihood will enable students to acquire skills essential for a successful start in the new e-Business and dot-com based IT computing environment.

Keywords: Curriculum, e-Business, IT Skills

1. INTRODUCTION

Since commerce on the Internet began in 1993 it's moved quickly from being a curious spectacle to a matter of survival for most businesses. Whereas fewer than 20 million consumers were connected to the Internet regularly in 1995, the numbers had more than doubled by end-1997. The number of organizations conducting business over the Internet over the past two years has exceeded most market projections and expectations (Kalakota 1999; McLaren 1999; Murphy 1999).

However, the track record of implementing successful e-Business solutions has been spotty at best. While "pure-play" Internet companies have been very successful, the results are only slightly positive for businesses that bring buyers and sellers together (e.g. e-Bay), online brokerage businesses (e.g. E*Trade), and portal advertising magnets (e.g. Yahoo! and America Online).

Delivery and fulfillment has further confounded newcomers to the e-Business world (Murphy 1999).

Never before has the issue of "design considerations and strategic planning of IT systems" taken a more important role. For the first time since 1996, "IT business and strategy planning" is most frequently cited by CEOs as the issue of major concern (Murphy 1999). Additionally, to achieve successful results on a consistent basis, companies need to rely on a robust framework to guide the design and implementation of their e-Business strategy.

Closely tied to these concerns is the issue of staffing and human resources. It is common knowledge that the Information Technology (IT) industry is currently experiencing a severe shortage for IT personnel. The gap between the number of jobs available and number of professionals available to fill these position is expected to widen at an increasing rate for at least the next three to five years. How do we prepare professionals for this information technology environment? What skills do

these professionals must acquire to have a successful career in the new computing paradigm? What role(s) can academic institutions, particularly those offering information systems (CIS or MIS) and computer science (CS) curricula, play in preparing the workforce for the IT world based on the e-Business strategy?

This paper first discusses issues pertaining to the design and implementation of e-Business solutions with an objective of suggesting a possible framework. Based on this suggested framework, and along with the data gathered from professionals in the IT industry, the paper will next examine and assess technology skills that are essential to support the suggested implementation framework. Finally, the paper will suggest an IT curriculum that in all likelihood will enable students to acquire skills essential for a successful start in the new e-Business and dot-com based IT computing environment.

e-Business Defined

The Web is changing every aspect of our lives. But no area is undergoing as rapid and significant a change as the way businesses operate. As businesses incorporate Internet technology into their core business processes they start to achieve real business value. Today, companies large and small are using the Web to communicate with their partners, to connect with their back-end data-systems, and to transact commerce. The next generation of business has arrived—it's called *e-Business*.

e-business is about using Internet technologies to transform key business processes (IBM 1999). It's about strengthening relationships with stakeholders, capitalizing on new business opportunities and increasing efficiency to become more profitable. No other aspect of e-Business has garnered more attention than e-Commerce.

e-Commerce, or the ability to offer goods and services over the Web, has had a remarkable impact on a wide number of industries. According to several published sources (Business Week 1999; Forrester 1999; Kalakota 1999; Newsweek 1999),

"e-Commerce between businesses is five times as much as consumer e-Commerce, or about \$43 billion last year. And by 2003, Forrester Research predicts that e-Commerce between businesses will balloon to \$1.3 trillion. That's 10 times consumer e-Commerce, constituting 9% of all US business trade, and more than the gross domestic product of Britain or Italy."

What are some of the driving forces behind this migration to the Internet? Results from the 1998 survey by Price Waterhouse Coopers of 800 CEOs attending the World Economic Forum in Davos, Switzerland provide two interesting statistics (Murphy 1999):

- Over 50% of the respondents said Internet startups like Amazon.com represent "a significant competitive threat" in their industries.
- Four out of 10 predicted that more than 10 percent of their company's revenues would come from electronic business in the next five years

e-Commerce is about much more than simply opening up a new, online sales channel. It's about using technology to streamline your business processes to improve operating efficiencies. The question is not whether companies should think about doing business on the Internet. The question most companies are asking is how to capture the advantages the Internet brings without abandoning their existing investments in systems and data. Taking full advantage of the opportunities e-Business can present requires careful planning. It requires that due considerations be given to the design of an e-Commerce and e-Business solution.

For the purpose of discussing the major design issues and framework for designing and implementing an e-Business solution, e-Commerce is defined as the ability to offer goods and services over the World Wide Web (IBM 1999).

e-Business, on the other hand, is defined as the transformation of key business processes through the use of Internet technologies. In e-Business, companies use the Web to communicate with their partners, to connect with their back-end data-systems, and to transact commerce in such a way that it leverages the strength and reliability of traditional information technology in the Internet environment (Kalakota 1996, 1999; McLaren 1999). This new Web + IT paradigm merges the standards, simplicity and connectivity of the Internet with the core processes that are the foundation of business

For companies to migrate to e-Business it requires a clear vision of what needs to be done and an equally clear picture of how to make that vision a reality. Successful e-Commerce systems will derive from good design practices, which, in most likelihood, culminate in systems having desirable properties such as (Harkey 1999; IBM 1999):

- Application simplicity and reusability,
- Leveraging current developer skills, data and information
- Robust security with good performance,
- Applications and Systems Manageability,
- Deployment flexibility and Scalable systems.

Key design Issues

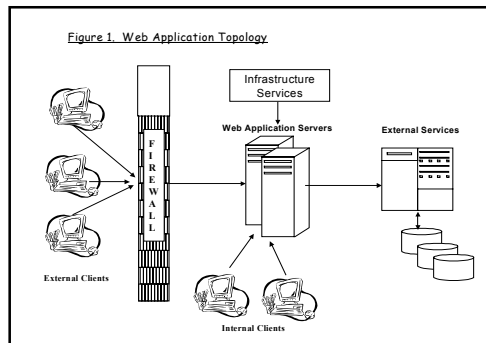
Some of the key issues to remember as you develop an e-Commerce solution include (IBM 1999):

1. Connecting and integrating business processes, information and people create e-Business/e-Commerce solutions.
2. e-Business solutions continue to evolve over time.
3. e-Business solutions must grow quickly in multiple dimensions. This is critical because the more successful an e-Business solution, the more users it attracts. In addition, content on successful sites tends to grow exponentially. The ability to grow will become even more important, given the growth of digital media and the evolution of the Internet itself.
4. e-Business solutions must work. These systems must offer reliability that builds trust, security that builds confidence, and manageability that ensures performance.

To develop applications with these characteristics, it is imperative that companies choose the right application model and design paradigm. One such framework is presented here.

2. FRAMEWORK FOR e-BUSINESS SOLUTION

e-Business/e-Commerce systems are applications that leverage Web clients (such as Web browsers), Web application servers, and standard Internet protocols. They also typically leverage existing applications and data from external non-Web services (Harkey 1999; IBM 1999). Figure 1 illustrates the major elements of the e-Business application topology supported by the suggested framework.

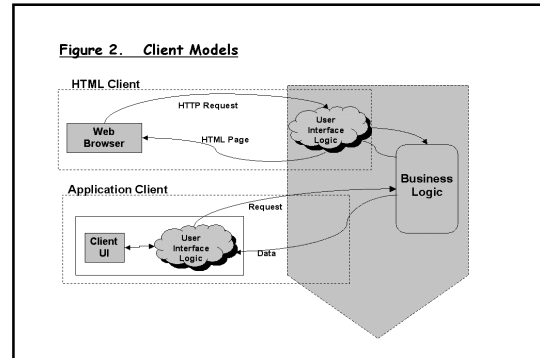


The Web application topology consists of (Harkey 1999; IBM 1999):

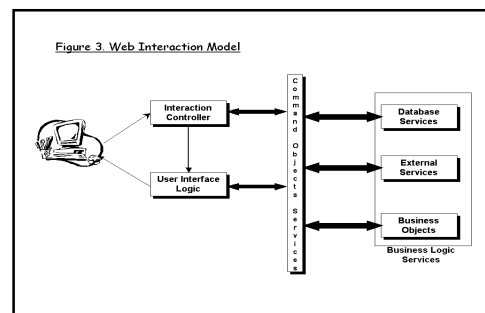
1. Internet and intranet clients
2. Web application server(s)
3. Web Infrastructure services
4. External services

Let us briefly review each of these major role players in the suggested design framework.

Users communicate with Web application servers to access business logic and data using the Internet and intranet clients. Ranging from information appliances to network PCs and relying on a set of web based technologies, the key role of the client within this framework is to present results received from the Web application server to the user. The suggested framework supports two basic client models as illustrated in Figure 2. The user interface can be driven from one of two places: either from the client (Application or "fat" Clients) or from the Web application server (HTML or "thin" clients).

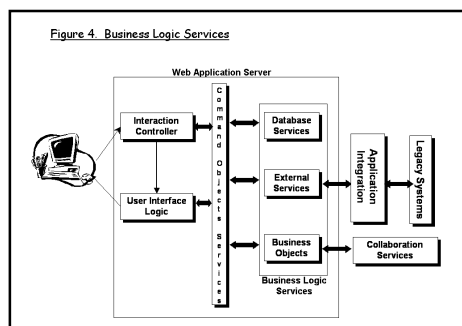


Web application server(s), the second major component in the framework, provide a wide range of programming, data access, and application integration services for writing the business logic. A Web application may be thought of as a set of processing steps or interactions, each of which gets a request generated from a page and each of which must produce a response in the form of a page that will serve as the input for subsequent interactions. This set of processing requirements can be nicely mapped to the classical model/view/controller (MVC) paradigm as shown in Figure 3.



- *Interaction Controller* handles client-side input and validation. It maps the HTTP protocol specific input request and session parameters to the business logic's input properties, and logic flow to correctly chain the business logic. It then delegates to the UI logic the process to actually create the response page to be returned to the client.

- *View* or the User Interface (UI) logic part of the system is responsible for generating the HTML page that will be returned to the client. The framework recommends implementation of UI logic using technologies that allow HTML and dynamic data to be mixed on the same HTML page.
- *Model* represents the business logic portion of the system. It comprises of code that is ultimately responsible for satisfying client requests. As a result, business logic must address quick access to application data in a secured manner, coordination of business workflow processes, and integration of new application components with existing applications. Within the suggested framework, these requirements are met through three core services. These are database, collaboration, and application integration services. The business logic gains access to these core services by invoking the methods of the command object service layer. Services provided by these core technologies are summarized below and illustrated in Figure 4.



- *Database services* manage both the operational data and multimedia content used to support internal decision-making and to conduct business on the Internet, an intranet, or an extranet.
- Collaboration services connect existing business data and transaction systems with people to create new business processes and workflows to easily define processes to route and track documents, and to coordinate activities both within and beyond the organization.
- Application integration: services address the need to Web-enable existing computing assets as well as the need to integrate business processes built on legacy architectures through connectors (e.g. Oracle cartridges), application messaging, and components integration architectures (e.g. CORBA).

The ability to easily locate application components, access and execute them securely, and ensure their availability are critical factors to deploying Web applications in Internet, intranet, and extranet environments. Web Infrastructure services, the third

major component of the Web application topology in the framework, is responsible for providing the Web application server and its business logic components with directory and security services.

The *Directory services* synchronize information between the different directories in an organization, allowing users accessing any of the directories to see the same information. Security Services comprises of several sub-services to implement security to build trust into business-critical Web applications. These sub-services include: Certification authority, Firewall support, Proxy server, and Network dispatcher services.

Finally, external services consist of existing, mission critical applications and data within the enterprise as well as external partner services such as payment services, financial services, and external information services.

3. ASSESSMENT OF KNOWLEDGE AND SKILLS

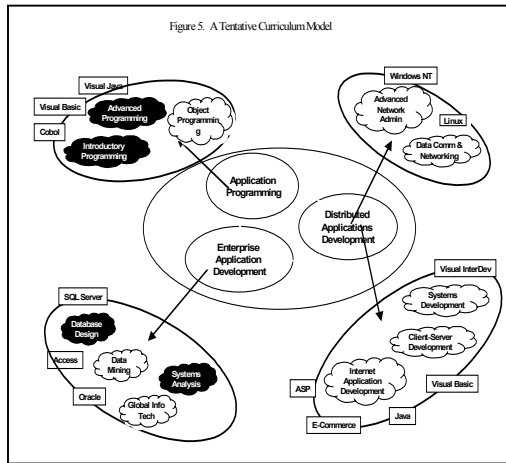
This section of the paper will examine and evaluate the implementation framework presented here from the standpoint of identifying knowledge and skills that are found to be essential for a successful career in an e-business driven IT industry. A set of core knowledge groups and skill sets will be identified based on the analysis of both the suggested e-Business implementation framework and data collected from professionals in the IT industry.

A survey instrument was piloted during Spring 2000. Twenty IT professionals, at the rank of manager and above, from major corporations that are represented on one college's advisory board were included in this pilot. The survey instrument is currently under revision as suggested by a preliminary examination of data obtained from the pilot survey.

4. SUGGESTED E-BUSINESS CURRICULUM

This section of the paper will present one approach to preparing students for the IT environment based on the e-Business paradigm discussed above and further substantiated with industry data. Based on the results of the analysis performed in the previous section, a set of courses designed to include the identified core knowledge groups and skill sets, along with the sequence in which these course may be taken, will be suggested. The paper will share the experiences of one Computer Information Systems (CIS) department as it moves from a curriculum targeted at traditional (legacy) and client/server computing environment to a curriculum designed to prepare students for the e-Business driven computing paradigm. Curriculum models and plans for the migrations to the new curriculum will be presented.

Sections 3 and 4 are work-in-process since data collection and analysis are on going. A tentative model based on a preliminary assessment of data is previewed in Figure 5.



5. SUMMARY

The Internet has had a dramatic impact on the way businesses transact commerce today. Today, companies large and small are using the Web to communicate with their partners, to connect with their back-end data-systems, and to transact commerce. e-Commerce and e-Business has allowed companies to strengthen relationships with stakeholders, capitalize on new business opportunities and increase efficiency to become more profitable. It has had a remarkable impact on a wide number of industries, ranging from the small "cottage industries" to large multinational corporations.

Implementing a successful e-Business solution requires careful planning, both from strategic and technological perspectives. It requires that due considerations be given to the design of e-Business solution. More importantly, it requires that companies need to pay close attention to recruiting qualified information technology professionals to ensure that their e-Business solutions are well designed and successfully implemented. The role of preparing graduates for the new work environment obviously belongs academic institutions of higher education.

This paper discussed a typical framework to guide the design of e-Business solutions. This paper uses the suggested framework as a guide to developing Computer Information Systems curriculum that will prepare graduates to enter the industry that is driven by e-Business strategies. A curriculum model developed from an analysis of e-Business framework and data obtained from industry professionals is presented. In addition, plans to migrate traditional CIS curriculum to a

curriculum with an e-Business focus are discussed and presented.

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Figure 1. Web Application Topology

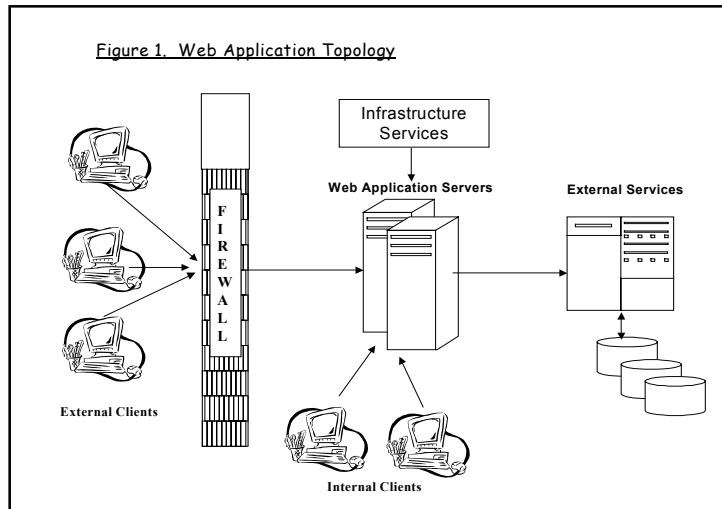


Figure 2. Client Models

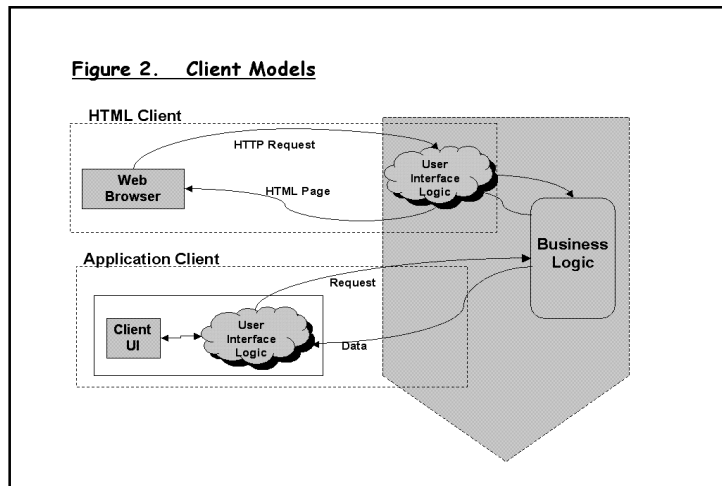


Figure 3. Web Interaction Model

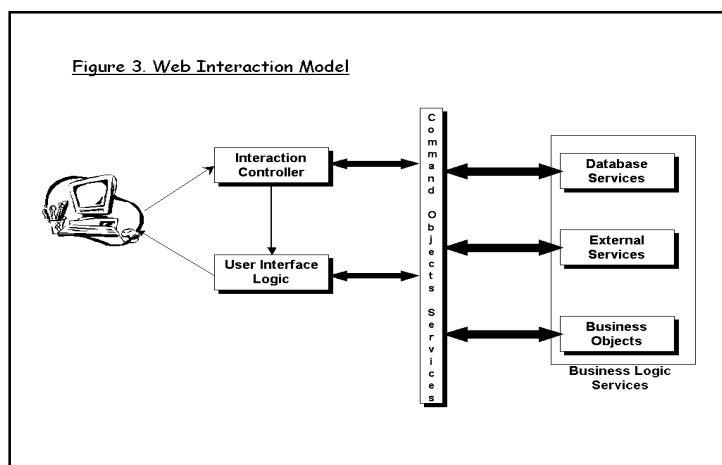


Figure 4. Business Logic Services

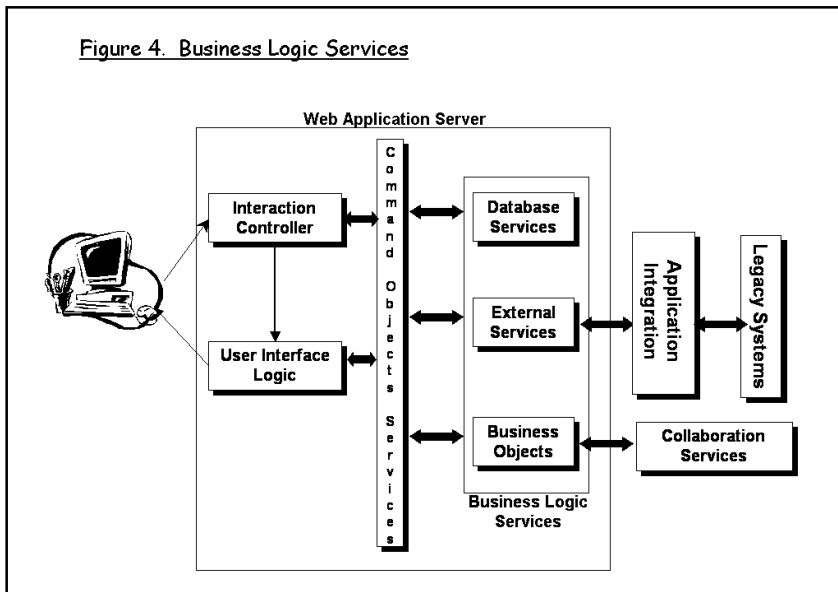


Figure 5. A Tentative Curriculum Model

