Unit- II

Types of Electronic Payment Systems

- Electronic payment systems are proliferating in banking, retail, health care, on-line markets, and even government—in fact, anywhere money needs to change hands.

- Organizations are motivated by the need to deliver products and services more cost effectively and to provide a higher quality of service to customers.

- The emerging electronic payment technology labeled electronic funds transfer (EFT).

- EFT is defined as "any transfer of funds initiated through an electronic terminal, telephonic instrument, or computer or magnetic tape so as to order, instruct, or authorize a financial institution

EFT can be segmented into three broad categories:

- Banking and financial payments

    – Large-scale or wholesale payments (e.g., bank-to-bank transfer)

    – Small-scale or retail payments (e.g., automated teller machines)

    – Home banking (e.g., bill payment)

- Retailing payments

    – Credit Cards (e.g., VISA or MasterCard)

    – Private label credit/debit cards (e.g., J.C. Penney Card)

    – Charge Cards (e.g., American Express

- On-line electronic commerce payments

    – 1. Token-based payment systems

        - Electronic cash (e.g., DigiCash)

        - Electronic checks (e.g., NetCheque)

        - Smart cards or debit cards (e.g., Mondex Electronic Currency Card))

    – 2. Credit card-based payments systems

        - Encrypted Credit Cards (e.g., World Wide Web form-based encryption)

        - Third-party authorization numbers (e.g., First Virtual)

1) Digital Token-Based Electronic Payment Systems

Electronic tokens are three types:

1. Cash or Real-time

- Transactions are settled with exchange of electronic currency.

- Ex: on-line currency exchange is electronic cash (e-cash).

2. Debit or Prepaid

- Users pay in advance for the privilege of getting information.

- Ex: prepaid payment mechanisms are stored in smart cards and electronic purses that store electronic money.

3. Credit or Postpaid

- The server authenticates the customers and verifies with the bank that funds are adequate before purchase.

- Ex: postpaid mechanisms are credit/debit cards and electronic checks.

Properties of Electronic Cash:

- There are many ways that exist for implementing an e-cash system, all must incorporate a few common features.

- Specifically, e-cash must have the following four properties:

1. Monetary value

2. Interoperability

3. Retrievability

4. Security

Electronic Cash in Action

- Electronic Cash is based on cryptographic systems called "digital signatures".

- This method involves a pair of numeric keys: one for locking (encoding) and the other for unlocking (decoding). (Through public key and private key).

Purchasing E-cash from Currency Servers

The purchase of e-cash from an on-line currency server (or bank) involves two steps:

- Establishment of an account and

- Maintaining enough money in the account to bank the   purchase.

Some customers might prefer to purchase e-cash with paper currency, either to maintain anonymity or because they don't have a bank account.

Using the Digital Currency

- Once the tokens are purchased, the e-cash software on the customer's PC stores digital money undersigned by a bank.

- The users can spend the digital money at any shop accepting e-cash, without having to open an account there or having to transmit credit card numbers.

- As soon as the customer wants to make a payment, the software collects the necessary amount from the stored tokens.
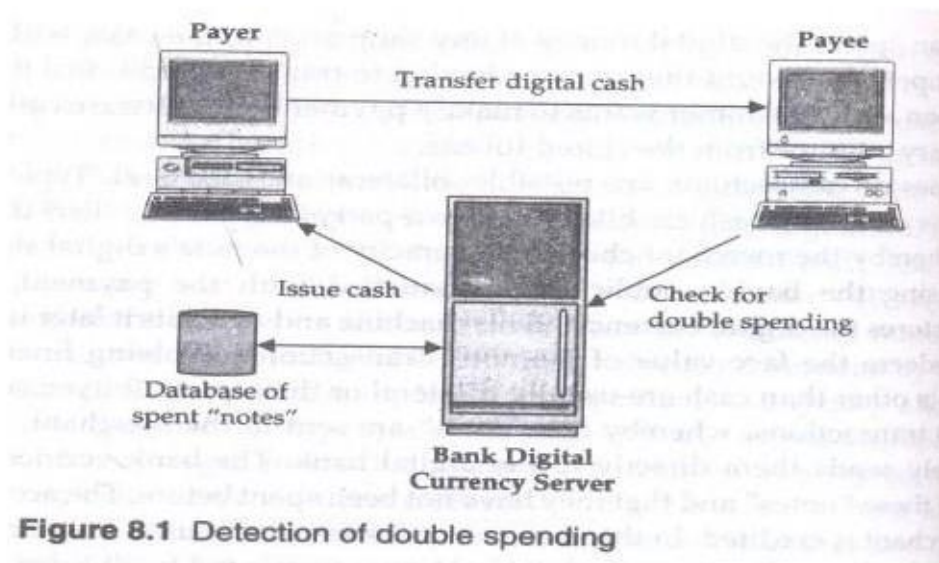

Figure 8.1 Detection of double spending

Electronic Checks

- It is another form of electronic tokens.

- In the given model shown in fig, buyers must register with third-party account server before they are able to write electronic checks.

- The account server acts as a billing service.

- The advantages are:

1. They work in the same way as traditional checks.

2. These are suited for clearing micropayments

3. They create float & availability of float is an important for commerce

4. Financial risk is assumed by the accounting server & may result in easier acceptance

Figure 8.2 Payment transaction sequence in an electronic check system
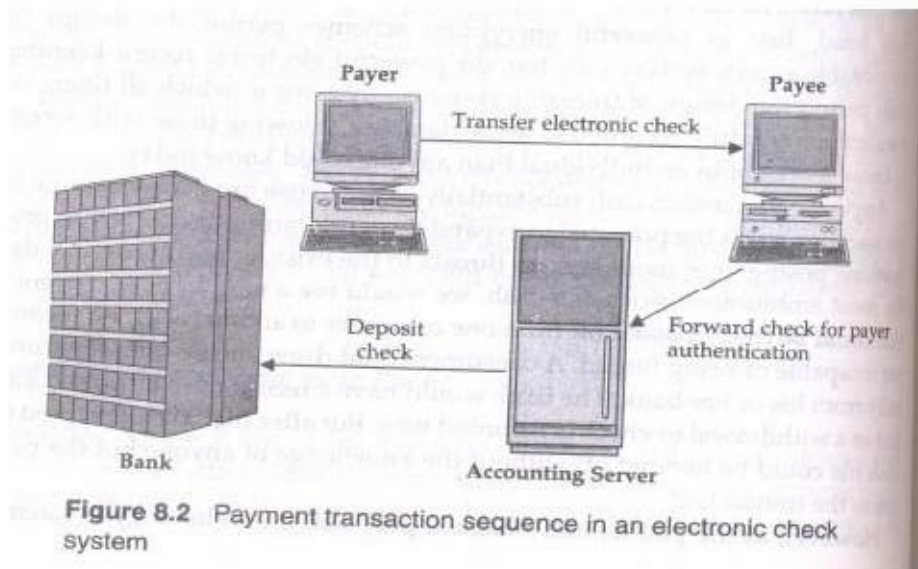
Smart Cards & Electronic Payment Systems

- Smart cards have been in existence since the early 1980s and hold promise for secure transactions using existing infrastructure.

- Smart cards are credit and debit cards and other card products enhanced with microprocessors capable of holding more information than the traditional magnetic stripe.

- The smart card technology is widely used in countries such as France, Germany, Japan, and Singapore to pay for public phone calls, transportation, and shopper loyalty programs.

Smart cards are basically two types:

- Relationship-Based Smart Credit Cards

- Electronic Purses, which replace money, are also known as debit cards and electronic money.

Relationship-Based Smart Credit Cards

- It is an enhancement of existing cards services &/ or the addition of new services that a financial institution delivers to its customers via a chip-based card or other device

- These services include access to multiple financial accounts, value-added marketing programs, or other information card holders may want to store on their card

- It includes access to multiple accounts, such as debit, credit, cash access, bill payment & multiple access options at multiple locations

Electronic Purses

- To replace cash and place a financial instrument are racing to introduce "electronic purses", wallet-sized smart cards embedded with programmable microchips that store sums of money for people to use instead of cash for everything

- The electronic purse works in the following manner:

1. After purse is loaded with money at an ATM, it can be used to pay for candy in a vending machine with a card reader.

2. It verifies card is authentic & it has enough money, the value is deducted from balance on the card & added to an e-cash & remaining balance is displayed by the vending machine.

2) Credit Card-Based Electronic Payment Systems

Payment cards are all types of plastic cards that consumers use to make purchases:

- Credit cards

  - Such as a Visa or a MasterCard, has a preset spending limit based on the user's credit limit.

- Debit cards

  - Removes the amount of the charge from the cardholder's account and transfers it to the seller's bank.

- Charge cards

  - Such as one from American Express, carries no preset spending limit.

Advantages:

- Payment cards provide fraud protection.

- They have worldwide acceptance (nearly!).

- They are good for online transactions.

Disadvantages:

- Payment card service companies charge merchants per-transaction fees and monthly processing fees.

Payment Acceptance and Processing

- Open loop (such as VISA) and closed loop (such as American Express) systems will accept and process payment cards.

- A merchant bank or acquiring bank is a bank that does business with merchants who want to accept payment cards.

- Software packaged with your electronic commerce software can handle payment card processing automatically.

Figure 8.4   On-line payment process using a third-party processor
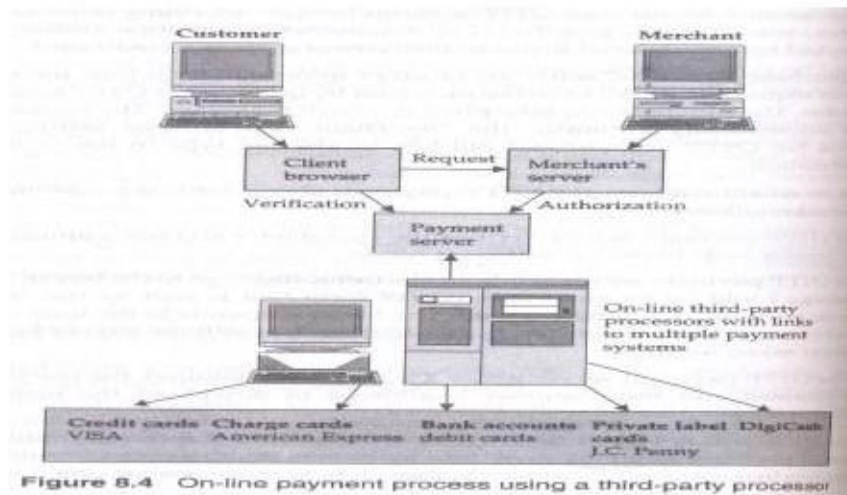
- Electronic cash is a general term that describes the attempts of several companies to create value storage and exchange system that operates online in much the same way that government-issued currency operates in the physical world.

- Concerns about electronic payment methods include:

    – Privacy

    – Security

    – Independence

    – Portability

    – Convenience

Electronic Cash Issues

- Primary advantage is with purchase of items less than £5

    - Credit card transaction fees make small purchases unprofitable

    - Facilitates Micropayments – eg for items costing less than £1

    - Must be anonymous, just like regular currency

- Safeguards must be in place to prevent counterfeiting

- Must be independent and freely transferable regardless of nationality or storage mechanism

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Electronic Cash Storage

- Two methods
    - On-line
        - Individual does not have possession personally of electronic cash
        - Trusted third party, e.g. e-banking, bank holds customers' cash accounts
    - Off-line
        - Customer holds cash on smart card or electronic wallet
        - Fraud and double spending require tamper-proof encryption

Risks in Electronic Payment systems

- Customer's risks
    - Stolen credentials or password
    - Dishonest merchant
    - Disputes over transaction
    - Inappropriate use of transaction details
- Merchant's risk
    - Forged or copied instruments
    - Disputed charges
    - Insufficient funds in customer's account
    - Unauthorized redistribution of purchased items
- Main issue: Secure payment scheme

Electronic payments Issues

- Secure transfer across internet
- High reliability: no single failure point
- Atomic transactions
- Anonymity of buyer
- Economic and computational efficiency: allow micropayments
- Flexibility: across different methods

- Scalability in number of servers and users

Designing Electronic Payment systems

It includes several factors:

- **Privacy.** A user expects to trust in a secure system; just as a telephone is a safe

- **Security.** A secure system verifies the identity of two-party transactions through "user authentication" & reserves flexibility to restrict information/services through access control

- **Intuitive interfaces.** The payment interface must be as easy to use as a telephone.

- **Database integration.** With home banking, for ex, a customer wants to play with all his accounts.

- **Brokers.** A "network banker"-someone to broker goods & services, settle conflicts, & 'inancial transactions electronically-must be in place

- **Pricing.** One fundamental issue is how to price payment system services. For e.g., from cash to bank payments, from paper-based to e-cash. The problem is potential waste of resources.

- **Standards.** Without standards, the welding of different payment users into different networks & different systems is impossible.

Electronic Data Interchange

- Electronic Data Interchange (EDI) - interposes communication of business information in standardized electronic form

- Prior to EDI, business depended on postal and phone systems that restricted communication to those few hours of the workday that overlap between time zones

Why EDI

- Reduction in transaction costs

- Foster closer relationships between trading partners

EDI & Electronic Commerce

- Electronic commerce includes EDI & much more

- EDI forges boundary less relationships by improving interchange of information between trading partners, suppliers, & customers

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- Electronic commerce includes EDI & much more

- EDI forges boundary less relationships by improving interchange of information between trading partners, suppliers, & customers

Benefits of EDI

- Cost & time savings, Speed, Accuracy, Security, System Integration, Just-In-Time Support.

- Reduced paper-based systems, i.e. record maintenance, space, paper, postage costs

- Improved problem resolution & customer service

- Expanded customer/supplier base or suppliers with no EDI program lose business

EDI layered architecture

- Semantic (or application) layer

- Standards translation layer

- Packing (or transport) layer

- Physical network infrastructure layer

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	

Figure 9.1 Layered architecture of EDI

EDI semantic layer:

- Describes the business application

- Procurement example

    – Requests for quotes

    – Price quotes

    – Purchase orders

    – Acknowledgments

    – Invoices

- Specific to company & software used

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

EDI transport layer

- How the business form is sent, e.g. post, UPS, fax

- Increasingly, e-mail is the carrier

- Differentiating EDI from e-mail

   – Emphasis on automation

    – EDI has certain legal status

Physical network infrastructure layer

- Dial-up lines, Internet, value-added network, etc.

EDI in Action

- The fig shows the information flow when paper documents are shuffled between organizations via the mailroom

- When the buyer sends a purchase order, then relevant data extracted & recorded on a hard copy.

- This hard copy is forwarded to several steps, at last manually entered into system by the data entry operators

- This process is somewhat overhead in labor costs & time delays.

Figure 9.2 Information flow without EDI
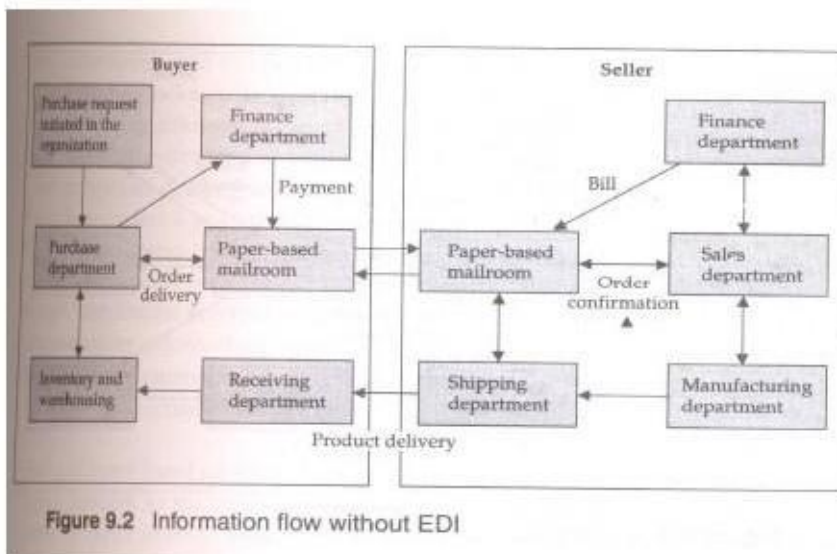
EDI in Action

- Information flow with EDI are as follows:

1. Buyer sends purchase order to seller computer

2. Seller sends purchase order confirmation to buyer

3. Seller sends booking request to transport company

4. Transport company sends booking confirmation to seller

5. Seller sends advance ship notice to buyer

6. Transport company sends status to seller

7. Buyer sends Receipt advice to seller

8. Seller sends invoice to buyer

9. Buyer sends payment to seller
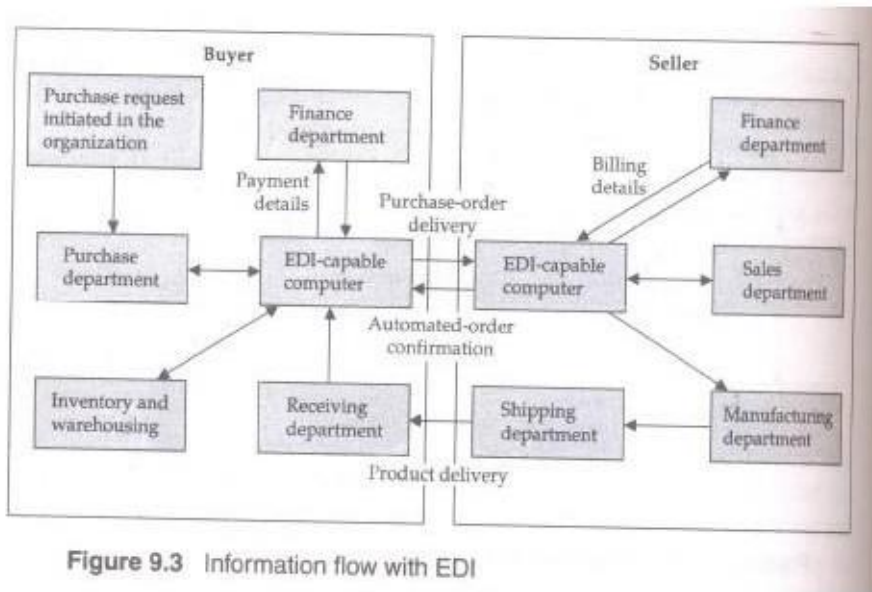
EDI as a fast, inexpensive & safe method

Figure 9.3 Information flow with EDI

Benefits of EDI

- Cost & time savings, Speed, Accuracy, Security, System Integration, Just-In-Time Support.

- Reduced paper-based systems, i.e. record maintenance, space, paper, postage costs

- Improved problem resolution & customer service

- Expanded customer/supplier base or suppliers with no EDI program lose business

EDI Applications in Business

Four different scenarios in industries that use EDI extensively:

1. International or cross-border trade

2. Electronic funds transfer

3. Health care EDI for insurance claims processing

4. Manufacturing & retail procurement

5. International or cross-border trade

- EDI has always been very closely linked with international trade.

- Trade efficiency, which allows faster, simpler, broader & less costly transactions

Role of EDI in international trade

- EDI facilitates the smooth flow of information

- It reduces paper work

- EDI benefits for international trade are

1. Reduced transaction expenditures

2. Quicker movement of imported & exported goods

3. Improved customer service through "track & trace" programs

4. Faster customs clearance & reduced opportunities for corruption, a huge problem in trade

2. Interbank Electronic Funds Transfer (EFT)

- EFTS is credit transfers between banks where funds flow directly from the payer's bank to the payee's bank.

- The two biggest funds transfer services in the United States are the Federal Reserve's system, Fed wire, & the Clearing House Interbank Payments System (CHIPS) of the New York clearing house

Automated Clearinghouse (ACH) Transfers

- ACH transfers are used to process high volumes of relatively small-dollar payments for settlement in one or two business days

- It provides services: preauthorized debits, such as repetitive bill payments; & consumer-initiated payments.

3. Health care EDI for insurance EDI

- Providing good & affordable health care is a universal problem

- EDI is becoming a permanent fixture in both insurance & health care industries as medical provider, patients, & payers

- Electronic claim processing is quick & reduces the administrative costs of health care.

- Using EDI software, service providers prepare the forms & submit claims via communication lines to the value-added network service provider

- The company then edits sorts & distributes forms to the payer. If necessary, the insurance company can electronically route transactions to a third-party for price evaluation

- Claims submission also receives reports regarding claim status & request for additional information

4. Manufacturing & retail procurement using EDI

- These are 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 & EDI

- Companies using JIT & EDI calculates how many parts are needed each day based on the production schedule & electronically transmit orders.

- Delivery has to be responsive, or it will cost too much in money & time.

- Getting data to suppliers quickly

- A major benefit of JIT & EDI is a streamlined cash flow.

Quick Response & EDI

- For the customer, QR means better service & availability of a wider range of products

- For the retailer & supplier, QR may mean survival in a competitive marketplace

- Much focus of QR is in reduction of lead times using event-driven EDI.

- In QR, EDI documents include purchase orders, shipping notices, invoices, inventory position, catalogs, & order status

EDI: Legal, Security, & Privacy Issues

Legal Status of EDI Messages

- To understand the legal framework, let's take a look on three modes of communication types: Instantaneous communication, delayed communication via the U.S. Postal Service (USPS), & 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

2. Delayed (USPS). The "mailbox rule" provides that an acceptance communicated via USPS mail is effectively when dispatched

3. Delayed (non-USPS). Acceptances transmitted via telegram, mailgram, & electronic messages, are communicated & operable upon receipt.

Digital Signatures & EDI

- Digital signatures might be time-stamped or digitally notarized to establish dates & times

- If digital signatures are to replace handwritten signatures, they must have the same legal status as handwritten signatures.

- It provides a means for a third party to verify that notarized object is authentic.

EDI & Electronic Commerce

- New types of EDI are traditional EDI & open EDI

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 is a term created by those working on the next generation of EDI standards in order to differentiate between the present & the future.

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.

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.

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

EDI Software Implementation

- EDI software has 4 layers:

1. Business application

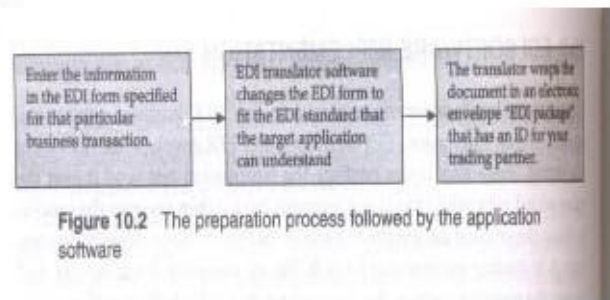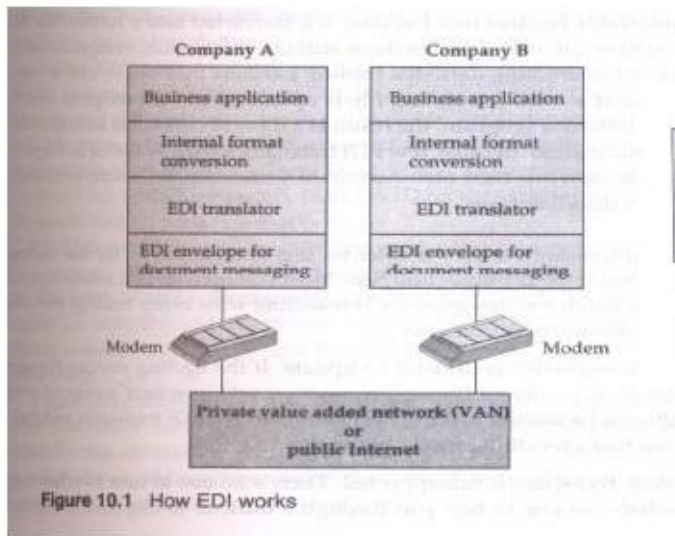2. Internal format conversion

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

EDI Business Application Layer

1. It creates a document, an invoice.

2. Sends to EDI translator, reformats the invoice into an EDI standard.

3. If there are on the same type of computer, the data move faster

Figure 10.1 How EDI works

Figure 10.2 The preparation process followed by the application software

EDI Envelope for Message Transport

The X.400 & X.435 Envelopes

- The X.400 standard was meant to the universal answer to e-mail interconnectivity

- It promises much & to date, delivers little.

- The work on X.400 began in1980

- It is the open standard for mail interchange

- The standard exists in 3 versions: 1984, 1988, & 1992.

EDI Software Implementation

- The X.435 inserts a special field in an X.400 envelope to identify an EDI message

- It includes data encryption; integrity; notification of message delivery & nondelivery; & nonrepudiation of delivery

- It is secure, reliable way to send EDI & accompanying files within the same message.

- Purchase orders, invoices, drawings, e-mail- all could be sent with end-to-end acknowledgment of message receipt.

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
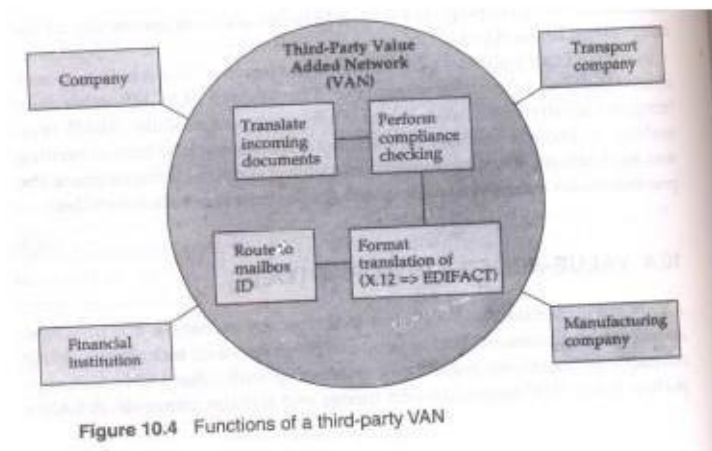
Internet-Based EDI

Several factors make internet useful for EDI:

- Flat-pricing that is not dependent on the amount of information transferred

- Cheap access with low cost of connection- often a flat monthly fee for leased line 0r dial-up access

- Common mail standards & proven networking & interoperable systems

- Security--public-key encryption techniques are being incorporated in various electronic mail systems