

UNIT 4: Electronic Data Interchange (EDI)

Course outline:

- Introduction to EDI
- EDI vs. E-mail
- EDI benefits
- How EDI works
- EDI application in various fields
- Security and privacy issues of EDI
- EDI for e-commerce

Introduction to Electronic Data Interchange (EDI)

As a cost-conscious, highly competitive electronic commerce environment comes of age, businesses are looking at **electronic data interchange (EDI)** in a new light. EDI is defined as the inter-process communication (computer application to computer application) of business information in a standardized electronic form. In short, EDI communicates information for business transactions between the computer systems of companies, government organizations, small businesses, and banks.

Using EDI, trading partners establish computer-to-computer links that enable them to exchange information electronically. This allows businesses to better cope with a growing avalanche (too many) of paperwork: purchase orders, invoices, confirmation notices, shipping receipts, and other documents. With the aid of EDI, all these documents are in electronic form, which aliases more work automation to occur and even alters the way business is done.

Many industries see EDI as essential for reducing cycle and order fulfillment times. Manufacturers work with customers and suppliers to convert to an electronic exchange the huge volume of orders and records that now crawl back and forth on paper. In retailing, EDI can provide vendors with a snapshot of what stores are selling, enabling them to recognize and meet

their customer's needs much faster than in the past. In addition, it enables retailers and vendors to place orders and pay bills electronically, reducing time and the expense of paperwork.

The primary benefit of EDI to business is a considerable reduction in transaction costs, by improving the speed and efficiency of filling orders. Studies show that it takes up to five times as long to process a purchase order manually as it does electronically.

Ironically, despite these advantages, EDI is not (yet) widely used. It is estimated that out of millions of businesses in the United States, only 44,000 companies exchange business data electronically. Only about 10 percent of these companies use EDI for financial transactions. Moreover, no more than fifty banks have the capability of providing complete financial EDI services to their corporate customers. The joke in industry is that most companies are so unfamiliar with EDI they don't even know how to spell it.

Background of Electronic Data Interchange: EDI developed in the 1960s as a means of accelerating the movement of documents pertaining to shipments and transportation. Not until the mid-1980s, however, was the technique used in a wide range of industries—automotive, retail, transportation, and international trade. Its use is growing and it is set to become the standard by which organizations will communicate formally with each other in the world of electronic commerce.

Electronic commerce is often equated with EDI, so it is important to clarify that electronic commerce embraces EDI and much more. In electronic commerce, EDI techniques are aimed at improving the interchange of information between trading partners, suppliers, and customers by bringing down the boundaries that restrict how they interact and do business with each other.

Technically speaking, EDI is one well-known example of structured document interchange which enables data in the form of document content to be exchanged between software applications that are working together to process a business transaction.

Emphasis must be placed on the fact that EDI only specifies a format for business information, that the actual transmission of the information is tackled by other underlying transport mechanisms such as e-mail or point-to-point connections.

Defining EDI: Because of the different approaches in the development and implementation of EDI, there is no one consensus on a definition of EDI. A review of some of the prevailing definitions follows:

Electronic data interchange is the transmission, in a standard syntax, of unambiguous information of business between computers of independent organizations. [The Accredited Standards Committee for EDI of the American National Standards Institute)

Electronic data interchange is the interchange of standard formatted data between computer application systems of trading partners with minimal manual intervention. [UN/EDIFACT Training Guide]

Electronic data interchange is the electronic transfer, from computer to computer, of commercial and administrative data using an agreed standard to structure an EDI message. [Article 2.1, of the European Model EDI agreement]

EDI Layered Architecture: EDI architecture specifies four layers: the **semantic** (or application) layer, the standards **translation** layer, the packing (or **transport**) layer, and the **physical** network infrastructure layer as shown in figure below.

EDI semantic layer	Application level services	
EDI standard layer	EDIFACT business form standards	
	ANSI X12 business form standards	
EDI transport layer	Electronic mail	X.435, MIME
	Point to point	FTP, TELNET
	World Wide Web	HTTP
Physical layer	Dial-up lines, Internet, I-way	

Fig: Layered Architecture of EDI

The **EDI semantic layer** describes the business application that is driving EDI. For a procurement application, this translates into requests for quotes, price quotes, purchase orders, acknowledgments, and invoices. This layer is specific to a company and the software it uses. In other words, the user interface is customized to local environments.

The information seen at the EDI semantic layer must be translated from a company-specific form to a more generic or universal form so that it can be sent to various trading partners, who could be using a variety of software applications at their end. To achieve this, companies must adopt universal EDI standards that lay out the acceptable fields of business forms. What complicates matters is the presence of two competing standards that define the content and structure of EDI forms: the **X12 standard**, developed by the American National Standards Institute (ANSI), and **EDIFACT**, developed by United Nations Economic Commission for Europe (UN /ECE).

When the trading partner sends a document, the EDI translation software converts the proprietary format into a standard mutually agreed on by the processing systems. When a company receives the document, their EDI translation software automatically changes the standard format into the proprietary format of their document processing software so that the company can manipulate the information in whatever way it chooses to.

Electronic Data Interchange versus E-mails

EDI document transport is far more complex than simply sending e-mail messages or sharing files through a network. These EDI documents are more structured than e-mail. What really differentiates EDI from messaging is its emphasis on the automation of business transactions conducted between organizations. In addition, EDI messages have certain legal status. For instance, if a buyer sends a supplier EDI purchase orders that specify the requirements, time of delivery, and quantity and the supplier does not uphold its end of the contract, it can be taken to court with the EDI trading agreements serving as evidence. Table below indicates some EDI properties which distinguish it from e-mail.

<i>Electronic Data Interchange (EDI)</i>	<i>Electronic Mail</i>
There is typically no human involvement in the processing of the information, as the interface has software-to-software orientation. The data are structured in a software-understandable way.	The data are not necessarily structured to be software-understandable. A human-to-software interface is involved at a minimum of one end of the interchange.
The interchange is composed by one software for interpretation by another software. If a reply is involved, it is composed by a software to be interpreted by another software.	The message is composed by a human and/or interpreted by a human and/or a reply is composed by a human and/or interpreted by a human.

Table: EDI versus E-mails

How EDI works?

The idea behind EDI is very simple. EDI seeks to take a form from a business application, translates that data into a standard electronic format, and transmit it. At the receiving end, the standard format is "untranslated" into a format that can be read by the recipient's application.

Hence output from one application becomes input to another through the computer-to-computer exchange of information. The result is an elimination of the delays and the errors inherent in paper-based transactions.

Benefits of EDI can be seen by comparing the flow of information between organizations before and after its implementation. For this purpose the purchasing application provides an ideal scenario. In general, EDI has been used extensively in the procurement function to streamline the interaction between the buyer and seller. Other uses for EDI are also available. For example, Universities use EDI to exchange transcripts quickly. Auto manufacturers use EDI to transmit large, complex engineering designs created on specialized computers.

Figure below shows the information flow when paper documents are shuffled between organizations via the mailroom. When the buyer sends a purchase order to a seller, the relevant data must be extracted from the internal database and recorded on hard copy. This hard copy is then forwarded to the seller after passing through several intermediate steps. Sellers receive information in the form of letters and in some cases a vast number of facsimiles. This information is manually entered into the internal information systems of the recipient by data entry operators. This process generates a considerable amount of overhead in labor costs and time delays. The reproduction of information also increases the risk of errors caused by incorrect data entries.

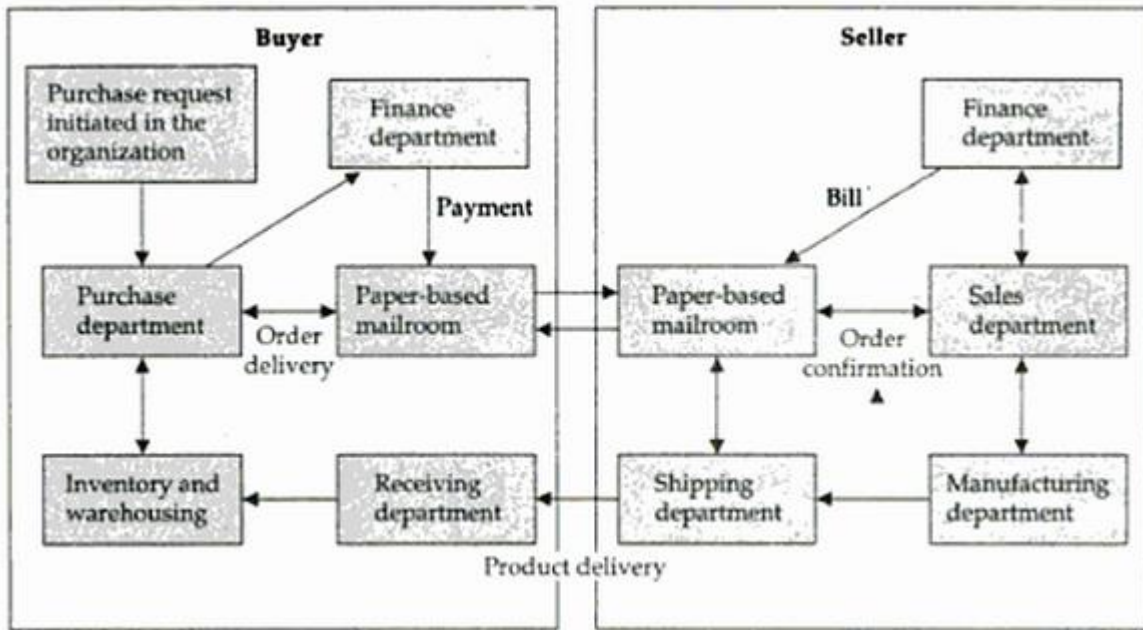


Fig: Information flow without EDI

This pervasive practice of converting digital data into hard copy data that is reconverted into electronic information again on the receiving end generates unnecessary costs. It is quite possible to exchange the information in its electronic format by means of EDI. EDI can substantially automate the information flow and facilitate management of the business process, as illustrated in Figure below.

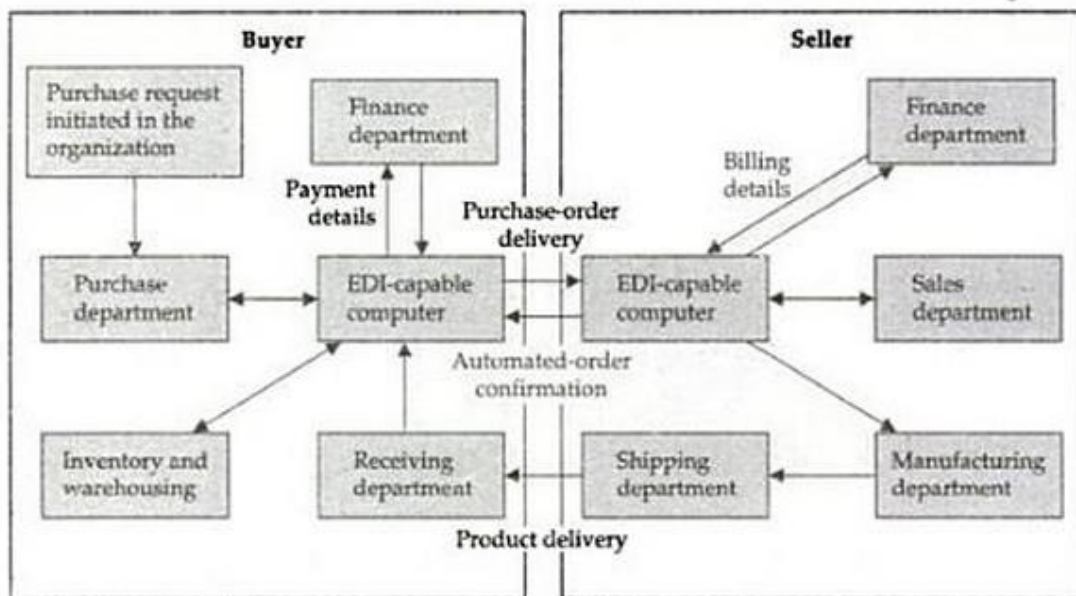


Fig: Information flow with EDI

The EDI transactions for a purchase, shipment, and corresponding payment are as follows:

Step 1: Buyer's computer sends **Purchase Order** to seller's computer.

Step 2: Seller's computer sends **Purchase Order Confirmation** to buyer's computer.

Step 3: Seller's computer sends **Booking Request** to transport company's computer.

Step 4: Transport company's computer sends **Booking Confirmation** to seller's computer.

Step 5: Seller's computer sends **Advance Ship Notice** to buyer's computer.

Step 6: Transport company's computer sends **Status** to seller's computer.

Step 7: Buyer's computer sends **Receipt Advice** to seller's computer.

Step 8: Seller's computer sends **Invoice** to buyer's computer.

Step 9: Buyer's computer sends **Payment** to seller's computer

In sum, firms are adopting EDI as a fast, inexpensive, and safe method of sending invoices, purchase orders, customs documents, shipping notices, and other frequently used business documents. The improved ability to exchange huge amounts of data in a fast and effective manner tends to speed up business processes.

Benefits of EDI

EDI can be a cost- and time-saving system, for many reasons. The automatic transfer of information from computer to computer reduces the need to rekey information and as such reduces costly errors to near zero. EDI transactions produce acknowledgments of receipt of data. Many firms are now finding that this acknowledgment can make the invoice obsolete and save many efforts now devoted to acquiring, receiving, and paying for goods.

For companies dealing with thousands of suppliers and tens of thousands of purchase orders a year, the savings from EDI are significant. For example, RJR Nabisco figures that purchase orders that previously cost between \$75 and \$125 to process now cost 93 cents. Companies can

also pay each other through "automated receipts settlement" or financial EDI, whereby electronic purchase order acknowledgments and shipping notices provide the data necessary for payment, further reducing paper.

Savings also accrue from the following improvements:

- 1. Reduced paper-based systems.** EDI can impact the effort and expense a company devotes to maintaining records, paper-related supplies, and to the personnel required to maintain all of these systems. Electronic transactions takeover most of the functions of paper forms and through automation drastically reduce the time spent to process them. EDI can also reduce postage bills because of the amounts of paper that no longer need be sent.
- 2. Improved problem resolution and customer service.** EDI can minimize the time companies spend to identify and resolve interbusiness problems. Many such problems come from data-entry errors somewhere along the way, and EDI can eliminate many of them. EDI can improve customer service by enabling the quick transfer of business documents and a marked decrease in errors land so can fill orders faster/ and by providing an automatic audit trail that frees accounting staff for more productive activities.

An example of problem resolution and customer service facilitated by EDI is the Vendor Stock Replenishment (VSR) initiated by retailers such as Wal Mart. This program requires that vendors maintain appropriate inventory levels in all stores. With VSR, stores do not run out of a product while suppliers or distributors wait for a purchase order from the headquarters. Suppliers and distributors send stock as soon as the store EDI system reports it is necessary and automatically bill the client. It cuts days, even weeks, from the order fulfillment cycle and ensures that the product is always on the shelf. The time savings come from not having to copy and fax/mail copies of invoices or purchase orders.

- 3. Expanded customer/supplier base.** Many large manufacturers and retailers with the necessary clout are ordering their suppliers to institute an EDI program. Today, when

evaluating a new product to carry or a new supplier to use, the ability to implement EDI is a big plus in their eyes. These same companies tend to stop doing business with suppliers who do not comply with EDI.

EDI Applications in various fields of Business

Although EDI was developed to improve transportation and trade, it has spread everywhere. In short, EDI has grown from its original (and somewhat limited) use as expeditor of the transfer of trade goods to facilitator of standard format data between any two computer systems.

An examination of EDI usage in various industries provides insight into the business problems that EDI is attempting to solve. We will present four very different scenarios in industries that use EDI extensively:

1. International or cross-border trade,
2. Financial EDI or electronic funds transfer (EFT),
3. Health care EDI for insurance claims processing, and
4. Manufacturing and retail procurement.

As these examples illustrate, companies have applied a number of EDI based solutions to improve business processes—for both strategic and competitive advantages. In some cases, EDI has transformed operational aspects of a company's business. Increased quality and cost reductions can significantly change industry standards of competition as innovators exert greater pressure on competitors to meet new standards of customer satisfaction and productivity. In others, EDI has shaped a company's marketing and distribution efforts by helping to create new distribution channels, develop new merchandising and market research methods, and introduce better customer service. In sum, major improvements in product manufacturing and customer service response time allow companies to be more competitive.

Let us describe the EDI business applications briefly:

1. International or cross-border trade

EDI has always been very closely linked with international trade. Over the last few years, significant progress has been made toward the establishment of more open and dynamic trade relations. Recent years have brought the General Agreement on Tariffs and Trade (GATT); the Free Trade Agreement (NAFTA) among the United States, Canada, and Mexico; and the creation of the European Union. These developments have meant the lifting of long-standing trade restrictions. Many countries, and in particular developing countries, have made significant efforts to liberalize and adjust their trade policies. In this context, trade efficiency, which allows faster, simpler, broader and less costly transactions, is a necessity. It is a widely held view that trade efficiency can be accomplished only by using EDI as a primary global transactions medium.

2. Financial EDI or electronic funds transfer (EFT)

Financial EDI comprises the electronic transmission of payments and remittance information between a payer, payee, and their respective banks. This section examines the ways business-to-business payments are made today and describes the various methods for making financial EDI payments.

Financial EDI allows businesses to replace the labor-intensive activities associated with issuing, mailing, and collecting checks through the banking system with automated initiation, transmission, and processing of payment instructions. Thus it eliminates the delays inherent in processing checks.

Types of Financial EDI: Traditionally, wholesale or business-to-business payment is accomplished using checks, EFT, and automated clearinghouses (ACH) for domestic and international funds transfer. ACH provides two basic services to industrial and financial corporate customers (including other banks): (1) fast transmission of information about their financial balances throughout the world, and (2) the movement of money internationally at rapid speed for settlement of debit/credit balances. Banks have developed sophisticated cash management systems on the back of these services that

essentially reduce the amount of money companies leave idly floating in low-earning accounts.

Thus, three principal types of noncash payment instruments currently used for business-to-business payments: **checks, electronic funds transfers, and automated clearinghouse (ACH) transfers.**

3. Health care EDI for insurance claims processing, and

Providing good and affordable health care is a universal problem. In 1994, the American public spent \$1 trillion on health care, nearly 15 percent of the gross domestic product (GDP). National health care expenditures have risen by 10.5 percent each year for the past eight years—more than double the rate of increase in the consumer price index. It is estimated that \$3.2 billion in administrative savings are expected to be achieved by switching from being paper-based to an EDI implementation. Employers could save \$70 million to \$110 million by using EDI for enrollment and to certify that a prescribed procedure is covered under the subscriber's health insurance contract.

4. Manufacturing and retail procurement.

Both manufacturing and retail procurement are already heavy users of EDI. In manufacturing, EDI is used to support just-in-time. In retailing, EDI is used to support quick response.

Just-in-Time and EDI: Companies using JIT and EDI no longer stock thousands of large parts in advance of their use. Instead, they calculate how many parts are needed each day based on the production schedule and electronically transmit orders and schedules to suppliers every day or in some cases every 30 minutes. Parts are delivered to the plant "just in time" for production activity.

Quick Response and EDI: Taking their cue from the efficiencies manufacturers have gained from just-in-time manufacturing techniques, retailers are redefining practices through the entire supply chain using quick response (QR) systems. For the customer, QR

means better service and availability of a wider range of products. For the retailer and suppliers, QR may mean survival in a competitive marketplace.

Much of the focus of QR is in reduction of lead times using event-driven EDI. Occurrences such as inventories falling below a specified level immediately trigger a chain of events including automatic ordering from one company's application directly into the other's application. In QR, EDI documents include purchase orders, shipping notices, invoices, inventory position, catalogs, and order status.

Security and privacy issues of EDI

Since in the case of EDI, we are dealing with trade between countries and corporations, issues of legal admissibility and computer security are important. Companies that deal with EDI often retain the services of a lawyer during the design of an EDI application so that the appropriate evidentiary/admissibility safeguards are implemented.

Legal Status of EDI Messages: There has been considerable debate concerning the legal status of EDI messages and electronic messages in general. Although a lot of work is being done on legal framework, nothing concrete has come out these efforts. No rules exist that indicate how electronic messages may be considered binding in business or other related transactions.

The establishment of such a framework is essential if EDI is to become widespread. To understand the legal status better, let's take a quick look at contract law. It distinguishes three modes of communication types: instantaneous communication, delayed communication via the U.S. Postal Service (USPS), and delayed communication via non-USPS couriers:

1. Instantaneous, If the parties are face to face or use an instantaneous communication medium such as the telephone, an offer or acceptance is held operable when spoken.
2. Delayed (USPS and non-USPS). The "mailbox rule" provides that an acceptance communicated via USPS mail or via telegram, mailgram, and probably electronic messaging systems, is effectively communicated when dispatched, or physically deposited in a USPS and non USPS mailbox.

Messaging systems combine features of both instantaneous and delayed communications. A message's delay is a function of the specific application, message routing, network(s) traversed, system configuration, and other technical factors typically unknown to the user. So, who assumes liability? If the U.S. mail or an overnight express service does not deliver a contract to the right addressee, it can be held responsible for any business losses caused by the error. Of course, liability also depends on the situation. In the case of EDI, however, the courts haven't decided who is liable if an EDI network fails to transmit a document or transmits a document to the wrong party. There is no legal precedence in this area (yet!).

Digital Signatures and EDI: The cryptographic community is exploring various technical uses of digital signatures by which messages might be time-stamped or digitally notarized to establish dates and times at which a recipient might claim to have had access or even read a particular message.

If digital signatures are to replace handwritten signatures, they must have the same legal status as handwritten signatures (documents signed with digital signatures must be legally binding). For example, an on-line "notarized time-stamping" service has been suggested that would accept a message and return one showing the date, time, and a digital signature binding the notarized message content and received date and time to the digital public notary. The digital signature provides a means for a third party to verify that the notarized object is authentic.

Digital signatures should have greater legal authority than handwritten signatures. For instance, if a ten-page contract is signed by hand on the tenth page, one cannot be sure that the first nine pages have not been altered. If the contract was signed by digital signatures, however, a third party can verify that not one byte of the contract has been altered.

EDI for e-commerce

The economic advantages of EDI are widely recognized. But until recently, companies have

been able to improve only discrete processes such as automating the accounts payable function or the funds transfer process. Companies are realizing that to truly improve their productivity they need to automate their external processes as well as their internal processes. This is the thrust of new directions in EDI.

New EDI services for electronic commerce are seen as the future bridge that automates external and internal business processes, enabling companies to improve their productivity on a scale never before possible. They present information management solutions that allow companies to link their trading community electronically—order entry, purchasing, accounts payable, funds transfer, and other systems interact with each other throughout the community to link the company with its suppliers, distributors, customers, banks, and transportation and logistics operations.

Another goal of new EDI services is to reduce the cost of setting up an EDI relationship. These costs are still very high because of the need for a detailed bilateral agreement between the involved business partners and for the necessary technical agreements. Therefore most successful EDI implementations are either in long-term partnerships or among a limited number of partners. With the advent of inter-organizational commerce, several new type of EDI are emerging that can be broadly categorized as **traditional EDI** and **open EDI**.

Traditional EDI: Traditional EDI replaces the paper forms with almost strict one-to-one mappings between parts of a paper form to fields of electronic forms called transaction sets. Traditional EDI covers two basic business areas:

- i) Trade data interchange (TDI) encompasses transactions such as purchase orders, invoices, and acknowledgments.
- ii) Electronic funds transfer (EFT) is the automatic transfer of funds among banks and other organizations.

Today, traditional EDI is divided into two camps: old EDI and new EDI. Old EDI is a term created by those working on the next generation of EDI standards in order to differentiate between the present and the future.

Old EDI refers to the current practice of automating the exchange of information pertinent to the business activity. Information that is generated by the business process of one computer is transferred electronically and effects a corresponding business process in another computer. Old EDI is also used to refer to the current EDI-standardization process (e.g., X12, EDIFACT) where tens of thousands of people in groups (or working committees) all around the world are attempting to define generic document interchanges (e.g., purchase orders) that allow every company to choose its own, unique, proprietary version (that is a subset of the original transaction set).

New EDI is really a refocus of the standardization process. With old EDI, the standardization is focused on the interchange structure, on the transaction set in X12 or the message in EDIFACT. With new EDI the structure of the interchanges is determined by the programmer who writes the business application program, not by the lengthy standards process.

Open EDI provides a framework where two potential trading partners can whip out an EDI structure for their potential partnership in the short time frame that it takes them to draw up and negotiate the legal contracts. The increased interest in open EDT is a result of dissatisfaction with traditional EDI. Open EDI is a business procedure that enables electronic commerce to occur between organizations where the interaction is of short duration. In essence, open EDI is the process of doing EDI without the upfront trading partner agreement that is currently signed by the trading partners before they commence trying to do business by EDI.