LESSON 4:
ARCHITECTURAL FRAMEWORK OF E COMMERCE

Topics :

- Introduction
- Various layers of electronic commerce application architecture
- Software framework necessary for building
- Summary
- Exercise

Objectives

After this lecture the students will be able to:

- Understand the software framework necessary for building Electronic Commerce applications

In the previous lecture we studied the conceptual framework of E Commerce, today we will discuss in detail the six layers of functionality or services in E Commerce application architecture.

Architectural Framework For Electronic Commerce

The software framework necessary for building electronic commerce applications is little understood in existing literature. In general a framework is intended to define and create tools that integrate the information found in today's closed systems and allow the development of e-commerce applications. It is important to understand that the aim of the architectural frame-work itself is not to build new database management systems, data repository, computer languages, software agent based transaction monitors, or communication protocols.

Rather, the architecture should focus on synthesizing the diverse resources already in place in corporations to facilitate the integration of data and software for better applications.

The electronic commerce application architecture consists of six layers of functionality, or services:

(1) applications;

(2) brokerage services, data or transaction management;

(3) interface, and; support layers"

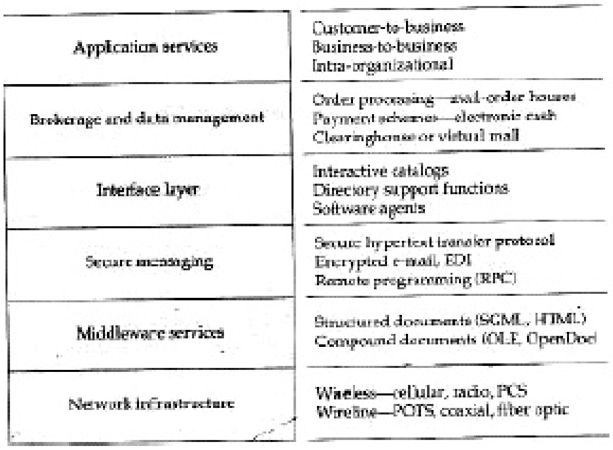
(4) secure messaging, security and electronic document interchange;

(5) middle ware and structured document interchange; and

(6) network infrastructure and basic communications services (see Fig. 4.1).

These layers cooperate to provide a seamless transition between today's computing resources and those of tomorrow by transparently integrating information access and exchange within the context of the chosen application. As seen in Fig. 4.1, electronic commerce applications are based on several elegant technologies. But only when they are integrated do they provide uniquely powerful solutions.

In the ensuing discussion of each of these layers, we will not elaborate on the various aspects of the network infrastructure that transports information. These were discussed extensively earlier and will not be addressed here. We begin our discussion with the application level services.



Application services	Customer-to-business Business-to-business Intra-organizational
Brokerage and data management	Order processing—mail-order houses Payment schemes—electronic cash Clearinghouse or virtual mall
Interface layer	Interactive catalogs Directory support functions Software agents
Secure messaging	Secure hypertext transfer protocol Encrypted e-mail, EDI Remote programming (RPC)
Middleware services	Structured documents (SGML, HTML) Compound documents (OLE, OpenDoc
Network infrastructure	Wireless—cellular, radio, PCS Wireline—POTS, coaxial, fiber optic

Fig 4.1 Electronic Commerce: A conceptual framework

Electronic Commerce Application Services

The application services layer of e-commerce will be comprised of existing and future applications built on the innate architecture.Three distinct classes of electronic commerce application can be distinguished: customer to business, business-to-business, and intra organization (Fig 4.2)

Consumer-to-Business Transactions

We call this category marketplace transaction. In a marketplace transaction, customers learn about products differently through electronic publishing, buy them differently using electronic cash and secure payment systems, and have them delivered differently. Also, how customers allocate their loyalty may also be different. In light of this, the organization itself has to adapt to a world where the traditional concepts of brand differentiation no longer hold-where "quality" has a new meaning, where "content" may not be equated to "product," Where "distribution" may not automatically mean "physical transport." In this new environment, brand equity can rapidly evaporate forcing firms to develop new ways of doing business .

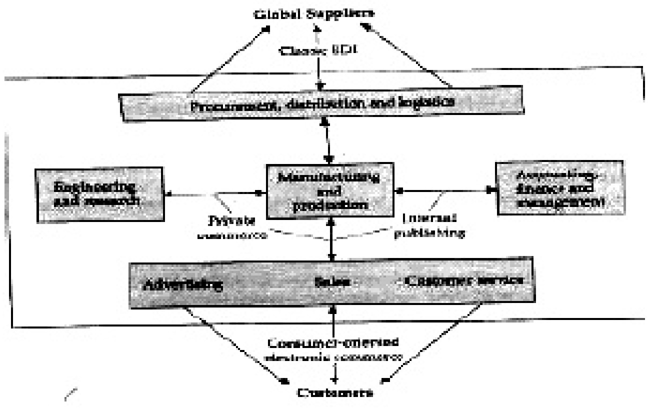

Global Suppliers
Classic EDI
Procurement, distribution and logistics
Engineering and research
Manufacturing and production
Accounting, finance and management
Private commerce
Internal publishing
Advertising
Sales
Customer service
Consumer-oriented electronic commerce
Customers

Figure 4.2 Different types of electronic commerce applications

Business-to Business Transactions

We call this category market-link transaction. Here, businesses, governments, and other organizations depend on computer -to-computer communication as a fast, an economical, and a dependable way to conduct business' transactions. Small companies are also beginning to see the benefits of adopting the same methods. Business-to-business transactions include the use of EDI and electronic mail for purchasing goods and services, buying information and consulting services, submitting requests for proposals, and receiving proposals.Examine this scenario. The current accounts payable process occurs through the exchange of paper documents. Each year the trading partners exchange millions of invoices, checks, purchase orders, financial reports, and other transactions. Most of the documents are in electronic form at their point of origin but are printed and key-entered at the point of receipt. The current manual process of printing, mailing is costly, time consuming, and error-prone. Given this situation and faced with the need to reduce costs, small businesses are looking toward electronic commerce as a possible savior.

Intra-organizational Transactions

We call this category market-driven transactions. A company becomes market driven by dispersing throughout the firm information about its customers and competitors; by spreading strategic and tactical decision making so that all units can participate; and by continuously monitoring their customer commitment by making improved customer satisfaction an ongoing objective. To maintain the relationships that are critical to delivering superior customer value, management must pay close attention to service, both before and after sales. In essence, a market-driven business develops a comprehensiveunderstanding of its customers' business and how customers in the immediate and downstream markets perceive value.

Three major components of market-driven transactions are

- customer orientation through product and service
- customization; cross-functional coordination through enterprise
- integration; and advertising, marketing, and customer service.

Information Brokerage and Management

The information brokerage and management layer provides service integration through the notion of information brokerages, the development of which is necessitated by the increasing information resource fragmentation. We use the notion of information brokerage to represent an intermediary who provides service integration between customers and information providers, given some constraint such as a low price, fast service, or profit maximization for a client. Information brokers, for example, are rapidly becoming necessary in dealing with the voluminous amounts of information on the networks. As on-line databases migrate to consumer information utilities, consumers and information professionals will have to keep up with the knowledge, and owner-ship/of all these systems. Who's got what? How do you use it? What do they charge? Most professionals have enough trouble keeping track of files of 1 interest on one or two database services. With all the complexity associated with large numbers of on-line databases and service bureaus, if it is impossible to expect humans to do the searching. It will have to be software programs-information brokers or software agents, to use the more popular term-that act on the searcher's behalf.

Information brokerage does more than just searching. It addresses the issue of adding value to the information that is retrieved. For instance, in foreign exchange trading, information is retrieved about the latest currency exchange rates in order to hedge currency holdings to minimize risk and maximize profit. In other words, the act of retrieving the information is the input to other transactions. With multiple transactions being the norm in the real world, service integration becomes critical. Taking the same foreign exchange example further,service integration allows one to link the hedging program (offered on a time-sharing basis by a third party) with the search program (could be another vendor) that finds the currency rates from the cheapest on-line service to automatically send trades to the bank or financial services company. In effect, a personalized automated trading system can be created without having to go to any financial institution. This is just one example of how information brokerages can add value.

Another aspect of the brokerage function is the support for data management and traditional transaction services. Brokerages may provide tools to accomplish more sophisticated, time-delayed updates or future compensating transactions. These tools include software agents, distributed query generator, the distributed transaction generator, and the declarative resource constraint basewhich describes a business's rules and-environment information. At the heart of this layer lies the work-flow scripting environment built on a software agent model that coordinates work and data flow among support services.

As pointed out earlier, software agents are used to implement information brokerages. Software agents are mobile programs that have been called "healthy viruses," "digital butlers/" and "intelligent agents." Agents are encapsulations of users' instruction that perform all kinds of tasks in electronic marketplaces spread across networks. Information brokerages dispatch agents capable of information resource gathering, negotiating deals, and performing transactions. The agents are intelligent because they have contingency plans of action. They examine themselves and their environment and if necessary

change from their original course of action to an alternative plan.

For example, suppose you send an agent to an on-line store with a request to order a bouquet of roses for $25 or less. If the shop offers roses starting at $30, your agent can either choose a different bouquet or find a different store by consulting an on-line “Yellow Pages” directory, depending on prior instructions.

Although the notion of software agents sounds very seductive, it will take a while to solve the problems of interregna communication, interoperable agents, and other headaches that come with distributed computing and net-working. To some critics, the prospect of a single-agent language like Telescript as a world standard is disturbing. They worry that agents sound a bit too much like computer viruses, which instead of running errands may run amok. Vendors such as General Magic go to great lengths to explain the precautions it has taken to make this impossible: the limits placed on the power of agents, the “selfdestruct” mechanism built into their codes. Yet until electronic commerce services are up and running on a large scale, it is impossible to know how well software agents will work.

Interface and Support Services

The third layer, interface and support services, will provide interfaces for electronic commerce applications such as interactive catalogs and will sup-port directory services-functions necessary for information search and access. These two concepts are very different. Interactive catalogs are the customized interface to consumer applications such as home shopping. An interactive catalog is an extension of the paper-based catalog andincorporates additional features such as sophisticated graphics and video to make the advertising more attractive.

Directories, on the other hand, operate behind the scenes and attempt to organize the enormous amount of information and transactions generated to facilitate electronic commerce. Directory services databases make data from any server appear as a local

file. A classic example of a directory is the telephone White Pages, which allows us to locate people and telephone numbers.

In the case of electronic commerce, directories would play an important role in information management functions. For instance, take the case of buying an airline ticket with several stopovers with the caveat that the time between layovers be minimized. This search would require several queries to various on-line directories to-find empty seats on various airlines and then the avail-ability of seats would; be coordinated with the amount of time spent in the air-port terminals.

The primary difference between the two is that unlike interactive catalogs, which deal with people, directory support services interact directly with soft-ware applications. For this reason, they need not have the multimedia glitter and jazz generally associated with interactive catalogs. From a computing perspective, we can expect that there will be no one common user interface that will glaze the surface of all electronic commerce applications, but graphics and object manipulation will definitely predominated. Tool developers and designers might incorporate common tools for interface building, but the shape of catalogs or directories will depend on the users’ desires and functional requirements.

Secure Messaging and Structured Document Interchange Services

The importance of the fourth layer, secured messaging, is clear.Everyone in business knows that electronic messaging is a critical business issue. Consider a familiar business scenario:

You hand over an urgent fax Monday and find out Tuesday that it’s still sitting on your fax operator’s desk. What happened?

The line was busy and he thought he’d try again later.Or, the number was wrong, but he forgot to let you know.

Or you’re in London and you need to send a spreadsheet that details a marketing plan for a product introduction strategy to a co-worker in New York. This must be done today, not tomorrow when the courier service would deliver. There is a solution to these common and frustrating problems. It’s called Integrated Messaging: a group of computer services that through the use of a network send, receive, and combine messages, faxes, and large data files. Some better-known examples are electronic mail, enhanced fax, and electronic data interchange.

Broadly defined, messaging is the software that sits between the network infrastructure and the clients or electronic commerce applications, masking the peculiarities of the environment. Others define messaging as a frame-work for the total implementation of portable applications, divorcing you from the architectural primitives of your system. In general, messaging products are not applications that solve problems; they are more enablers of the applications that solve problems.

Messaging services offer solutions for communicating non formatted (unstructured) data-letters, memos, reports as weft as-formatted (structured) data such as purchase orders,

shipping notices, and invoices. Unstructured messaging consists of fax, e-mail, and form-based systems like Lotus Notes. Structured documents messaging consist of the automated inter-change of standardized and approved messages between computer applications, via telecommunications lines.

Examples of structured document messaging include EDI. Messaging is gaining momentum in electronic commerce and seems to have many advantages. It supports both synchronous (immediate) and asynchronous (delayed) message delivery and processing. With asynchronous messaging, when a message is sent, work continues (software doesn’t wait for a response).This allows the transfer of messages through store-and-forward methods.

Another advantage of messaging is that it is not associated with any particular communication protocol. No preprocessing is necessary, although there is an increasing need for programs to interpret the message. Messaging is well suited for both client server and peer-to-peer computing models. In distributed systems, the messages are treated as “objects” that pass between systems.

Messaging is central to work-group computing that is changing the way businesses operate. The ability to access the right information at the right time across diverse work groups is a challenge. Today, with the messaging tools, people can communicate and work together more effectively-no matter where they are located. When an employee sends an electronic mail form, the information travels along with the form. So one person can start the form, mail it to the next person, fill it in/ sign it, mail it to the next, and so on. This is known as message-enabled workflow solutions.

The main disadvantages of messaging are the new types of applications it enables-which appear to be more complex, especially to traditional pro-grammers-and the jungle of standards it involves. Because of the lack of standards, there is often no interoperability between different messaging vendors leading to islands of messaging. Also, security, privacy, and confidentiality through data encryption and authentication techniques are important issues that need to be resolved for ensuring the legality of the message-based transactions themselves.

Middleware Services

Middleware is a relatively new concept that emerged only recently. Like so many other innovations, it came into being out of necessity. Users in the 1970s, when vendors, delivered homogeneous systems that worked, didn't have a need for middleware3&heR conditions changed-along with the hardware and the software the organizations couldn't cope: The tools were inadequate, the backlog was enormous, and the pressure was overwhelming. And, the users were dissatisfied. Something was needed to solve all the interface, translation, transformation, and interpretation problems that were driving application developers crazy.With the growth of networks, client-server technology, and all other forms of communicating between / among unlike platforms, the problems of get-ting all the pieces to work together grew from formidable to horrendous. as the cry for distributed computing spread, users demanded interaction between dissimilar systems, networks that permitted shared resources, and applications that could be accessed by multiple software programs.

In simple terms, middleware is the ultimate mediator between diverse software pro-grams that enables them talk to one another.

Another reason for middleware is the computing shift from application centric to data centric. That is, remote data controls all of the applications in the network instead of applications controlling data. To achieve data-centric computing, middleware services focus on three elements: transparency, transaction security and management, and distributed object management and services.

Transparency

Transparency implies that users should be unaware that they are accessing multiple systems. Transparency is essential for dealing with higher-level issues than physical media and interconnection that the underlying network infrastructure is in charge of. The

ideal picture is one of a "virtual" network: a collection of workgroup, departmental, enterprise, and inter enterprise LANs that appears to the end user or client application to be a seamless and easily accessed whole.

Transparency is accomplished using middleware that facilitates a distributed computing environment. This gives users and applications transparent access to data, computation, and other resources across collections of multi-vendor, heterogeneous systems. The strategic architectures of every major system vendor are now based on some form of middleware. The key to realizing the theoretical benefit of such architecture is transparency. Users need not spend their time trying to understand where something is. Nor should application developers have to code into their applications the exact locations of resources over the network. The goal is for the applications to send a request to the middleware layer, which then satisfies the request any way it can, using remote information.

Transaction Security and Management

Support for transaction processing (TP) is fundamental to success in the electronic commerce market. Security and management are essential to all layers in the electronic commerce model. At the transaction security level, two broad general categories of security services exist: authentication and authorization.

Transaction integrity must be a given for businesses that cannot afford any loss or inconsistency in data. Some commercial sites have had gigantic centralized TP systems running for years. For electronic commerce, middleware provides the qualities expected in a standard TP sys-tem: the so-called ACID properties (atomicity, consistency, isolation, and durability).

Distributed Object Management and Services

Object orientation is proving fundamental to the proliferation of network-based applications for the following reasons: It is too hard to write a net-work-based application without either extensive developer retraining or a technology that camouflages the intricacies of the network. Objects are defined as the combination of data and instructions acting on the data. Objects are an evolution of the more traditional programming concept of functions and procedures. A natural instance of an object in electronic commerce is a document. A document carries data and often carries instructions about the actions to be performed on the data. Today, the term object is being used interchangeably with document resulting in a new form of computing called document oriented computing. Here, the trend is to move away from single data-type documents such as text, pictures, or video toward integrated documents known as com-pound document architectures.

The best example of this approach is an active document. If you create a new document that is an integration of the spreadsheet, word processor, and presentation package, what you'll see in the next generation of operating systems is that as you scroll through your document, the tool bar will automatically change from a spreadsheet too bar, to a word processing tool bar, to a presentation package tool bar. These applications will also be able to access and retrieve data from any file in the computing network. The implications are clear: We're going to see a gradual movement toward active documents that will be designed out of linked applications.

Summary:

- The architectural framework of E Commerce focuses on synthesizing the diverse resources already in place in corporations to facilitate the integration of data and software for better applications.
- The electronic commerce application architecture consists of six layers of functionality, or services:

  (1) applications;

  (2) brokerage services, data or transaction management;

  (3) interface, and; support layers"

(4) secure messaging, security and electronic document interchange;

(5) middle ware and structured document interchange; and

(6) network infrastructure and basic communications services

- The application services layer of e-commerce categorizes three distinct classes of electronic commerce application: customer to business, business-to-business, and intra organization.
- The information brokerage and management layer provides service integration through the notion of information brokerage which represents an intermediary who provides service integration between customers and information providers, given some constraint such as a low price, fast service, or profit maximization for a client.
- The third layer, interface and support services provide interfaces for electronic commerce applications such as interactive catalogs and will sup-port directory services-functions necessary for information search and access
- Secure Messaging and Structured Document Interchange Services the fourth layer deals with the issues of security, privacy, and confidentiality through data encryption and authentication techniques
- Middleware the fifth layer is the ultimate mediator between diverse software pro-grams that enables them talk to one another.
- Last but not the least is the Network Infrastructure

Exercise:

1. What is the functionality of middleware in E-commerce
2. How do middleware provide transparency?
3. Discuss the security issue in middleware.
4. What do understand by C2b and B2B transaction?
5. Explain various layers in electronic commerce architecture

Notes