UNIT IV

4.1 Electronic Data Interchange (EDI)

The birth of EDI, like that of many other technologies, has an interesting story. In 1964, an innovative sales manager at the American Hospital Supply Company (AHSC) developed a system whereby its customers (the hospitals) could dramatically improve their inventory management costs. In those days, punched cards were used as input-output media, for reading as well as writing data from and to external sources. The AHSC manager created a deck of punch cards for all the items that a hospital could require. The system allowed the person looking after purchases and inventory at the hospital to use these punched cards to enter purchase requests as and when necessary. The cards at the hospital's end were fed into a punched card reader, and the information read by the card reader was sent across to AHSC across the normal telephone lines. A punched card machine with empty cards would receive this electronic information via the telephone network by virtue of being connected to it. It would then output the information exactly as it read on punched cards at AHSC.

This Electronic Data Interchange dramatically improved the accuracy and efficiency for a number of hospitals that were ordering their supplies from AHSC. Soon, the problems of incorrect information, loss of information and delay in placing an order and receiving the delivery were almost completely eliminated. The hospitals were thus able to eliminate inventory shortages as well as inventory stacks. Over the last several decades, this basic approach is used in all EDI systems to enable an effective and standardized business document exchange process.

On the positive side, EDI has helped businesses in gaining tremendous competitive advantage. This is due to the lower costs involved (over a period of time), tighter one-to-one link with the trading partners and product differentiation. During this time, EDI has transformed from a one-to-one system to a very powerful and extremely complex electronic market that is made up of industry suppliers, producers, network operators and customers. However, it involves major costs in VANs (or dedicated leased lines), EDI software, etc., limiting its widespread usage.

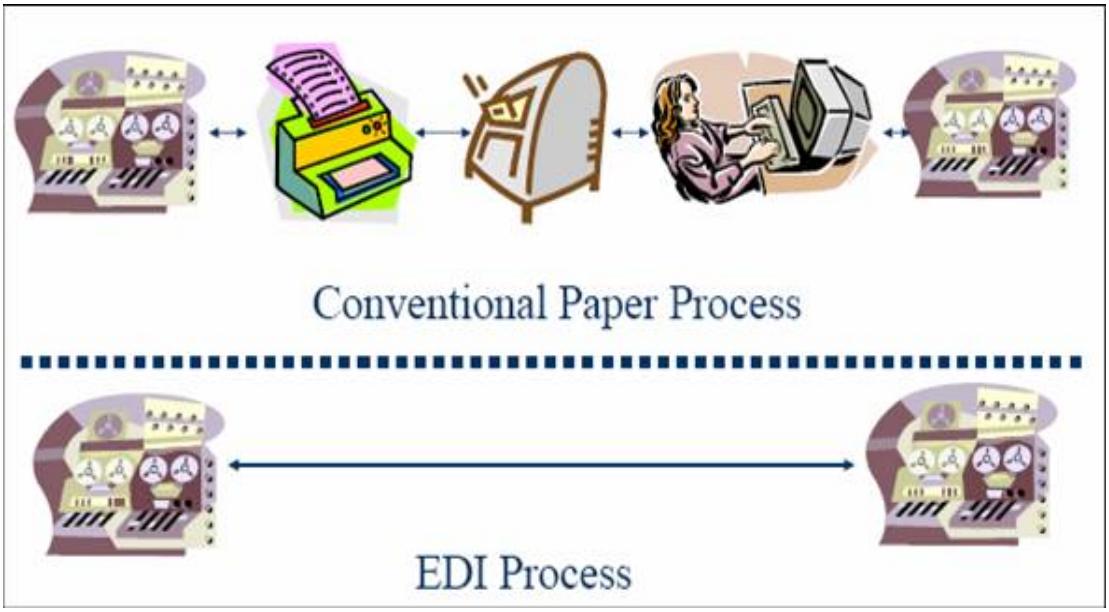
4.2 Definition of EDI:-

Electronic Data Interchange is the **computer-to-computer** exchange of **routine business data** between trading partners in **standard data formats**. This definition contains 3 key concepts about EDI:

1. Computer-to-computer: EDI in its most efficient form flows directly out of a sender's computer system directly into a receiver's computer system without any human intervention; however, it is not always possible for EDI to flow in this most efficient manner.

2. Routing business data: EDI is used for routine business documents like Purchase Orders and Invoices. It is not used for non-routine business documents like complicated contracts or information meant for humans to read and analyze.

3. Standard data formats: A standard definition of the location and structure of the data is provided. Unstructured text is not EDI.



The diagram above illustrates how much slower the conventional paper process than the EDI process. Additionally, the conventional paper process includes substantially more human intervention to move business information from one company to another.

The conventional process requires someone to handle a printed computer generated form and mail it. Then, the recipient re-keys the data back into another computer for their internal processing. (It is estimated that 80% of the data that is keyed into computers is output from other computers!) The EDI process is a computer transmitting the information directly to another computer, eliminating the paperwork and human intervention.

4.3 Advantages of EDI

1. Reduced lead-time from placing an order to actually receiving goods.
2. Substantial decrease in the number of errors due to manual data entry and paperwork.
3. Reduction in overall processing costs.
4. Availability of information all the time.
5. Provision for planning future activities in a far better and organized manner. Building long-term relationships between trading partners.

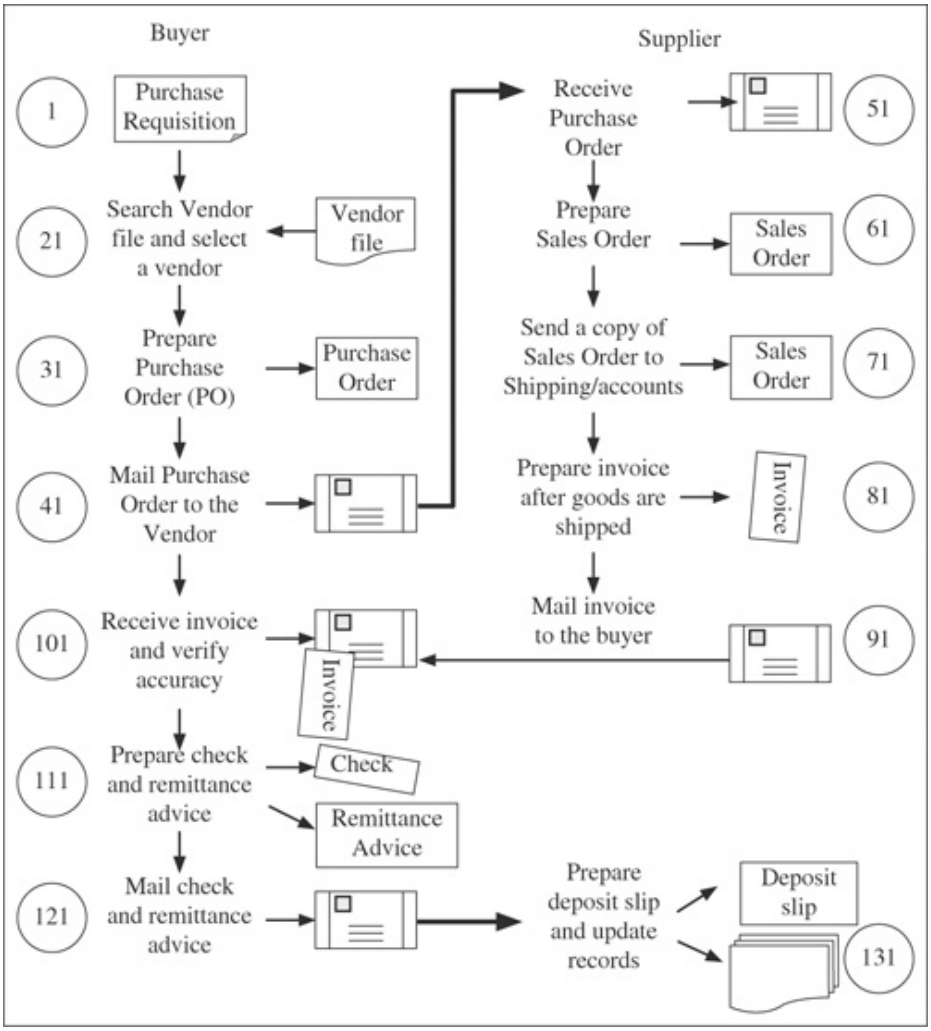
4.4 Dis- advantages of EDI

1. Since EDI is a structured way of working, companies usually change operating procedures.
2. Responsibilities may have to be changed during the introduction of EDI system. Unless this system and the links with other systems are managed well, it is not possible for the data processing department to become involved in production and purchasing decisions
3. Less transparent than paper-based systems.
4. Certain EDI systems are highly flexible, other are very simple to implement.
5. Users have developed systems to take advantage of the FAX machine which may avoid portal delays. Acknowledgment could be received through FAX.

4.5 Types of EDI

4.5.1 Non-EDI systems

EDI is primarily used by two categories of businesses: (a) Large business houses, and (b) Smaller companies that trade with large business houses. Figure 2 shows how a procurement cycle happens when the business is not using EDI systems.



Workflow of a Purchase Order in a non-EDI system

The left hand portion of the figure shows the operations that take place inside the large business house for initiating the procurement request. The right hand portion shows what happens in the supplier's house, when they are trying to fulfil the procurement request. We have assumed in the example that the goods ordered are available in the warehouse for immediate dispatch. (Then they do not have to be procured or manufactured by the organization [depending on whether it is retail or manufacturing organization])

1. The production-planning department, or any other department that needs some equipment or items to be procured, within the buyer organization, completes the purchase requisition.

2. A person in the purchasing department then searches the vendor files to find out which vendors (i.e., suppliers) supply these items. Negotiations about prices and delivery schedule may take place here, after selecting the vendor based on the criteria such as quality, price and timely delivery.

3. Based on this search, the person prepares a purchase order. The purchase order contains details such as the items to be purchased, quantities, prices, discounts delivery address and schedule, etc., apart from, obviously, the vendor name and address, etc.

4. This purchase order is then physically mailed to the vendor.

5. The supplier receives the purchase order, which was mailed by the buyer.

6. Based on the details contained therein, the supplier has to deliver these items to the buyer. Therefore, the sales department of this supplier now prepares a sales order. The sales order contains the items to be sold, to which party, by what date, at what price, etc.

7. A copy of the sales order is then sent to the warehouse, so that they can keep the items ready. The warehouse then dispatches the goods, after they are ready. Another copy is sent to the accounts department, etc. As mentioned earlier, we have assumed a trading organization. If it is a manufacturing organization, a sales order may result into a shop floor order to manufacture the goods before they are dispatched.

8. After the goods are dispatched, a delivery or dispatch note is prepared stating the goods as well as their quantities (if quantity available is less than the quantity ordered, goods have be dispatched in parts). Using the delivery or dispatch note, the sales department of the supplier prepares an invoice for the goods sold.

9. The supplier then sends the invoice to the Accounts Department. Many a times this is sent along with the dispatch note.

10. The purchase department at the purchasing organization receives the goods and prepares a Goods Receipt Note (GRN) mentioning the goods received and accepted (quality checked) with respect to one (or more) purchase order (s), and sends it to the Accounts Department.

11. The Accounts Department tallies the GRN with the vendor's invoice to ensure that everything is OK. After this, the invoice (or bill) is approved for payment.

12. Once the accuracy of the invoice is approved for payment, the Account Department prepares a check for payment, and the corresponding remittance advice.

13. The Accounts Department then sends the check and the remittance advice by mail to the seller.

14. The Accounts Department at the selling organization receives the check and the remittance advice. It verifies the details and updates its own records.

This system has several undesirable features, as described below.

1. There are too many clerical people from too many departments (such as purchase, sales, inventory controls, accounts payable and receivable, cash, etc.) involved in this process. This is true for both the purchasing as well as the selling organization.
2. The process is time consuming. Since there is scope for plenty of paperwork and manual interventions, this is unavoidable.
3. The scope for errors is also high. At every stage, each document needs to be manually examined, and certified.

Since organizations felt the need for making their purchases with minimum delay and costs, they thought of using more advanced tools and technologies. This was the reason for EDI systems getting prominence.

However, it should be noted that EDI plays a role in exchanging documents such as sales and purchase order, invoices, etc., electronically and speedily. The other processes like checking the available inventory stocks, dispatching, updating the inventory records, matching the GRN (Goods Receipt Note) and the PO(Prepare Purchase Order) and the invoice for approving the bills or invoices for payment, etc., is a part of general data processing. EDI only compliments it. Once a sales order becomes a purchase order directly through the EDI process, the remaining process has nothing to do with EDI.

4.5.2 Partially integrated EDI systems

Not all EDI systems are fully automated to the extent that they could be. In many situations, organizations employ a partially integrated EDI system. In such a scenario, the purchase order process begins in the same way as it does in case of a manual purchase order system. However, it then shifts to EDI-based features, as shown in figure 3, and discussed step-by-step.

The process involved in a partially integrated EDI system, step-by-step.

1. The process begins with a requesting department completing a purchase requisition form, just like a manual system. This form arrives at the purchasing department.

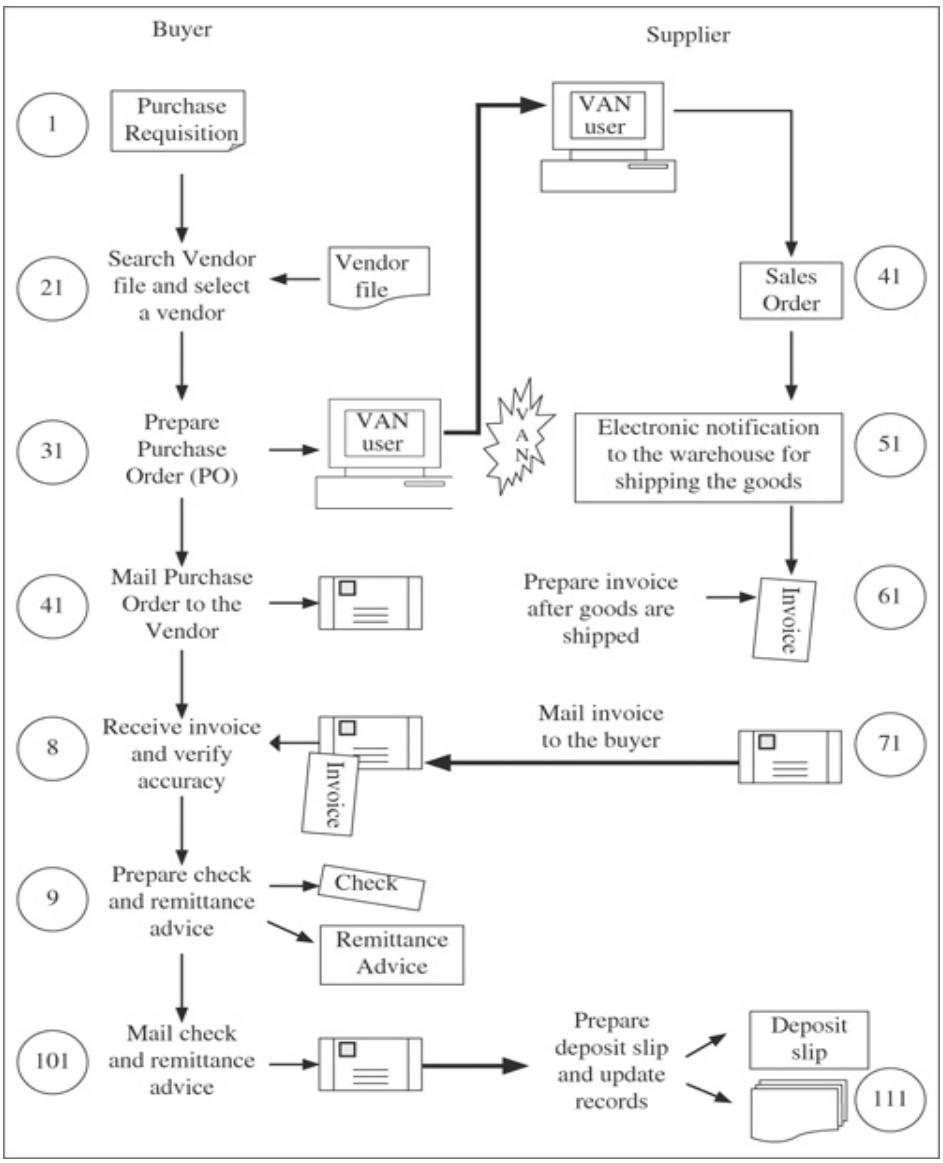
2. A person working in the purchasing department receives the purchase requisition form and reviews it. He might combine it with many other purchase requisitions, if they are similar in nature, to take advantage of quantity discounts. The person then manually consults a list of vendors for availability of the item, and its price, etc.

3. From this point, the EDI process takes over. This marks the end of the manual system. Rather than manually creating a purchase order (PO) and sending it, the person in the purchasing department now logs on to a computer system that shows him an online purchase order form. The person enters the appropriate data similar to what he would have done in the manual system, and submits the purchase order to the computer system upon entering data in all the necessary fields. Note that the computer system is now responsible for checks to ensure that the data is correct, and also to perform operations such as calculating totals, basic validations, etc.

4. Now, the VAN takes over, and routes the purchase order to the mailbox of the appropriate vendor in a secure fashion. The VAN is responsible for ensuring that the purchase order travels successfully across to the vendor (supplier), without errors.
5. At the vendor's end, the VAN retrieves this document, and automatically produces a sales order out of it. Note that another data entry step is removed here, thus reducing the chances of errors further. This might follow by an automatic credit checking procedure, which can be done either by the EDI systems, or can be a part of the organization's computer application.
6. The EDI system at the vendor's end would send an electronic notification to the warehouse personnel for shipping the goods.
7. At this stage, the role of the EDI system would end. The remaining steps would be manual or done by a computer system outside of EDI, similar to a non-EDI system, involving invoice-processing functions. We shall not repeat these steps, as they are described in steps 8 to 14 of the description of a non-EDI system earlier.

Historically, it is observed that a partially integrated EDI system reduces the time required for completing the chain of events by about three to seven days.

The reason for this is the elimination of traditional methods such as manual data entry and checks, use of postal services for dispatching documents, etc. Also, the scope for a lot of paperwork, and therefore, the possibility of errors and duplication of information, is reduced.



Partially integrated EDI

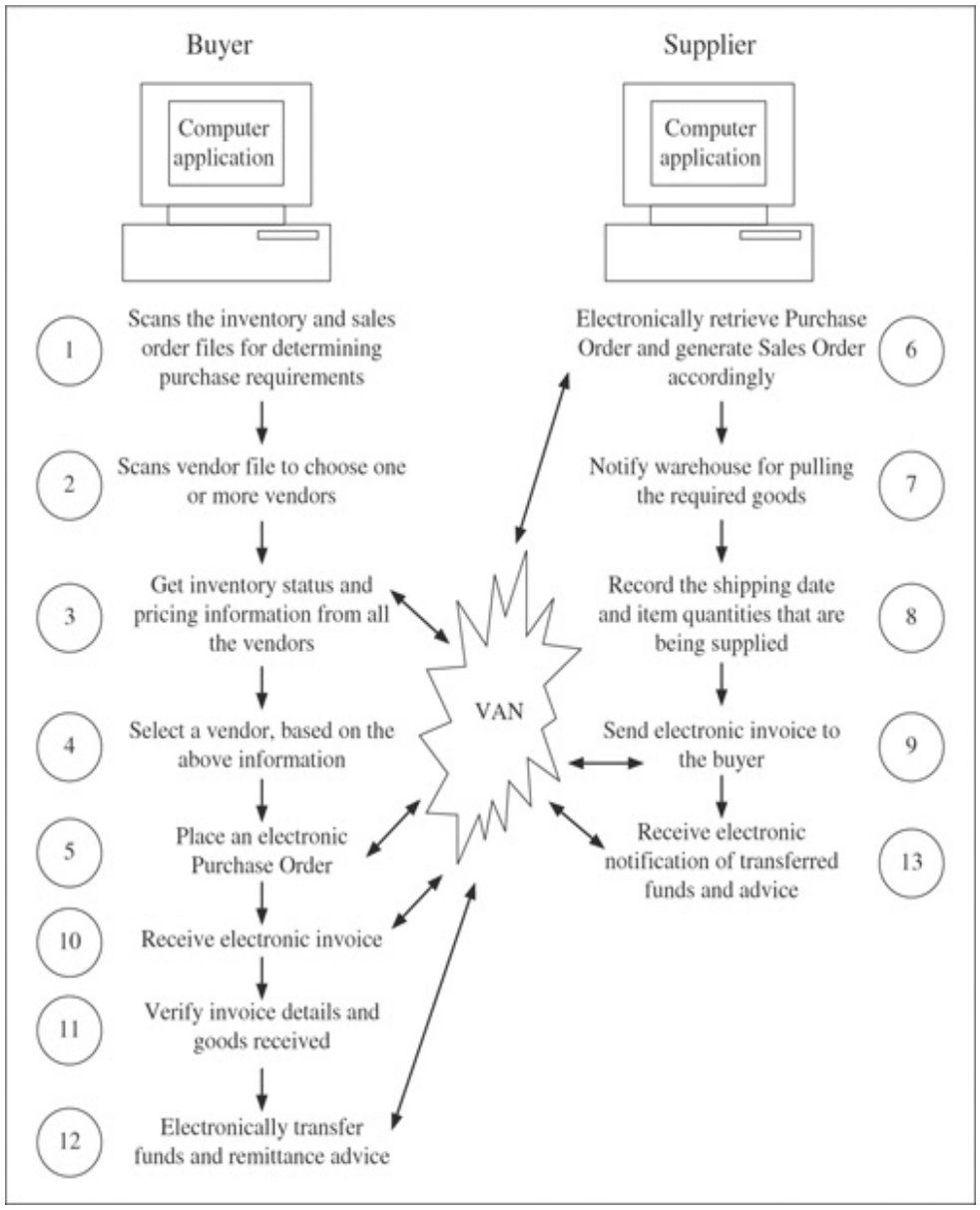
4.5.3 Fully integrated EDI

Rather than using EDI systems in bits and pieces, as it is done in case of the partially integrated EDI, fully integrated EDI employs the EDI technology to the entire lifecycle of an activity, such as a purchase order processing.

A sub-portion of the fully integrated EDI deals with the actual payment and remittance advice processing, and is called as financial EDI.

Fully integrated EDI provides for speed and accuracy of information processing. Of course, this comes at the cost of expensive set up and maintenance of the EDI systems. In fully integrated EDI, almost everything is left to the

automated processing features of EDI with the help of computer-based systems. The only human interventions required are for activities such as pulling goods out from a warehouse, and loading them into a vehicle for dispatch. The rest is the EDI system's responsibility.



Fully integrated EDI system

Moreover, fully integrated EDI systems also allow the purchaser's computer system to electronically query the inventory levels and the planned production schedules, so that the requested item can be procured, if required. Of course, other backend systems such as SAP and ERP or backend applications developed in-house provide this data. But the point is that EDI systems can connect to them. The errors in such a scenario are minimal as there is virtually no human action involved. For instance, when the goods arrive, the purchasing system uses computer-generated data to compare its original purchase order with the invoice of the goods actually received, to see if the two match. If everything is correct, the supplier's invoice is approved for payment. After this, based on the situation of the funds, the money can be electronically transferred from the purchaser's account to the vendor's account, and appropriate

accounting entries can be made in their respective systems. The number of people, amount of paperwork, and duplication of information are all minimum in such a situation.

4.6 Value-Added Networks (VANs)

- A VAN is a communication network that typically exchanges EDI messages among trading partners.
- It provides services, including holding messages in "electronic mailboxes", interfacing with other VANs
- Disadvantage is EDI-enabling VANs is that they are slow & high-priced, charging by the no. of characters transmitted

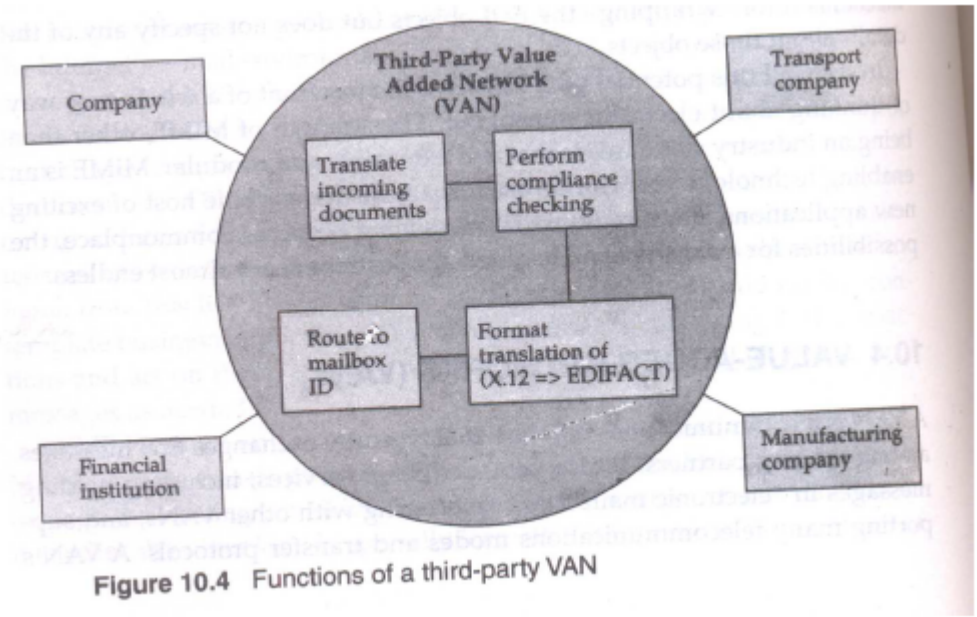


Figure 10.4 Functions of a third-party VAN

4.7 EDI & Electronic Commerce

1. Traditional EDI

It 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.

It covers two basic business areas:

1. Trade data Interchange (TDI) encompasses transactions such as purchase orders, invoice & acknowledgements.
2. Electronic Funds Transfer (EFT) is the automatic transfer of funds among banks & other organizations

   It is divided into 2 camps: old EDI & new EDI.

   Old EDI

   - Automating the exchange of information pertinent to business activity
   - It is referred as the current EDI-standardization process where it allows every company to choose its own, unique, proprietary version

New EDI

- It is refocusing of the standardization process.
- In this, the structure of the interchanges is determined by the programmer who writes a program.
- It removes long standardization process.

2. Open EDI

- It is a business procedure that enables e-commerce to occur between organizations where the interaction is of short duration.
- It is process of doing EDI without the upfront trading partner agreement that is currently signed by the trading partners
- The goal is to sustain ad hoc business or short-term trading relationships using simpler legal codes.
- It is a law of contract within the context of e-commerce where transactions are not repeated over long period of time.

4.8 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!).

Security Issues in EDI

The types of security controls networks should have are crucial when your organization adopts EDI as you and your trading partners are entrusting some of your most crucial and confidential data to the network.

Securing an EDI system is much like securing any kind of computer network with this difference : EDI extends to more than one company. Not only must organizations make sure their system is secure, but their trading partners must all do the same.

A full EDI security system should include three levels of security:

- **Network level security:** This level of security basically screens users accessing a particular network. With a set of account/user identification codes coupled with the corresponding passwords, authorized users will be able to log into the network and to perform transactions (that is, sending and receiving of EDI messages) across the network. This level of security ensures that users not registered in the EDI network are not able to gain access to its facilities.
- **Application level security:** Beyond network security, application level security can also be put in place. This level of security is usually controlled by the individual front-end EDI application (or software).
  In any given EDI application or software, there might be some data you are not allowed to see, some you can see but not alter, some to which you can add information and some where you can change existing information. Application level security makes use of passwords to admit different catagories of users to the different levels of application to which they can gain access. For example, a clerical staff may only be given authority to key in data in an electronic purchase order but not the authority to send the EDI document to the supplier. A higher level managerial staff may hold a password which allows him to view the data keyed in by the clerical staff, make the necessary corrections and send the document out.
  A system administrator is usually appointed to oversee the EDI application to maintain a system that both identifies the data and monitors which password holders shall be given and to decide on the kind of access to the system
- **Message level security:** Message level security can also be put in place to combat unauthorized disclosure of message content, non-bona fide messages, duplication, loss or replay of messages, deletion of messages and repudiation of message responsibility by its sender or its receiver. To counter these, EDIFACT has in place several methods of message-level security:
  I. **Encryption**: The idea of data encryption is that data, whether on screen or as ASCII within a computer system, can be totally enciphered by a transmission process, and on receipt by an authorized user can be reconstituted into its original format. This method of security is used to ensure confidentiality of contents and protects against unauthorized reading, copying or disclosure of message content.
  II. **Message authentication:** Message authentication, or a MAC (Message Authentication Code), can be applied to a whole message or only part of a message. The idea behind the MAC process is to ensure that only authorized senders and receivers correspond and that no one is impersonating another correspondent.
  III. **Message sequence numbers:** Message sequence numbers are used to protect against duplication, addition, deletion, loss or replay of a message.
  IV. **Hashing:** Hashing is a technique used to protect against modification of data. Message content integrity can be achieved by the sender including with the message an integrity control value (or known as hash value). The receiver of the message computes the integrity control value of the data actually received using the corresponding algorithms and parameters and compares the result with the value received.
  V. **Digital signatures**: Digital signatures protects the sender of a message from the receiver's denial of having received the message. The use of digital signatures can also protect the receiver of a message

from the sender's denial of having sent the message. Protection can be achieved by the sender by including a digital signature with the transmitted message. A digital signature is obtained by encrypting, with an asymmetric algorithm. The digital signature can be verified by using the public key which corresponds to the secret key used to create it. This public key may be included with the interchange agreement signed by the parties. The use of digital signatures provides not only non-repudiation of origin and receipt, but also message content integrity and origin authentication.

4.9 EDI business applications

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.
3. **Health care EDI for insurance claims processing:** 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.

a. 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 its some cases every 30 minutes. Parts are delivered to the plant "just in time" for production activity.

b. 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.

4.10 EDI Standards

Standardization & EDI

Standards translation

- Specifies business form structure so that information can be exchanged
- Two competing standards
  – American National Standards Institute (ANSI) X12
  – EDIFACT developed by UN/ECE, Working Party for the Facilitation of International Trade Procedures

Structure of EDI transactions

- Transaction set is equivalent to a business document, such as a purchase order
- Data Segments are logical groups of data elements that together convey information
- Data elements are individual fields, such as purchase order no.

Comparison of EDIFACT & X.12 Standards

- These are comprised of strings of data elements called segments.
- A transaction set is a set of segments ordered as specified by the standard.
- ANSI standards require each element to have a very specific name, such as order date or invoice date.
- EDIFACT segments, allow for multiuse elements, such as date.
- EDIFACT has fewer data elements & segments & only one beginning segment (header), but it has more composites.
- It is an ever-evolving platform

4.11 EDI Software Implementation

EDI software has 4 layers:

1. Business application
2. Internal format conversion
3. EDI Translator
4. EDI envelope for document messaging

These 4 layers package the information & send it over the value-added network to the target business, which then reverses the process to obtain the original information

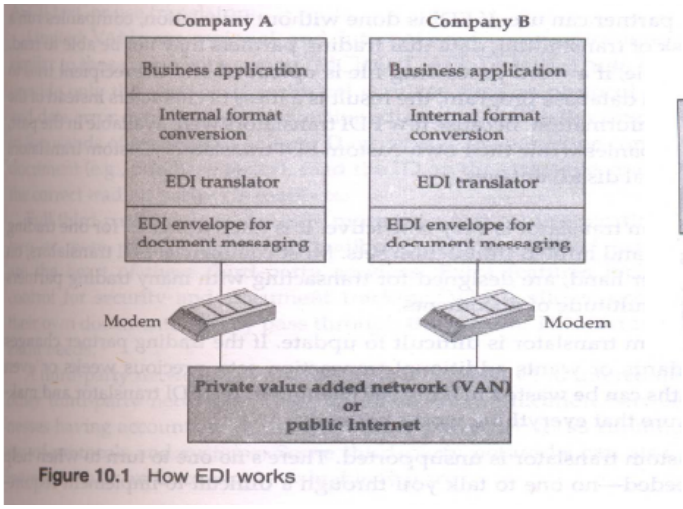


Figure 10.1 How EDI works

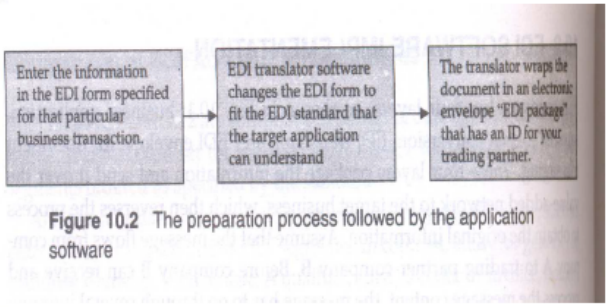


Figure 10.2 The preparation process followed by the application software