Chapter 1: -- Introduction to E-commerce

1. What is E– COM

- **Introduction:**

  - It is a modern business methodology that addresses the needs of organizations, merchants and consumers to cut costs while improving the quality of goods and services and increasing the speed of service delivery.
  - It is a new on-line approach to performing traditional functional such as payment and funds transfer, order entry and processing, invoicing, inventory management, cargo tracking, electronic catalogs, and point-of-sale data gathering.
  - It is the use of computer networks to search and retrieve information in support of human and corporate decision making.
  - It is associated with buying and selling of info, products and services via computer networks today and in the future via any one of the myriad of networks that make-up the Information Superhighway (I-way).
  - It stands poised to make a momentous contribution to the way Govt; business, and individual conduct business.
  - Key building block of E-com - Electronic messaging technologies – to streamline business processes by reducing paperwork and increasing automation
  - For ex. EDI combined with JIT (Just In Time) manufacturing methods, enables suppliers to deliver components directly to the factory floor, resulting in savings in inventory, warehousing and handling costs.
  - Technologies such as EDI and e-mail widely used for years in workflow and reengineering applications are now diffusing into other aspects of e-com.
  - Earlier efforts resulted in small gains in productivity and efficiency, integrating them together into the Info Superhighway will fundamentally change the way business in done.

- **Effects of E-Com:**

  - It can result in improved efficiency in finding and interacting with customers, in communicating with trading partners and in developing new products and markets.
  - Facilitates new types of info-based business processes for reaching and interacting with customers (e.g. on-line advertising and marketing, on-line order taking, and on-line customer service
  - Reduce costs in managing orders and interacting with a wide range of suppliers and trading partners.
  - Enables the formation of new types of info-based products such as interactive games, electronic books and info on-demand (can be very profitable for content providers and useful for consumers

- **Information Processing (Key Element of E-Com)**

  - All steps of commerce are forms of info gathering, processing, manipulation and distribution (except production, distribution and delivery of physical goods)
  - Various categories of business transactions:

- Between company and consumer over public networks

(Home shopping, home banking using encryption for security and electronic cash, credit or debit tokens for payment)

- With trading partners using EDI
- For info gathering (e.g. market research using barcode scanners), info processing (for managerial decision making or organizational problem solving), and info manipulation (for operations and supply chain management)
- For Info distribution with prospective customers, including interactive advertising, sales and marketing.

- From a managerial perspective these transactions require tight coordination and control among many participating organizations to minimize the exposure to risk.

- From global point of view, long transportation distances, currencies, custom regulations and language barriers compound the complexity.

- Codifying these transactions and coordinating them through software via the I-way can reduce the complexity of the task.
- Info processing activity is in the form of business transactions

2. E-commerce Frame Work

Electronic Commerce Applications
Supply chain management
Video-on-demand
Remote banking
Procurement and purchasing
On-line marketing and advertising
Home shopping

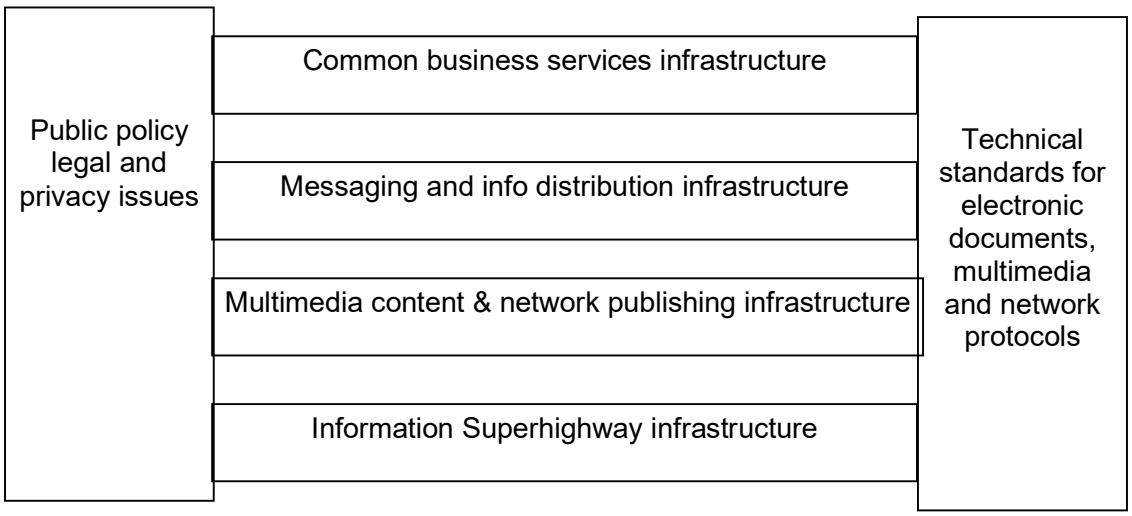


Fig : Generic Framework for E-com

- E-Com applications will be built on the existing technology infrastructure – a myriad of computers, communication networks and communication software forming the nascent Information Superhighway.

- Building Blocks in the infrastructure: -
  - Common business services - For facilitating the buying and selling process
  - Messaging and info distribution – As a means of sending and receiving info
  - Multimedia content and network publishing – For creating a product and a means to communicate about it.
  - The Information Superhighway – Very foundation, for providing the highway system along which all e-com must travel
  - Two Pillars supporting all e-com applications and infrastructure
    (a) Public policy – universal access, privacy and info pricing
    (b) Technical Standards – to dictate the nature of info publishing, user interface, and transport in the interest of compatibility across the entire network
- Any Successful E-com application will require the I-way infrastructure
- The I-way will be a mesh of interconnected data highways of many forms: telephone wires, cable TV wires, radio-based wireless – cellular and satellite
- Revenues in E-com are based on vehicular traffic (vehicles transporting information on multimedia content)
- Other than building various highways, transport vehicles are needed, routing issues must be addressed, transport costs must be paid.
- On the I-way, nature of vehicular traffic is extremely important
- Information and Multimedia content (Vehicle) determines type of vehicle needed E-com vehicles vary widely in complexity and may need to travel different routes on the I-way
  - Movies = video + audio
  - Digital games = music + video + software
  - Electronic books = text + data + graphics + music + photo + Video

- In the Electronic "highway system" multimedia content is stored in the form of electronic documents often digitized, compressed and stored in computerized libraries/ multimedia storage warehouses (servers).
- These servers are linked by transport networks to each other and to the software or hardware clients that allow customers to access them.
- On the I-way, messaging software* moves the vehicles from one distribution warehouse to another in the form of e-mail, EDI or point-to-point file transfers.
- Encryption and authentication methods have been developed to ensure security of the contents while traveling the I-way and at their destination
- Numerous electronic payment schemes are being developed to handle highly complex transactions with high reliability.
- In info traffic, public policy issues deal with
  - The cost of accessing info,
  - Regulation to protect consumers from fraud
  - Regulation to protect users' right to privacy,
  - Policing of global info traffic to detect info pirating or pornography.
- Standards
  - To ensure seamless and harmonious integration across the transportation n/w
  - To ensure access of any type of device the consumer chooses on all types of operating systems
- Convergence of Technical, policy and business concerns
  - Essential to the operation of the Info superhighway
  - Essential to the way the business world is gearing up to deal with it.

3. Electronic Commerce and Media Convergence

- The Term E-com has become irrevocably linked with the idea of convergence of industries centered on info that until today has been isolated – content, storage, networks, business applications, and consumer devices
- Convergence – is the melding of consumer electronics, TV, publishing, telecommunications, and computers for the purpose of facilitating new forms of info-based commerce.
- Multimedia Convergence – Conversion of text, voice, data, image, graphics and full-motion video into digital content.
- Cross- media convergence – Integration of various industries – entertainment, publication, and communication media – based on multimedia content.
- Convergence requires removing the barriers between the telecomm, broadcasting, computing, movie, electronic games, and publishing industries to facilitate interoperability.

Technological Advances driving Convergence phenomenon

- **Convergence of content**
  - Translates all types of info content (books, business documents, videos, movies, music) into digital info.
  - This info can be easily processed, searched, sorted, enhanced, converted, compressed, encrypted, replicated, transmitted (and so on) in ways that are conveniently matched to today's info processing systems.

- **Convergence of transmission**
  - Compresses and stores digitized information to let it travel through existing phone and cable wiring.

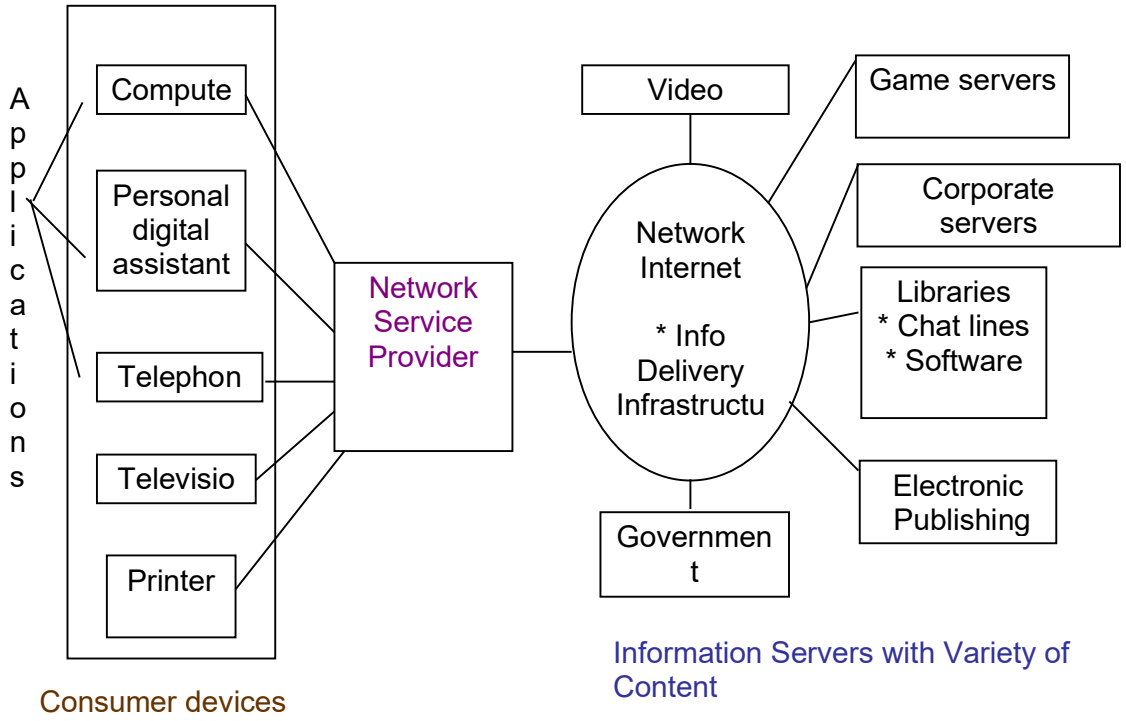
- **Convergence of info access devices**
  - To function as both computers and TVs. Or, ubiquitous telephone, with internal fax machine, modem and video monitor.

- **Market conditions driving convergence**
  - Widespread availability of increasingly low-cost, high performance enabling component technologies
    - E.g. semiconductors, storage and display devices, communications systems, operating systems etc
  - Entrepreneurs feeding on anticipated end-user demand for new applications (products and services)
  - Aggressive regulatory actions introducing competition in monopoly markets –
    - local and long distance communications, telecommunication and cable equipment.

4. Anatomy of E-Com Applications

- Most of the E-com applications rest on the entire E-Com infrastructure and reach out to customers.
- Applications can be found at all levels of the infrastructure itself. (e.g. multimedia content is part of infrastructure but its creation is itself an e-com application, e-mail is messaging infrastructure as well as a purchasable end product.
- Parts of e-com infrastructure in light of business applications: -
  - Multimedia content for E-com applications
  - Multimedia Storage servers and E-com applications
  - Info Delivery/ Transport and E-com Applications
  - Consumer Access Devices

Elements of E-com Applications



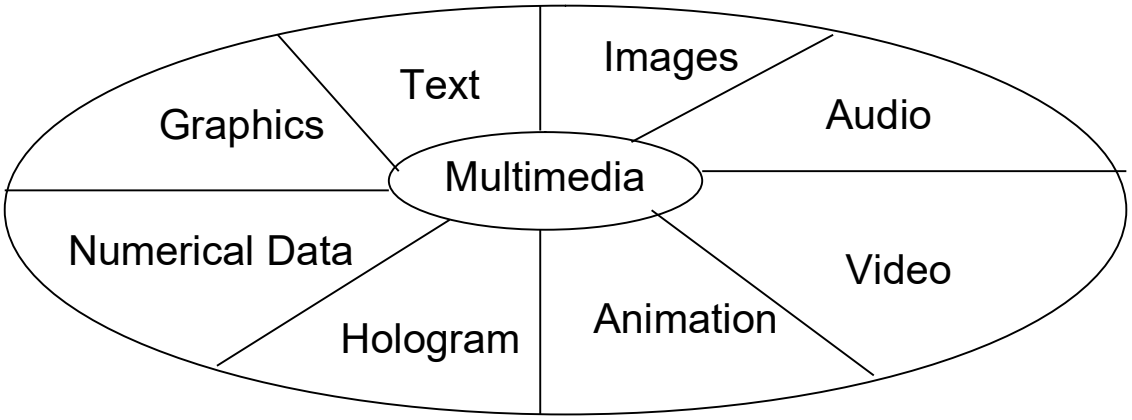
➔ E-com Infrastructure I : Multimedia Contents for E-Com Applications

- Multimedia is both fuel and traffic for E-com Applications

- **Technical Definition: -**

Use of digital data in more than one format, such as combination of text, audio, video and graphics in a computer file/document.

- Fig: Possible Components of Multimedia



- **<u>Purpose of Multimedia</u>*::-***

  - To combine the interactivity of a user-friendly interface with multiple forms of contents.
  - Multimedia is associated with the hardware convergence-taking place in the telecommunications, computer, and cable industry.
  - It has come to mean the combination of computers, television and telephone capabilities in a single device.

- **<u>Goal of Multimedia</u>*::-***

  - To increase the utility of all information through the processing and distribution of new forms such as images, audio and video.
  - Multimedia represents next generation of computing.
  - It covers so many things that it is often difficult to conceptualize.
  - Telecommunications, cable/broadcasters, and computer software and hardware providers each have a different view of what multimedia means.

In multimedia, every form of content is interrelated to other forms (e.g. an electronic book contains text, photographs, voice, video clips, animation and host of other things.)

- Access to multimedia content depends on the hardware capabilities of the customer.
- Key issue in E-com development: What does the consumer want??
- No one could develop the “killer” application for e-Com until the technical infrastructure is in place, clearly defined or at least articulated.
- The success of e-com applications also depends on the variety and innovativeness of multimedia content and packaging.
- The advantage goes to the current providers (packagers) of multimedia content – to entertainment, broadcast TV productions, traditional print publications and software and information services.

➔E-com Infrastructure II: Multimedia Storage servers and Electronic Commerce Applications

- E-Com requires robust servers to store and distribute large amounts of digital content to consumers.

- These servers are large info warehouses capable of handling various content (books, newspapers, advertisement catalogs, movies, games, x-ray images etc)

- These servers must handle large-scale distribution, guarantee security and complete reliability.

- Steady advances in digital memory technology are making mass-storage devices technologically feasible and increasingly cost-effective.

- E.g.256 MB and 1 GB memory chips can be used to store frequently accessed contents of length of entire movie.(less often requested contents can be stored on less expensive media (optical disks &magnetic tape)

Client-server Architecture in E-Com

- All E-com applications follow the client –server model.
- Clients are devices plus software that request info from servers
- The dominant model of client-server architecture links PCs to a storage (or database) server, where most of the computing is done on the client
- The Client-server model allows the client to interact with the server through a request-reply sequence governed by ***Message Passing***
- ***Server*** manages application tasks, handles storage and the critical elements (distribution, connectivity, security, accounting), and provides scalability*.
- Server is expected to simplify and make scaling more cost effective.
- Client devices handle the user interface.

- Commercial users have only recently begun downsizing their applications to run on client-server networks.
- It is a trend that E-com is expected to accelerate.

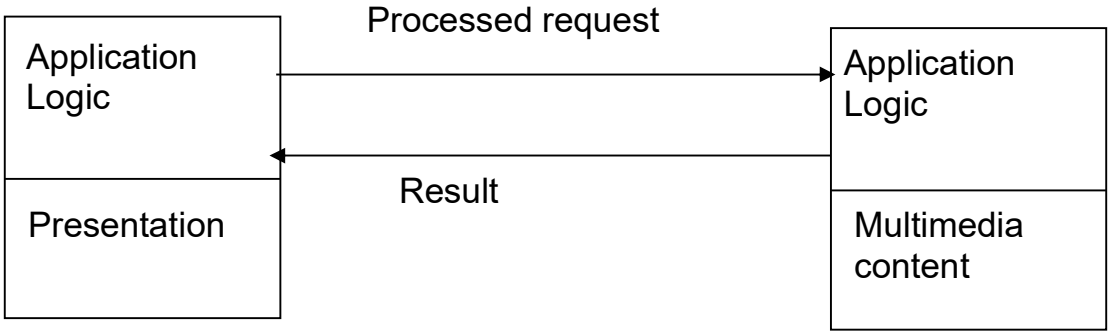


Fig: Distribution of processing in multimedia client – server world.

Internal Processes of Multimedia Servers::

- Internal processes involved in the storage, retrieval, and management of multimedia data objects are integral to e-com applications.
- A multimedia server is a hardware and software combination that converts raw data into usable info and then distributes it to users where and when needed.
- It captures, processes, manages and delivers text, images, audio and video.
- Most multimedia servers provide a *core set of functions*:
    - To display, create and manipulate multimedia documents.
    - To transmit and receive multimedia documents over computer networks

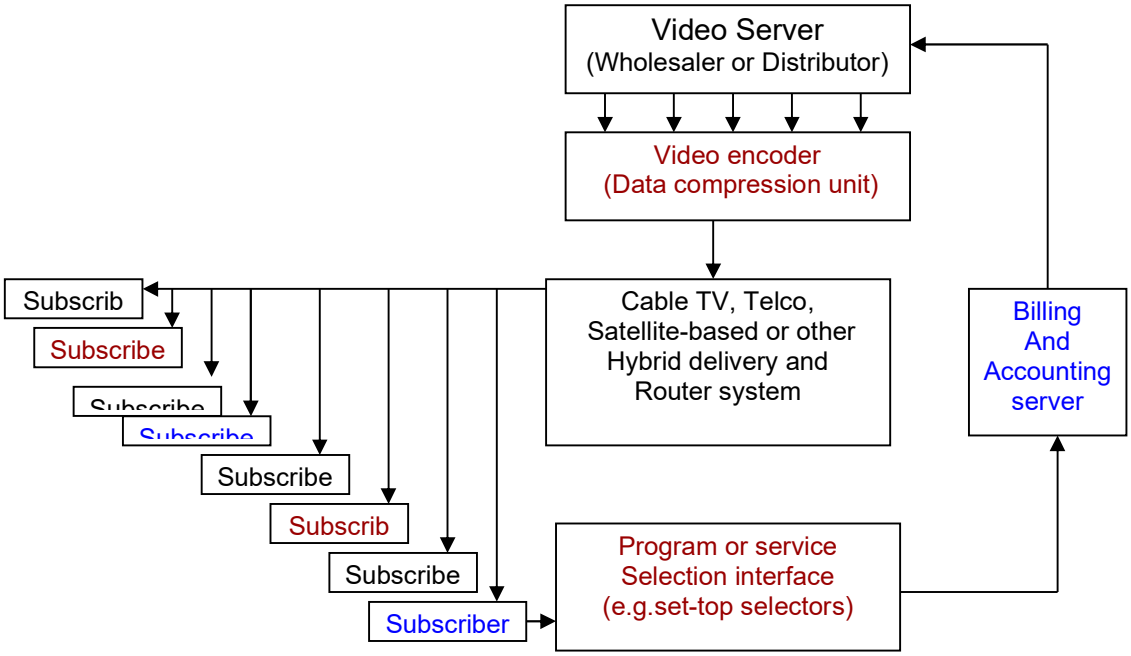
        - To store and retrieve multimedia documents.
    - To make interactive multimedia a reality, a server must :
        - Handle hundreds of simultaneous users
        - Manage the transactions of the users (purchases, specific info requests, customer billing)
        - Deliver info streams to consumers at affordable costs
    - Traditional models v/s new models (Technical Challenges)
        - Data difference (no longer table-formatted alphanumeric data)
        - Old computing platforms pose bottlenecks when trying to deliver large pieces of complex data

(Single 90 min video consuming over 100 gigabytes of storage space requires platform that includes high-end symmetric multiprocessors, clustered architecture and massive parallel systems (that harness the power of cheap processors and intricately chain them)

- Economical storage and manipulation of digital video is possible only with several magnitude of compression using video compression standards (e.g. Motion Picture Expert Group (MPEG)

Video servers and Electronic Commerce::

- The need for large-scale video storage has led to new video servers.
- Video servers are important link between the content providers (entertainment/media) and transport providers (Telco's/wireless/cable operators).
- Video servers (unlike client-server systems) deliver info to hundreds of consumers simultaneously via public telecommunications and cable networks.
- To make video available to numerous households either simultaneously or at overlapping times h/w or s/w solutions can be used.
- Hardware Solutions:
    - Use Power of massive parallel architecture. Each processor acts as a "video pump" and distributes a portion of the film so that a single film can be viewed by numerous households on demand.
    - (e.g. nCube video server with 512 processors, each equivalent to Intel Pentium chip, RAM 16 gigabytes)
- Software Solutions:
    - Microsoft's "Tiger" based on Windows NT OS
    - Implemented on PCs for individual/work group, as corporate servers for small/mid sized private n/w and as large servers for large-scale consumer use.
    - Its goal is to provide the power, functionality and scalability to give users split-second access to thousands of media files and to allow laser disc-type functions (pause, reverse, fast-forward and jump-ahead to user-specified locations.



Block Diagram: Generic Video-on-demand system

➔E-com Infrastructure III : Info Delivery/Transport and E-Com Applications

- Principle transport providers –
  - Telecommunication, cable and wireless industries
  - Computer networks (commercial n/w such as CompuServe and America Online, public n/w such as Internet)
- Transport system does not function as a monolithic system
- The architecture is a mix of many forms of high-speed network transport whether it be land-based telephone, air-based wireless, modem-based PCs or satellite transmissions.
- Transport routes for e-com applications are boundless

Information Transport Providers	Information Delivery Methods
Telecommunication Companies	Long-distance telephone lines; local telephone lines
Cable television companies	Cable TV coaxial, fiber optic, and Satellite lines
Computer –based on-line servers	Internet; Commercial on-line service providers
Wireless communications (Personal communications services)	Cellular and radio networks; paging systems

- Currently about 65 % of E-com applications are delivered on-line via computers equipped with modems

- Percentage of info delivered on CD-ROM still continues to grow.
- Info delivery by telephone (*audio text*) is a promising medium.
- Audio text is especially popular for delivery in real time, of info such as stock quotes, mortgage rates, sports, lottery results, weather and news.
- Next generation of delivery media is expected to be interactive multimedia (computer + telephone + television services)
- Distribution of information has become a competitive market.
- Playing on the defense:
  - Telephone companies and Cable television companies,
    - That have enjoyed monopoly for decades
    - Whose enormous wiring and equipment have become vulnerable to new competition
- Playing offense are:
  - Computer companies that
    - Offer new hardware capabilities and software programs
    - Banking on public network such as Internet
- Another emerging threat will be wireless communications (personal communicators) that bypasses traditional telecom companies and uses wireless communications

Challenges to router provider::

- **Telecom**
  - Most visible and vocal
  - Include long-distance and local telephone service providers
  - ADSL (asymmetric digital subscriber line) – technology which squeezes a video signal through a telephone wire
  - ADSL cannot handle live transmissions and picture produced is not clear
  - Recently picture quality is improved
  - With further compression several channels of live video over a single telephone wire can be accommodated
- **Cable Based**
  - Depends on coaxial cable as transport roads
  - Helps determine the preferred broadband applications and services
  - Most cable providers are expected to use fiber optic cable and coaxial wire as the delivery medium
  - The strategy among cable companies is to develop a “network neutral” content that uses digital compression and is adaptable to alternative delivery systems such as wireless and satellites.
- **Computer Network Based**
  - Often dial-up linkages of lower bandwidth
  - Bandwidth is analogous to the number of lanes on a highway (examples CompuServe, Prodigy, America Online, which serve both as transport road and content providers.
- **Wireless based**
  - Typically radio based – cellular, satellite and light based – infrared.
  - Some of the most exiting transport architectures are invisible.
  - New wireless – based systems require new ways of thinking about information delivery.
  - **Personal communicators**:
    - Couple cellular phone with pen computer’s user interface

- E.g. Simon, A cellular phone with pen-based display instead of standard keypad
- Includes many functions, such as fax transmission and reception, e-mail and limited personal information management.

➔E-com Infrastructure IV: Consumer Access Devices

- The way majority of users will access e-com applications, is heavily linked to the access device opted for use.

- **Info Access Devices**:

- Interactive TV has been touted as the info access device of the future.
- Because, almost everyone has TV and comfortable in using than using computer.
- Also, advances in computers making it much easier to operate, more useful, less expensive.
- The newest generation of PCs operates microprocessors powerful enough to run video with the resolution of a television picture.
- Access devices based on software (*Software Agents*) is being created to act as the consumer's PDAs.

Info consumers	Access Devices
Computers with audio and video capabilities	Personal/desktop computing (workstations, multimedia PC) Mobile computing (laptop and notebook) CD-ROM-equipped computers
Telephone devices	Videophone
Consumer Electronics	Television + set-top box Game systems
Personal Digital Assistants (PDAs)	Pen-based computing Voice-driven computing Software agents.

- Operating system choice will depend upon transport highway and user interface.
- If On-line services used, PC –based access may predominant (Windows 95 OS is well positioned here)
- There is great deal of uncertainty about the future configuration of access devices and so about the designing of user interface in E-com applications.
- On-line browsing is not easy (Users have a menu of brief headlines, each for a story. Often menu doesn't give enough info to make an informed decision. Also colors and layouts are not very attractive)
- Though these early systems present first generation of on-line publications and we'll figure out how to design effective interface with pictures, text, sound, movies (and probably smell)
- Home shopping, video-on-demand or other services present similar challenges. To make these services attractive, a consumer must be able to make a purchase decision in four remote control clicks.

- To tack these challenges, two options are there:
  - Software agents – that act on consumer's behalf thru voice commands
  - Broker - a machine that delivers consumer's typical preference to other computer systems in the network.
- This raises two issues:
  - Need for additional computer systems to track consumer preferences implies

  –>Additional application and network costs.
  - Increasingly feature-rich s/w content implies

  -> Vast variety of choices means

  -> Increased chance of major s/w bugs implies

  -> Damage product's attractiveness.
- The complexity of user interface design illustrates the gap between what seems obvious to application developers but makes no sense to the user.
- Currently companies are bypassing the issue of effective user interface design and focusing on getting the basics to work.
- Interfaces have to be very effective at recreating experience of browsing an electronic shelf to provide some sort of memory by association.

5. Electronic Commerce Consumer Applications

- Consumer desires are very hard to predict, pinpoint or decipher in electronic markets whose shape; structure and population are still in the early stages.
- Needs envisioned include entertainment on-demand (including 500 - channel TV), video-on-demand, news-on-demand, electronic retailing via catalogs, home shopping networks, interactive distance education, collaboration through desktop videoconferencing, medical consultations etc.
- To plan the infrastructure, hard choices about a winning application have to be made.
- Currently the application of choice among cable and telecom providers developing infrastructure is: Video-on-demand.

Why Video-on-demand ??

- Mostly house-holds have TV and connected to cable
- Most of the free time is spent watching TV
- Not all watching the TV are watching the same channel
- Sight, sound and motion combine to make TV a powerful means of marketing.
- It is seen as part of an overall long-term trend from the passive delivery vehicles of movies, radio and TV to consumer interactive platforms.
- As currently envisioned, it is merely a cheaper and more convenient replacement for the corner video store. (To see a video, consumers would pick one from a wide selection and would be billed later)
- The changing trends in consumer choice can be seen in consumption of sports, TV shows and educational programs
  (e.g. popularity of CNN channel).
  (But, Video-on-demand is not a killer application for E-com.)

Consumer Applications and Social Interaction

- Applications oriented toward social interaction will be winner in long run.
- Impact of telephone on business and social communications and influence of television on consumer behavior and entertainment is very significant.
- Other social revolutions have bearing on the e-com applications (e.g. current trends in radio and TV talk shows are replicated in on-line news groups)
- Social interactions were also promoted by the introduction of the 800 toll free service around.
- Contrast to toll-free services is caller-paid 900service *(audio text)*
- Audio text allows callers to access a live, prerecorded/interactive program.
- Four major 900services are fax-back, interactive, recorded – sports scores, financial services and weather, opinion polling, and conferencing or simultaneous conversation using GAB (Group Access Bridging)
- Marketers explore 900services as a way to offset costs in areas like customer service by getting caller to pay.
- The most successful marketplaces are expected to be those that cater to customers' loneliness, boredom, education and career.
- Video-on-demand, adult entertainment (sports, gambling), electronic mails, grocery shopping and local news can be added to this list.

What do consumers really want ?

- The key questions are : Do consumers want new services and will they pay for them ??

- Plans for video-on-demand and other applications are predicted on imaginary customers who are expected to buy multimedia services.
- To accurately gauge consumer intentions with respect to services they do not yet understand is very difficult.
- Focus groups and limited market tests suggest consumer's show no pressing demand for additional services or for a 500-channel interactive TV.
- Some businessmen are convinced that public will gobble up interactive services if they are made available.
- Challenges facing marketers in electronic markets: -
  - Consumers are generally satisfied with the range of choices now available on cable TV. The main complaint is quality and cost of service.
  - If a new system requires more steps to do essentially the same things as present day systems, consumers may resist it
  - Some system developers and s/w programmers assume consumers want to move from passive to interactive TV watching, but most of the public want to lay back and just watch TV.
- New interactive systems must be easy to use, inexpensive and appealing in terms of satisfying a need before consumers will use them and buy them.

What are consumers Willing to spend?

- Right now, charge for a rental video is a cash, out-of-pocket item. Video-on-demand would necessitate monthly billing.
- If consumers are unwilling to spend the amounts needed to fully recover the costs of bringing entertainment to their homes, n/w operators may look to advertisers to fill the gap.
- Television is truly a broadcast medium, interactive multimedia is not.
- N/w operators could target consumers with advertising but this would raise technical and privacy issues not easily resolved.
- Issues of how customer data will be collected, stored and who will have to access to it are difficult to resolve

Delivering Products to customers

- In addition to developing e-com applications, packaging and distribution must be considered.
- Until user interfaces become sophisticated, the process of scrolling through dozens of menus to select a video will be time consuming and frustrating.
- Children and adults have similar options to select the video from.
- Cocooning may be a very valid concept, but it does not mean that people will never want to leave their homes

Consumer Research and Electronic Commerce

- Evaluating customer preference is the main uncertainty facing application designers -
  - What mix of voice, data, video, entertainment, education, information, geographic coverage, mobility, and interactivity will consumers demand?
  - How much time and money will they be willing to spend to use these networks?
  - How much will regional or cultural differences influence application architectures?
- **Results of surveys: -**
  - Movies on demand attract the most interest, then news, which fares relatively well.
  - People are more interested in facts than in growing number of entertainment services envisioned for the electronic market place
  - Consumers rate high-tech entertainment and shopping networks lower than info access, community involvement, and self-improvement and communication computer services.

  - Most desirable on-line capability - voting in elections
  - People also favors on-line public opinion poll, interactive electronic town hall political meetings/
  - Gaining access to reference and government information and educational courses is preferable to entertainment services.
  - Consumers discredited expert predictions that “video text” would transform the society.
- Companies argue that consumers don’t yet know what interactive television is and can’t be sure they will pay for it or use it.
- So there is split between commercial applications being promoted by business and the public’s needs and interests.

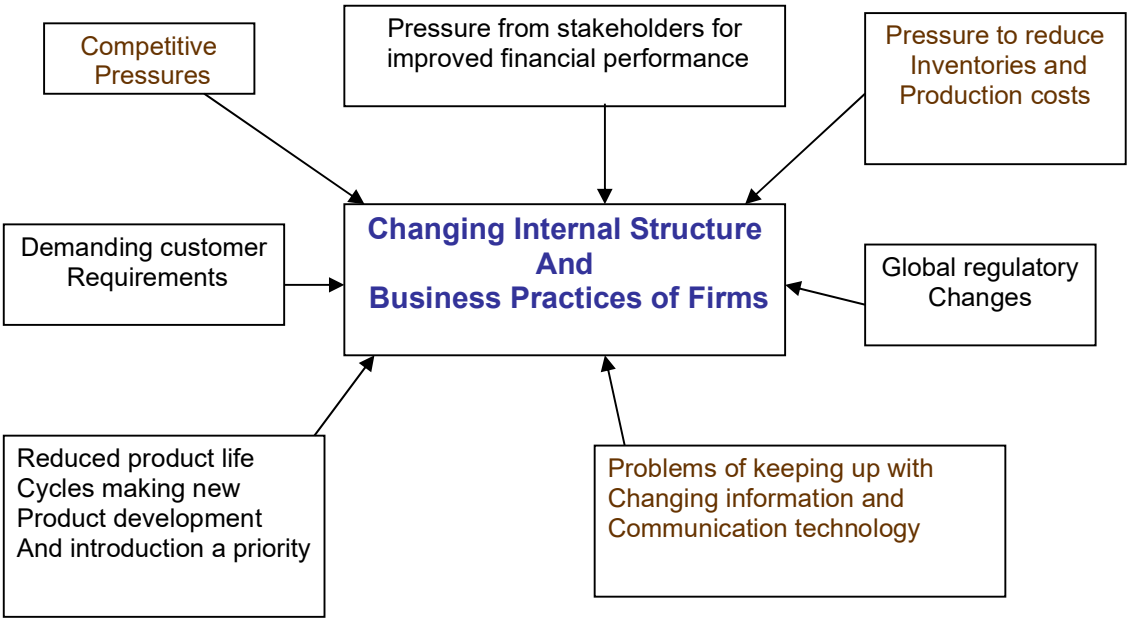
6. Electronic Commerce Organization Applications

- Companies do not buy info and communication technology just because of its simplicity and interesting write-ups about it.
- Companies adopt technology to save money and improve the bottom line.
- How can electronic markets be utilized:
  - To further organizational goals: better coordination, faster problem solving, and improved decision making.
  - To help better serve the customers
  - To better interact with suppliers and distributors
- How the new applications impact business processes currently established internally?

Changing Business Environment::

- Customers and businesses seek the flexibility to change trading partners, platforms, carriers and networks at will.
- Companies are looking outside and within when shaping business strategies
- These activities include establishing private electronic connections to customers, suppliers, distributors, industry groups and even competitors:
  - to increase the efficiency of business communications
  - To help expand market share
  - To maintain long-term viability in today's business environment
- The Information superhighway will allow business to exchange info among constantly changing sets of customers, suppliers and research collaborators in a government and academia on a global basis.
- Internetworking via a public network infrastructure provides a firm with a pathways to conduct e-com between trading partners, support collaboration with partners
- Firms utilize consumer and market research to form the assumption that shape its strategy, dictate its decisions about what to do/not do, and define meaningful results.
- On the issue of developing a theory of business in electronic marketplace, it is stated that "with the aid of new technology and new forms of corporate organization, firms are finding ways to do things faster, better and cheaper, revitalizing entire industries and redefining the terms of economic competition at the same time."

Pressures influencing business



Electronic Commerce and the retail Industry::

- Consumers are pushing retailers to the wall, demanding lower prices, better quality, a large selection of in-season goods.
- Retailers are revamping distribution channels to ensure low warehouse costs by:
  - Reducing average inventory levels
  - Coordinating consumer demand and supply patterns
- More and more retailers turning to overseas suppliers (in part due to cheaper labor costs).
- Retailers are putting that pressure on manufacturing and suppliers.
- Quest for efficiencies has led to turmoil and consolidation within the retail industry.
- The pressure on retailers and suppliers can be seen in disappearance of jobs, in mergers and business failures in manufacturing sector.
- Electronic markets could provide a partial solution by promising
  - Customers more convenience
  - Merchant's greater efficiency and Interactivity with suppliers to revitalize the troubled retailing sector.

Marketing and Electronic Commerce::

- E-com is forcing companies to rethink the existing ways of doing:
  - Target marketing (isolating and focusing on a segment of population)
  - Relationship marketing (building and sustaining a long-term relationship with existing and potential customers)
  - Event marketing (setting up a virtual booth where interested people can come and visit)
- Conventional direct marketers devote 25 % of revenues on printing and postage costs for catalogs.
- Interactive marketing could help cut such expenses and may even deliver better results.
- Interactive marketing accomplished in electronic market via interactive multimedia catalogs*.
- Ideally, an interactive shopping program should produce full-motion demonstrations of the selected products, but such a practical and economical technology has yet to be developed.
- Consumer info services are a new type of catalog business. (e.g. CUC international)
- Virtual-Reality Inventory – stocks nothing, sell everything.

Inventory Management and Organizational Applications::

- With stiff global competition, managers need to catch on quickly to better ways of doing international business.
- Adaptation would include moving toward computerized “paperless” operations to reduce trading costs and facilitate the adoption of new business processes.
- Inventory management is one often-targeted business process.
- Solutions for these processes:
  - Just-in-Time (JIT) inventory systems (in manufacturing industry)
  - Quick response programs (in retail industry)
  - Consignment tracking systems (in transportation industry)

Just-in-Time Manufacturing::

- It is viewed, as an integrated management system, consisting of a number of different management practices, is dependent on the characteristics of specific plants.
- JIT management system is based on two principles: -
  - Elimination of waste (time, materials, labor and equipment) in production cycle.
  - Empowering workers
- Management practices associated with JIT systems:
  - Focused factory
  - Reduced set-up times
  - Group technology
  - Total productive maintenance
  - Multifunction employees
  - Uniform workloads
  - JIT purchasing
  - Total quality control
  - Quality circles

JIT purchasing

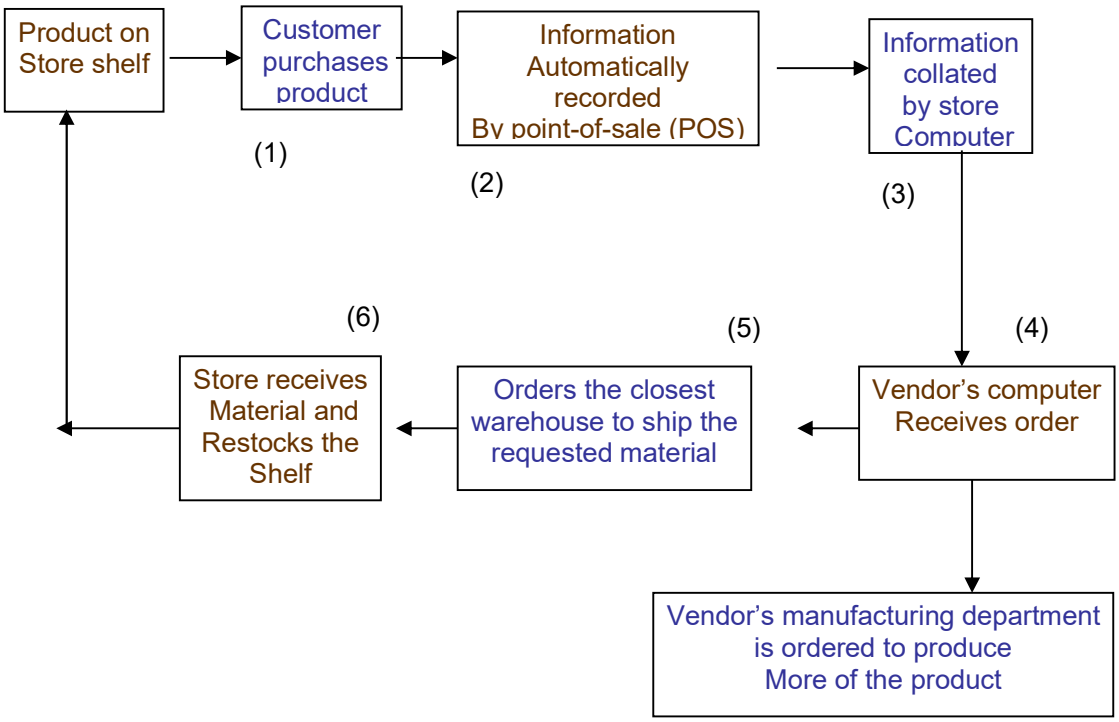
- Allows a manufacturer to incorporate its supplier efforts toward eliminating waste in the upstream portion of the manufacturing cycle.
- Focuses on the reduction of inventories throughout the logistical systems of the manufacturing firms involved
- Provides a careful audit of the production process.
- Optimizes supplier and customer relations
- In production, needed materials are to be supplied just in time (no earlier or later than is demanded for processing)
- Production costs decrease as required stock level is reduced.
- Market risks passed on through supplier chain (material from supplier is ordered by production plant, only if products can be sold)
- Quality control of production is considerably enhanced.
- All stages of production are closely monitored for adequate assessment of imperfections.
- Concept of co-makership has been introduced by such collaboration between suppliers and customers.
- To achieve JIT savings, corporations have installed private communication networks. The I-way makes this practice more affordable and easily available to a number of small firms.

Quick Response Retailing

- Quick Response (QR) is JIT purchasing version for retailing.

- Most often, shoppers do not keep a store filled with merchandise until the wanted product is out of stock.
- The failure to stock merchandise that matches customer demand can be extremely costly.
- To reduce risk of being out of stock, retailers are implementing QR systems.
- QR provides a flexible response to product ordering & lowers costly inventory levels.
- QR retailing focuses on market responsiveness while maintaining low level of stocks.
- It creates a closed loop encompassing the retailer, vendor, and customer chain (Fig: Quick Response Chain)
- Availability of accurate information with respect to the current sales enables sophisticated marketing capable of responding to consumer's preferences.

Quick Response Retailing
Quick Response Chain



Supply Chain Management

- Inventory management solutions (QR & JIT) address only part of the overall picture.
- These may not be feasible if a company depends on an unresponsive supplier for key components.
- What is required is a technique for managing unanticipated problems (or perturbations) in the supply chain.
- Supply Chain management (SCM) integrates the internal and external partners on the supply and process chains
  - to get raw materials to the manufacturer and finished products to the consumer.
- SCM process increasingly depends on electronic markets because of :
  - Global sourcing of products and services to reduce costs
  - Short product life cycles
  - Increasingly flexible manufacturing systems resulting in a variety of customizable products.

Functions

- **Supplier Management**

  - The goal is “to reduce number of suppliers and get them to become partners in business in a win/win relationship.”
  - Benefits:
    - Reduced purchase order (PO) processing costs
    - Increased number of POs processed by fewer employees
    - Reduced order processing cycle times.
- **Inventory Management**
  - The goal is “to shorten the order-ship-bill cycle.”
  - Majority of partners are electronically linked, information can be sent/received quickly.
  - Documents can be tracked to ensure they were received.
  - Benefits:
    - Improved Audit Capabilities. (Documents can be tracked to ensure they were received).
    - Enable the reduction of inventory levels
    - Improve inventory turns
    - Eliminate out-of-stock occurrences.
- **Distribution Management**
  - The goal is “to move documents related to shipping (bills of lading, purchase orders, advanced ship notices, and manifest claims)””””””””””
  - Benefits:
    - Improved Resource planning (Documents can be sent in moment and contain accurate data).
- **Channel Management**
  - The goal is “to quickly disseminate information about changing operational conditions to trading partners.”
  - Benefits:
    - Technical products and pricing information can be posted to electronic bulletin boards, thus allowing instant access.
    - Electronically linking production with their international distributor and reseller networks eliminate thousands of labor hours per week in the process.
- **Payment Management**
  - The goal is “to link the company and the suppliers and distributors so that payments can be sent and received electronically.”
  - Benefits:
    - Increased speed at which companies can compute invoices.
    - Reduced clerical errors
    - Lower transaction fees and costs with increasing productivity (number of invoices processed)
- **Financial Management**
  - The goal is “to enable global companies to manage the money in various foreign exchange accounts.”
  - Companies must work with financial institutions to boost their ability to deal on a global basis.
  - They need to assess their risk and exposure in global financial markets
  - They need to deal with global info as opposed to local market information.

- **Sales Force Productivity**
  - The goal is “ to improve the communication and flow of information among the sales, customer and production functions.”
  - Linking the sales force with regional and corporate offices establishes greater access to market intelligence and competitor information that can be funneled into better customer service and service quality.

- Companies need to collect market intelligence quickly and analyze it more thoroughly.
- Companies also need to help their customers (relationship management) introduce their products to market faster, giving them a competitive edge.

Work Group Collaboration Applications

- For workgroup applications, e-com represents a ubiquitous inter-network
  - That enables easy and inexpensive connection of various organizational segments
  - To improve communication and information sharing among employees and to gather and analyze competitive data in real-time.
- E-com also facilitates sales force automation by enabling salespeople to carry product and reference information in one portable device.
- Applications such as *video-conferencing*, document sharing, and multimedia e-mail are expected to reduce travel and encourage telecommuting.
- Improving the distribution channel for documents and records to suppliers, collaborators and distributors can reduce processing costs.
- Video conferencing is now the best-established application.
- Organizational applications of e-com have to meet the challenges of new business environment, where the emphasis is on service quality, flexibility and customization of production to meet customer needs.

Work Group Collaboration Applications Video-conferencing

- It allows distant business colleagues to communicate without the expense, time and inconvenience of traveling.
- In hospitals, it allows surgeons to examine computerized X-rays and CAT scans of distant patients whose doctors need second opinion.
- Its appeal and applicability to small business is limited because it :
  - Requires of significant investment in equipment
  - Entails the use of dedicated facilities with special communication lines.
- It is beginning to penetrate the desktop PC market (limited growth due to technical limitations)
- Faster chips for processing video (compressing and decompressing) are required.
- As the point-to-point or point-to-multipoint video conferencing drops, it is expected to continue its penetration into the corporate **marketplace.**

Limitations of E-Commerce

Technical Limitations :

- -Lack of sufficient system's security, reliability, standards, and communication protocols
- -Insufficient telecommunication bandwidth
- -The software development tools are still evolving and changing rapidly

Non Technical Limitations

- -***Security and Privacy***

•These issues are especially important in the B2C area, and security concerns are not truly so serious from a technical standpoint Privacy measures are constantly improving too
•Yet, the customers perceive these issues as very important and therefore the EC industry has a very long and difficult task of convincing customers that online transactions and privacy are, in fact, fairly secure

- ***-Lack of trust and user resistance***

•Customers do not trust an unknown faceless seller, paperless transactions, and electronic money
•So switching from a physical to a virtual store may be difficult

Chapter 2 ::-- Network infrastructure for E-com

➔ Introduction ::

- E-com needs a n/w infrastructure to transport the content.
- Information Superhighway (I-way)
  - A high capacity (broadband), interactive (two-way) electronic pipeline to the home or office capable of :
  - Simultaneously supporting a large number of e-com applications
  - providing interactive phone like connectivity between users and services and between users and other users.
- Principal shortcoming of the existing communications infrastructure :
  - Inability to provide integrated voice, data and video services.
- Emergence of integrated electronic commerce applications in health care, manufacturing, education and other industries is paving the way for a n/w infrastructure capable of supporting multiple types of info.
- Interest in the I-way is slowly diffusing to other industries as the investment in new info technologies and tools accelerates.
- Companies are upgrading their n/w infrastructure or creating new products
- They are reorganizing through mergers and acquisitions to better prepare for life on the I-way.

➔ Components of I-way ::

- **Three major components make up the I-way infrastructure :**

(i) Network Access Equipment	(ii) Local on-ramps	(iii) Global Information Distribution Networks
Consumer / Business Premises equipment	Telecom –based Infrastructure Cable TV-based Infrastructure Wireless Infrastructure Communication On-line infrastructure	Backbone Communications And satellite Networks

- **Consumer Access Equipment (CAE)**

  - Represents a critical category
  - Its absence or slow progress holds up other segment of I-way.
  - E.g. Interactive TV is uncommon because of lack of affordable equipment on customer's side for access and provider's side for distribution.
  - CAE includes hardware and software vendors who provide:
    - Physical devices – routers, switches etc.
    - Access devices – computers, set-top boxes etc
    - Software platforms – browsers, operating systems etc.

- **Global Information distribution Networks :**

  - Represents the infrastructure crises-crossing countries and continents.
  - Most of the I-way infrastructure already exists in the vast n/w of fiber-optic strands, coaxial cables, radio waves, satellites, and copper wires spanning the globe.
  - This backbone includes such networks as long-distance telephone lines, satellite networks, and the Internet.
  - Although Internet uses the same hardware, its history, protocols and regulations put it into different category.

- **Local or access roads, or on-ramps :**
  - Called "last mile" in telecommunications industry
  - Simplify linkages between businesses, schools and homes to the communications backbone.
  - Four categories of access ramps providers:

    1> Telecom based
    2> Cable TV based
    3> Wireless based
    4> Computer based on-line info services. (Including value added networks VANs)

  - These backbone access providers link users and E-com application providers.
  - Before choosing provider, consumer should decide the services.
  - Careful consideration is required to applications deployed or accessed, objectives and costs, security and privacy.(These factors influence choice of tools and the access ramps consumers/business choose).
- Linking all the components of the I-way require vast capital investments in "open systems" (interoperable equipment that uses common standards) and installing gateways between various networks.
- A final requirement is switching hardware and software to move huge amounts of data effortlessly over such a complex network.

➔ Network Access Equipment

- Customers premises equipment (CPE) or terminal equipment is a generic term for privately owned communications equipment that is attached to the network.
- Three parts:
  - **Cable-TV set-top boxes**
  - **Computer based telephony**
  - **Hubs, wiring closets and routers or digital switches.**

1> Cable TV Set-top Boxes

- Also known as cable converter boxes, converter boxes, and converters/descramblers.
- Will be Gateway for information services, commercial transactions, and 500-digitally compressed channels.
- Will have greater intelligence and more features than the existing converter boxes such as:
  - Enabling users to make phone calls
  - Surf the Internet
  - Plan the viewing schedule for the week.
- This will be possible because, all cable-boxes are owned not by cable subscribers but by the cable systems that delivers programming.
- Local Cable Company will decide type of boxes.

• Simplest set-top boxes will feature on-screen text-menus enabling features like:
- Lockout, favorite-channel grazing, time-delay programming for unattended VCR recording.
• At the high end it might be a box with a menu system based on icons for navigating through various activities:
  - To shop, access a bank account, play video games, watch a pay-per-movie, examine an on-screen TV schedule.
• Cable operators will be able to download software through the cable system into the set-tops.
• Set-tops will have slots for add-on cards that can be used to:
  - Change or add applications, provide security, expand unit's memory
• Set-top boxes will also have a serial data port that can be hooked up to a printer.
• Main goal: to be flexible for the applications of tomorrow.
• For more sophisticated transactions, much of the intelligence will be in the set-top device (as opposed to residing in a central computer).

->> Comparison of accessing I-way via a set-top v/s a PC

• **<u>Criteria for comparison</u>**

(i) Display
(ii) Controls
(iii) Pipeline
(iv) Brains
(v) Accessibility

• **Display**
  - TV is well adapted to showing full-motion video to viewers sitting several feet away, but it's text display is extremely limited.
  - High-definition TV, still getting off the ground, is sharper but still too poor for text.
  - Computer displays can easily display video, text, and graphics crisply to a viewer seated one and half feet away.
  - Computers wouldn't have to adapt much to match TV's strengths, but TV is a long way from matching a computer monitor's strength.
• **Controls**
  - Set-top will use a hand-held remote control that permits selections from menus.
  - Computer has a full-function keyboard; most also have a mouse for pointing, clicking and high-lighting; other devices such as joysticks, trackballs, light pens, and voice recognition systems are widely available.
  - Far more flexible and powerful ways to interact with a computer than with a television.

- **Pipeline**
  - Existing cable TV systems can deliver a huge amount of info rapidly one way – to the home – but must be modified to allow a significant return flow.
  - New modems and networks let computers communicate over high capacity cable lines.
  - Future systems will need high-capacity lines to deliver the vast volume of data needed for digitized video like movies on-demand.
- **Brains**
  - Set-top box is a special-purpose computer with powerful graphics and communications features but limited versatility*
  - Box is largely a slave to the central computers of the interactive system.
  - PCs are very versatile; interactive applications are just part of its versatility.
  - PCs are powerful in their own right and not dependent on system's central computers with which they communicate.
  - Centralized control has usually given way to autonomy for users.
- **Accessibility**
  - Every household has a TV and is familiar and comfortable with using it.
  - People most likely to use interactive systems may be the same ones most attracted to computers.
  - Leap to interactive use is greater from passive TV watching than from active computer use. Thus, universality of TV is less advantageous than it appears.
  - But a Significant part of public remains uncomfortable with computers.

2> Computer-Based Telephony

- Largest CPE product sectors are Private Branch Exchanges (PBXs), facsimile products, modems, voice processing equipment, video communication equipment.
- Personal communicators combine voice, data, and facsimile functions and enable users to send, store, and receive information over either wire line or wireless networks.
- These software intensive equipments improve business productivity by reducing communications and travel expenses.
- PBXs
  - A telephone exchange local to a particular organization who use, rather than provide, telephone services.
  - Earlier manual PBX (Private Manual Branch Exchange – PMBX) was in use which involved company employed operators manually switching each call using a manual switchboard.
  - Now PABX (Private Automatic Branch Exchange) is in use that is used for switching calls between internal lines and between internal and Public switched Telephone Network (PSTN) lines.
  - PABX can route calls without manual intervention, based entirely on the number dialed. Not all PABXs can route external calls to internal numbers automatically however.

3> Digital Switches, Routers and Hubs

Digital Switches:

- The digital switches industry has a major impact on the I-way.
- Switching technology has six generations and now is in place to offer sophisticated services:

1880s to 1920s	Manual operator controlled
1920s to 1940s	Step-by-step electromechanical switches
1940s to 1960s	Crossbar Electromechanical switches
1960s to 1970s	Semi electronic switching stored-program-control computers, analog and digital
1970s to 1980s	Totally electronic solid state digital, increasingly software driven.
1990s	Fiber optic based integrated switching and transmission systems

- In a computer n/w, data move from one point to their intended destination(s) because they are tagged on the front with a small bundle of identifying digits (*header*).
- Digital data pass through switches that route them to their intended destination(s).
- Since the bundles of data (*packets*) move through a n/w at a very high speeds, routing technique is known as *Fast Packet Switching*.
- Longer-term benefit of the digitization of program content will be the growing ability to switch or route content from a sender to a single receiver. (*point-to-point communication*)
- Adding switching technology to hubs solves both the efficiency and predictability problems with the Ethernet LAN problems.
- A switched hub gives each user on the n/w his/her own private line and allows traffic to flow more evenly.
- Switched Hubs can improve n/w efficiency by more than an order of magnitude.

Routers:

- A device that forwards data packets (units of info) from one network to another.
- Based on routing tables (lists of addresses, permissions etc) and routing protocols, routers read the network address in each transmission and make a decision on how to send it based on the most expedient route (determined by traffic load, line costs, speed, bad lines)
- Routers are used to segment networks to balance and filter traffic for security purposes and policy management
- They are also used at the edge of the n/w to connect remote offices
- Router can only route a message that is transmitted by a routable protocol (e.g. Internet Protocol)
- Routers have to inspect n/w address in the protocol, so they process data and thus add overhead.
- Most routers are specialized computers that are optimized for communications
- Router functions can also be implemented by adding routing software to file server. (e.g. Windows 2000 include routing software)
- The operating system can route from one n/w to another, if each is connected to its own n/w adapter (or NIC), in the server.

Hubs:

- A hub is a single-threaded communication device (only one device at a time can use the wires in the hub)
- It's a central connecting device in a network that joins devices together in star configuration.
- Passive Hubs are simply pass-through units that add nothing to the data as it is transmitted, and they do not require power because they are simply connections.
- Active Hubs regenerate the data bits in order to maintain a strong signal, and require power to do so,
- Some newer hubs are intelligent, modular and customizable.
- This allows for insertion of bridging, routing and switching modules within one unit.
- A hub may even possess a CPU and N/W operating system so that it can become a file server or type of N/W control processor to perform complex functions.
- Hub acts as a connector for multiple devices on a single n/w (which includes clients, various types of servers, printers, fax machines etc.)
- It manages the flow of information from computer to computer

➔Local Roads and Access Ramps

- - Four types of "last mile" connections are currently in existence:
    - Plain Old Telephone System (POTS) wires [**Telecom – Based]**
    - Cable TV coaxial cable [**Cable TV- based]**
    - Electricity wires
    - Wireless (a radio based cellular or satellite connection)
- Huge investment needed for wiring and upgrades will come only after sufficient consumer demand for e-com services.
- Companies can expect to upgrade the last mile only once in the next decade due to the tremendous cost.
    - The telephone and cable providers are expected to spend large amount over the next 20 yrs
    - Multiple ways exist to implement/migrate to the hybrid architecture.
    - Migration from an existing cable system is relatively straightforward.

(By upgrading trunk portion of cable n/w, channel capacities can be upgraded and switched voice can be added at relatively low cost.)

- Because of limited bandwidth available over existing telephone lines, telcos must increase their last mile capacities.

- Last mile economics is the most important issue that impel a unified version of the I-way.

1>> Telecom – Based Last Mile

- Telco's are the vanguard of I-way construction.
- Their lines into homes and businesses represent the most common access ramps to the backbone.
- They also control the world's largest switched distributed network providing point-to-point voice, fax, data, and video-conferencing services to hundreds of millions of subscribers.
- This n/w appears to be primary foundation for the I-way due to:
    - Capability of handling millions of simultaneous calls.
    - Providing accurate usage tracking and billing.
- Telephone network suffers from two problems:

- **Lack of digital transmission capability** – telephone network continues to be dependent on analog transmission.
- **Uneven distribution** – much of trunk (long-distance or local area interoffice networks) infrastructure is comprised of fiber. Local loops from local switching center into businesses and homes are still two or four wire unshielded copper wire with limited capacity.

- Telephone companies are in a bind: Trade-off between more investment and better utilization of existing investment is creating very interesting dynamics in market place.
- What will likely be offered to consumers is probably far different from what is bring proposed today.

- **Structure of US Telecom industry**

  - Voice, data and video conferencing services are provided
    - By local exchange carriers (local telephone companies) serving local access and transport areas, and
    - By the interexchange carriers (long-distance carriers) providing long-distance and international dialing services through their long-distance networks.
  - Local services in the United States are provided by about 1325 local telephone companies, including 7 *Regional Bell Operating Companies (RBOC)*
  - RBOCs have exclusive rights to provide a basic, local telephone service.
  - In 1988, they were allowed to provide information transmissions – ability to carry data over their networks.
  - In 1990, RBOCs were allowed to provide information services as well.

- **RBOCs I-Way Strategy**

  - RBOCs have now entered the long-distance and telecommunications equipment manufacturing businesses and to offer video programming services.
  - Telco's are following two strategies in their expansion: in-territory and out-of-territory.
  - Some RBOCs actually implementing only one strategy and some both.
  - Several other RBOCs are focusing on in-territory growth and plan to expend significant investment into deploying basically traditional cable

(a hybrid fiber/coax wire).

- **Broadband to the Loop "Video-Dial Tone" Strategy**

  - The primary challenge is to provide broadband digital services over the existing plant (hundreds of thousands of miles of copper wire)
  - Telephone companies are adopting a mix of technologies and strategies.
  - The most promising approaches are *Asymmetrical digital subscriber line (ADSL)* (copper) and the fiber-to-the-curb architectures: a switched digital fiber-to-the-curb (fiber) and switched digital hybrid fiber-coax (HFC) (fiber and coaxial)
  - Fiber-to-the-curb architecture provides high-capacity switched digital network services to optical network units serving multiple residences.
  - Switched digital fiber-to-the-curb system provides video programming and info in a digitally compressed format (MPEG) and transports digitally by fiber optic equipment to the central office.
  - Digital video signals from all providers are combined on a video distribution element *(Host Digital Terminal – HDT).*
  - Fibers are extended from HDT to the local pedestal (similar to cable head-end).

- The pedestal is an optical network unit, which houses the necessary equipment to convert the optical signals to electrical impulses and distribute them to individual homes over a copper wire or coaxial cable.
- Only requested programs are transmitted.
- Mostly newer or rebuilt cable systems use a hybrid fiber optics/coaxial cable architecture (*Fiber Optic Feeder*).
- The ADSL approach is expected to be the least expensive and the fiber-to-the-curb the most expensive.

2>> Cable TV- based last mile

- Cable is vigorously pushing the concept that high-speed data to the home is best served by running over cable networks, not on telephone analog and more recent ISDN connections.
- Cable companies already have the high-capacity wiring in the form of coaxial cable for broadcasting analog video.
- Cable companies also want to provide important business services such as voice telephony, data communications, and access to on-line services.
- Major hindrance is that cable systems tend to be proprietary and not well interconnected.

Wired Cable TV

  - Cable TV network links thousands of cable systems with millions of subscribers via broadband coaxial cable.
  - Cable systems traditionally use coaxial cable and a series of amplifiers throughout the distribution network.
  - Today, most large-scale upgrades replace traditional components with fiber optic technology in the trunk sections of the network.
- Differences between transmission technologies and network architectures deployed in telephone and cable systems:
  - The telephone system is based on a switched, distributed n/w architecture and uses standard switching transmission protocols capable of supporting global, narrowband, two-way, point-to-point communications.
  - Cable systems are based on a tree-and -branch network architecture and proprietary transmission protocols designed to support one-way broadband analog transmission with little or no provision for ‘upstream’ communication
- Cable systems traditionally use coaxial cable and a series of amplifiers throughout the distribution network.
- Today, most large-scale upgrades replace traditional components with fiber optic technology in the trunk sections of the network.
- A fiber optic system can send its signals greater distances and with less signal degradation than can the traditional coaxial system.
- This system also eliminates the need for expensive electronic amplifiers.
- Fiber optic transmission offers greater security from illegal signal tapping.
- In near future, new digital and fiber optic technologies will allow cable companies to provide telephone services over their networks.

Wireless Cable TV

- Direct broadcast satellite (DBS) uses super high frequency (SHF) channels to transmit satellite cable programming over the air instead of through overhead or underground wires.
- DBS is a name given to a service MMDS (**Multichannel Multipoint Distribution Service**) which could only send one or two channels.
- DBS offers two benefits: ***Availability* & *Affordability***
    - It can be made available in rural areas of scattered population where it is too expensive to build a traditional cable infrastructure and those savings can be passed on the subscribers.
- Currently two types of DBS services are available:
    - Prime Star
    - Direct Satellite System (DSS) – Hughes DirecTV.
- **Technical Problems:**
    - Rain Fade: picture quality degradation and/or due to rain droplets absorbing signals
    - Solution: availability of more dish area for signal to reach

- **DBS Working:**
    - It Sends scrambled satellite cable programming to a central location
    - There it is processed and fed into special SHF transmitters for distribution throughout the coverage area.
    - Signals (combined with existing VHF and UHF channels from subscriber's antenna) are received by special antennas installed at subscribers' roofs.
    - These signals are distributed within the home or building through coaxial cable into a channel program selector located near TV set.
- Upfront cost to DBS subscribers is likely to be prohibitive for most current and potential wireless cable subscribers.
    - Subscribers to DirecTV pay for dish and a set-top box (per TV set), or for dish that allows two-set hook-up, installation fees and then, monthly programming fee. Additional fee for additional services.
    - Prime Star operators do not charge subscribers for the customers premises equipment nor do they charge much for installation.
- In a nutshell, Wireless operators are expected to be low-cost providers in the video to the home market.

3>> Radio-Based Wireless Last Mile

- Radio-based wireless networks are made up of cellular, microwave, and specialized mobile radio data networks.
- Advantageous over terrestrial (wired) networks - potentially accessible from any point on the globe without the cost of installing wire or cable.
- Provide users with an unprecedented degree of mobility and flexibility.
- Two applications of radio technology led to its wide spread usage:
    - Radio broadcasting
    - Military warfare
- **Factors influencing Wireless growth**
    - Wireless can give consumers a mix of mobility and convenience unparalleled in the wired world.

        - Wireless entails less infrastructure and environmentally disruptive construction activities than more labor-intensive fiber-optic and coaxial systems requiring underground cabling.
    - Radio-based wireless networks are made up of cellular, microwave, and specialized mobile radio data networks.
    - Advantageous over terrestrial (wired) networks - potentially accessible from any point on the globe without the cost of installing wire or cable.
    - Provide users with an unprecedented degree of mobility and flexibility.
    - Two applications of radio technology led to its wide spread usage :
        - Radio broadcasting
        - Military warfare
    - **Factors influencing Wireless growth**
        - Wireless can give consumers a mix of mobility and convenience unparalleled in the wired world.
        - Wireless entails less infrastructure and environmentally disruptive construction activities than more labor-intensive fiber-optic and coaxial systems requiring underground cabling.

- **Cellular Network infrastructure**

    - Wireless data services are logical extensions to existing and trusted services.
    - Availability of new features (e.g. voice dialing, alphanumeric display for short messages) and increasing intelligence are built into the cellular network.
    - Shortcoming: lack of a seamless national network. One obstacle in creating a national architecture is proliferation of competing standards in the cellular market.
    - Cellular operators are upgrading their analog networks to digital to provide :
        - greater capacity at lower cost
        - Increased quality and functionality of the cellular network.

- **Specialized Mobile Radio (SMR)**

    - Conventional two-way radio system configured in a manner that provides “interconnects” service, functionally similar to cellular.
    - Existing SMR systems is being converted to a digital cellular like architecture (Enhanced Specialized Mobile Radio – ESMR)
    - ESMR uses a digital technology that will expand the call-carrying capacity of a set of SMR channels by as much as a factor of 15 or more
    - It is offering a whole plethora of wireless features and functions.

- **Mobile Data Networks**

    - Built on SMR infrastructure
    - In existing applications, the workers on road typically receive instructions and collect information in written form or by voice.
    - Information thus collected must be entered into the database later at the home office, increasing the possibility of inaccuracies and delaying database updates.
    - Wireless data networks have the ability to connect mobile workers to the central database directly.

- **Commercial On-Line Services based Last Mile**

  - Provide customers with both E-com applications and ramps to access the I-way.
  - Goal: to become one-stop shopping mall of cyberspace.
  - On-line services tend to be general purpose, for profit networks available nationwide, regionally or locally.
  - In addition to processing power, consumers want direct link to I-way by which content reaches home/business through Electronic Distribution Channels
  - These channels act as on-ramps to the Internet or other on-line information services.

➔Global Information Distribution Networks

Two major technologies underpinning high-speed global information distribution networks are :

- **Fiber Optic long distance networks**
- **Satellite networks**

1>> Fiber Optic Long Distance Networks

- Connectivity is available via cable (fiber/coax) owned by long-distance or interexchange carriers (IXCs).
- Fiber optic cable provides better-quality service for interactive applications and is likely to grow for international transmission*.
- Interexchange carriers (IXCs) also play a significant role in local access market by teaming with firms in the wireless and cable TV business.
- Alternative arrangements are being explored to lower the cost of using local networks that will also allow IXCs to provide local network access themselves through business partnerships or acquisitions.
- Interexchange carriers (IXCs) have advanced switched networks nationwide that can serve as a backbone for alternative local access networks.
- AT&T and others provide US long-distance services.
- In Europe, uniform speed, efficiency, levels of technology and cost of telecom services are necessary for both voice and data services.
- At present, wide disparities remain among different network operators in terms of both efficiency and pricing.
- Major long-distance carriers have focused their attention on wireless technologies and made plans to work with or acquire companies in the wireless market.
- This would enable them to provide long-distance services to cellular users and to develop a more economical local access network to reach their own subscribers.

2>> Satellite Networks

- Initially, satellites were used to transport long-distance tele communications and one-way video broadcasts.
- Advent of fiber optic changed the role of satellite in global communication industry.
- Communications satellites are crucial part of the global communications infrastructure.
- Advantages of satellite networks
  - They are accessible from any spot on the globe.
  - Can provide broadband digital services, including voice, data, and video to many points without the cost of acquiring right-of-way and wire installation
  - Can add receiving and transmitting sites without significant additional costs.

- Today, about 150 communications satellites in geo synchronous orbit (GEO) are providing a wide range of services, including broadcast video and overseas telephone links.
- Geo synchronous satellites are designed to broadcast a wide beam to ensure wide area coverage.
- Network's receiving stations require large antennas to capture the relatively weak signal.
- Satellite can provide services to areas that cannot reach by fiber.
- Earth blanketing satellite services* are expected to provide the basic infrastructure to beam data and voice practically anywhere in the world.

- **VSAT (Very Small Aperture Terminal)**

  - Many satellite networks use a large number of small dishes (VSATs) for the outlying nodes and one central hub with a big dish that can transmit very powerful signal and is very sensitive to incoming ones.
  - This system minimizes the cost of the majority of the ground stations at the expense of maintaining one big one, which can be shared by several users.
  - This approach can cause additional delays:
    - VSATs are not powerful enough to talk to one another directly through the satellite.
    - Messages must pass through the hub and make two trips into space before reaching the final destination
  - VSATs are typically used by organizations (e.g. oil companies) that require data or voice communications between sites distributed over a geographical area.
  - VSAT networks are often used in countries where telephone links are overloaded, unreliable or difficult to obtain.

  - **Strategic advantages:**

    - Average availability of 99.5 % and ease of rapid development in remote or hard-to-reach areas.
    - With a VSAT network, organizations have control over and insight into entire network from a single point

➔Public policy issues shaping the I-way

- **Cost:**

  - Who should pay for Network Infrastructure for E-com
    Public policy issues shaping the I-way constructing I-way?
  - Some favor interstate highway model with government construction, ownership and maintenance.
  - Others support current regulated telephone system model.

- **Universal access:**

  - Equal access probably mean that cable and phone companies deploying upgraded networks will be required:
    - to serve some consumers at prices below cost, and

        - To extend wires to places where other technologies (like satellite) would make more sense.
    - As per Economists, market should decide who gets access to the I-way.
    - Others insist that highway operators must provide universal access at reasonable cost.
    - If the I-way is built and run by private interests without significant government investment, the non-profit organizations might not be able to afford hooking up to the network.
    - Whether universal access is nationwide or international is still undecided.

- **Subsidies:**

    - Developers might hope for subsidies, tax breaks, government business or other forms of encouragement.
    - What will be these tax subsidies actually subsidize?
        - Cost of hardware
        - Rate payers subsidize "work-at-home" employees
    - Who will pay to extend the network to non-profit organizations (schools, hospitals, police, fire department)?

- **Information Privacy issues:**
    - On I-way, each keystroke – the companies can track interests, purchases and inquiries –.
    - Most on-line services invite members to create on-line profiles that are accessible to all other members increasing the potential of abuse.
    - The questions are:
        - Can vendors keep track of consumer's preferences?
        - Can this information be sold to others?
        - Can network managers read e-mail or ads to root out fraud or pornography?
        - On what grounds can they deny access?
        - When will police surveillance be allowed?

- **Regulation:**
    - Some free enterprises argue that if highway is built with private funds then no government regulation.
    - Some argue the open competition among highway operators, but regulation to provide public access, privacy and reasonable tolls.
    - What are the rules? Who writes them? Who enforces them? These issues remain undecided.

- **Social and religious barriers:**
    - Cyberspace is considered to be a representation of free speech and democracy.
    - For many countries where free speech is alien, Internet presents interesting problems and policy issues.
    - For other strongly religious countries where women have been denied voice and access to media for many years, Internet causes many headaches (Internet doesn't distinguish between sexes).
    - Some countries have strict pornographic laws. With Internet, it is very hard to control influx of pornographic material (as it is hard to distinguish one byte from another)

➔ **Public policy and global connectivity**

- To achieve global connectivity, the following policy implications are there :

  - **Global Subsidies**
  - **Access to local Infrastructure**
  - **Cost and pricing of "Universal Access" transmission capacity**
  - **Adoption of technology standards.**

- **Global Subsidies:**

  - The richer countries may have to subsidize the infrastructure through World bank (in the countries not able to afford investments to finance telecom development)
  - Despite improvements in the telecommunications infrastructures*, still significant investments are required to be "Telco equivalent" to developed countries.
  - These investments largely depend on country's capability to promote market economics, demonstrate business environment that will provide investors a reasonable risk and return on their investments.

- **Access to Local Infrastructure:**

  - Local infrastructure within a country is a matter of local policy and investment and is the area of greatest unevenness across countries.
  - Disparity between developed and developing data communications environments is a source of operational frustration to businesses while effecting or using international connections.
  - In some countries, state-owned Telco's control both domestic and international communications.
  - There, it is extremely difficult to acquire a direct link into a specific site, and often use of an expensive Telco-operated network is mandated.
  - To overcome shortcomings in local distribution:
    - Wireless communication technology (including microwave cellular telephony)
    - Cable telephone technology might also enhance local infrastructure
  - Since local infrastructure is a national issue, It is not appropriate for international private or government groups to try to dictate national network approaches.

- **Cost of pricing of "Universal Access" Transmission Capacity:**

  - To create a high-speed network, a nation must first consider who will pay and how payment will be made?
  - The disparity between the costs of international circuits initiated in US and other countries seriously constraints the cost-sharing efforts of government agencies using these circuits.
  - Today some government agencies (e.g. DOE, NASA) pick-up the costs of long-haul transmission channels and their international partners pay for local distribution circuits within their own countries.

- **Adoption of Technology Standards:**

  - Achieving consensus on standards in the current international environment has been difficult at best.
  - Standards developed by slow-moving international committees seem to be not serving needs of user community.

Chapter 3: --E-com and World Wide Web

➔ Introduction

- **Need for E-com :**

  - To improve business processes and information exchange both within an enterprise and across organizations.
  - It is an integrating force that represents the digital convergence of 21st century business applications and computing technologies.

- **E-com Applications :**

  - Emphasize the generation and exploitation of new business opportunity.
  - Information about a product or service is separated from the physical product or service.
  - This information can become as crucial as the actual product or service in terms of its effect on a company's profits.
  - Information based business transactions are creating new ways of doing business and even new types of business.

- **Common E-com Applications :**

  (i) Paperless exchange of business information using EDI (ii) E-mail
  (iii) Electronic bulletin boards
  (iv) Electronic Funds Transfer (EFT) and other similar technologies.

  - These technologies normally applied in high-payments, recognizing that paper-handling activities usually increase expenses without adding value.
  - These are also considered as part of e-com application domain:
    (I) Advertising
    (ii) Marketing
    (iii) Customer Support Functions

- **Business Goals :**

  (i) Stay competitive
  (ii) Improve productivity
  (iii) Deliver quality service

- **Challenges :**

  - Some aspects of the e-com infrastructure are already in place : such as to automate the key processes purchasing, invoicing etc. How to leverage the prior investment ?
  - Prices for computer hardware and network equipment continue to fall. However, investors must first exert some effort to understand the technology underlying –COM applications.

- EDI and E-mail like messaging based technologies, combined with database and information management services appeared to form technical foundation for effective electronic commerce applications.
- However none can deliver full potential of E-com.
- An integrated architecture required is emerging in the form of World Wide Web (WWW).
- Technically and commercially, WWW client-server model seems poised to Become a dominant technology.

➔ Architectural framework for E-com

- A framework is intended to define and create tools that:
  - Integrate the information found in today's closed system
  - Allow the development of e-com applications
- Aim of architectural framework is not to build new database management systems, data repository, computer languages, software agent-based transaction monitors, or communication protocols.
- It should focus on synthesizing the diverse resources already in place in corporations to facilitate the integration of data and software for better applications.
- E-com application architecture has six layers of functionality or services
- These layers cooperate to provide a seamless transition between today's computing resources and those of tomorrow by
  - Transparently integrating information access
  - Exchange within the context of chosen application
- E-com applications are based on several elegant technologies.
- When they are integrated, then only they provide powerful solutions.
-

Architectural Framework for E-com
A Conceptual Framework

Layers	Services provided
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 – OPTS, coaxial, fiber optic

1… E-COM Application Services::

- It will be comprised of existing and future applications built on the innate architecture.
  - Three distinct classes are :
    - Consumer-to-Business Transactions
    - Business-to-business Transactions
    - Intra organization Transactions

~~> Consumer-to-Business Transactions

- Also called Marketplace transaction
- Customers learn about products differently through electronic publishing
- Buy products differently using electronic cash and secure payment systems
- Have the products delivered differently.
- How customers allocate their loyalty may also be different.
- In new environment, brand quality can rapidly evaporate forcing firms to develop new ways of doing business.

Mercantile Process Models

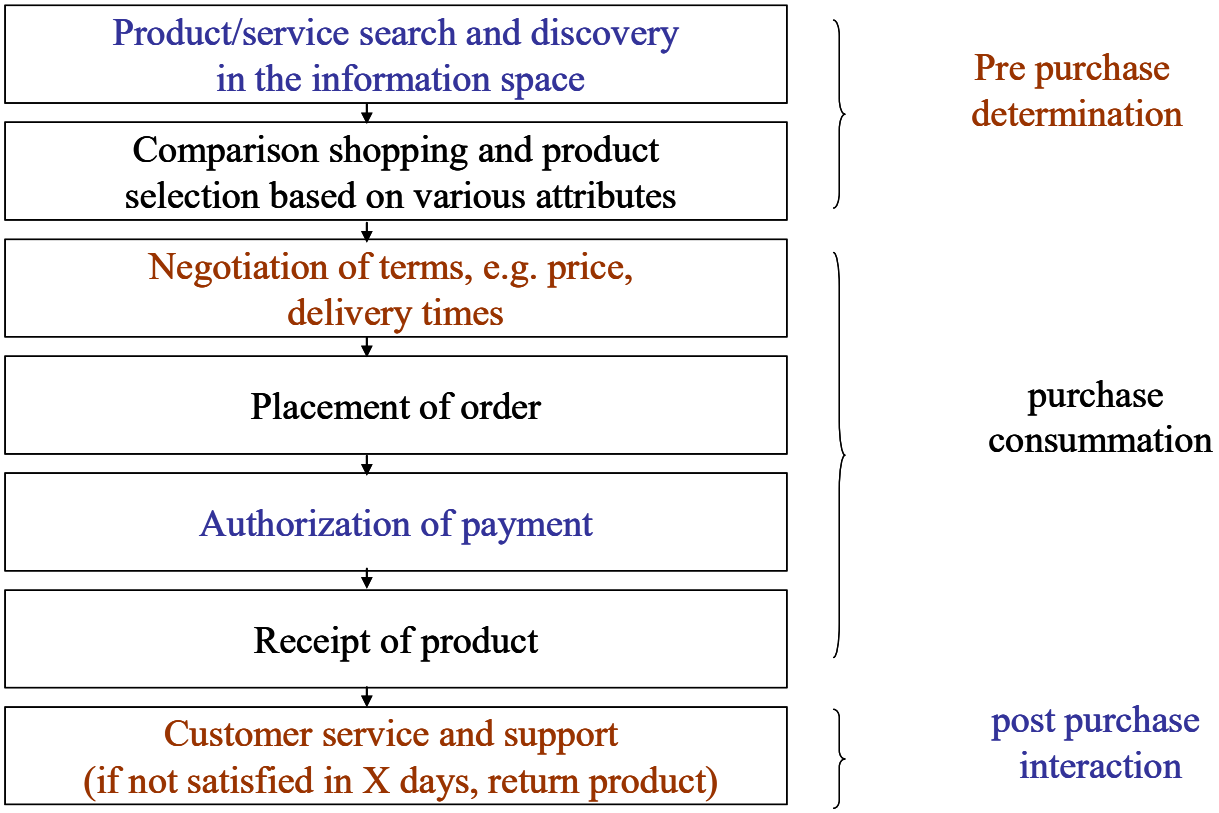
- Mercantile processes define interaction models between consumers and merchants for on-line commerce.
- To buy and sell goods, a buyer, a seller and other parties must interact in ways that represent some standard business process.
- A common way of doing business over the I-way will be essential to the future growth of e-com.
- The establishment of a common mercantile process (a set of processes) is expected to increase convenience for consumers who won't have to figure out a new business process for every single vendor.
- The absence of a common process for managing and completing transactions will result in E-com being entangled in a mesh of bilateral ad hoc mechanisms.
- The review of existing business process models would provide the understanding required to determine the features needed in an architectural model designed specifically for E-com.
- A general architecture would lead to a set of methods and tools from which specific protocols can be easily implemented.

- **Mercantile Models from the consumer's perspective**

  - On-line consumer expects quality, convenience, value, low price and control.
  - To meet these expectations, a business process model is needed that provides a standard product/services purchasing process from an interactive services and merchandising point of view.
  - Business process model from a consumer's perspective has seven activities that can be grouped into three phases
  - Although each consumer has a distinct way of doing business and different criteria define various products and services, some generalizations can be made about the way consumers make on-line purchasing decisions.
  - The specialization of this model to particular cases would help merchants and others understand:

- Why consumers shop on-line?
- Where they shop?
- What they buy?
- What sizes do consumers purchase and why?
- How often do they shop?
- Who shops the competition and why?

Steps taken by customers in product/service purchasing



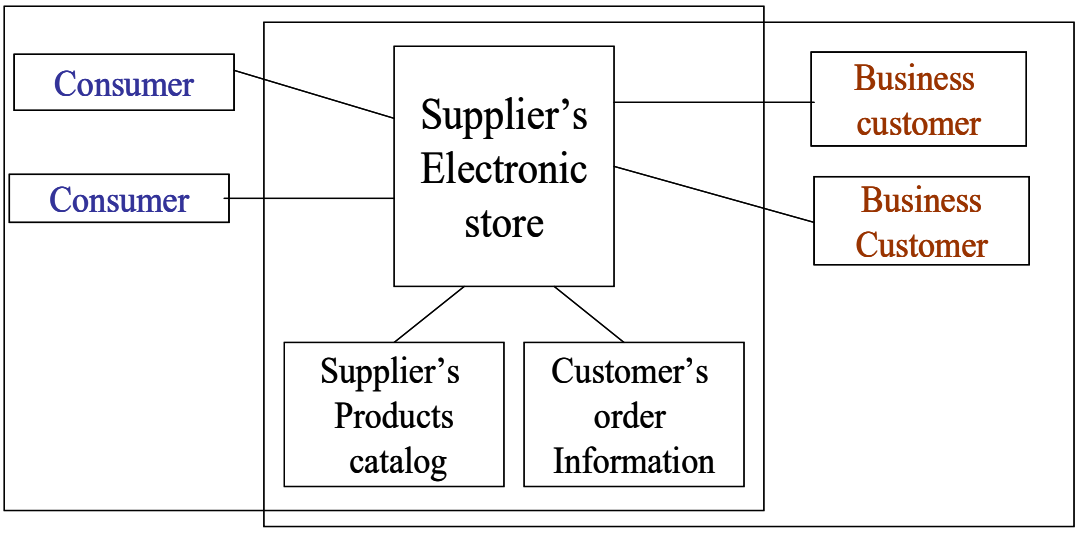
~~> Business to Business (B2B) Transactions

- Also called Market – link transaction
- Businesses, governments and other organizations depend on computer-to-computer communication as a fast, an economical and a dependable way to conduct business transactions.
- B2B 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.
- Current manual process of printing, mailing, and rekeying is costly, time-consuming and error-prone.
- To reduce these costs, small businesses are looking toward E-com.
- The advantages of E-business to business transactions
  - Lower procurement costs;
  - Reduced processing errors and inventory costs;
  - Reduced time to market;
  - Extended business reach; and
  - Improved customer service.

- **Models of B2B E-Commerce: -**
  - **Supplier oriented marketplace**
  - **Buyer oriented marketplace**
  - **Intermediary oriented market place**

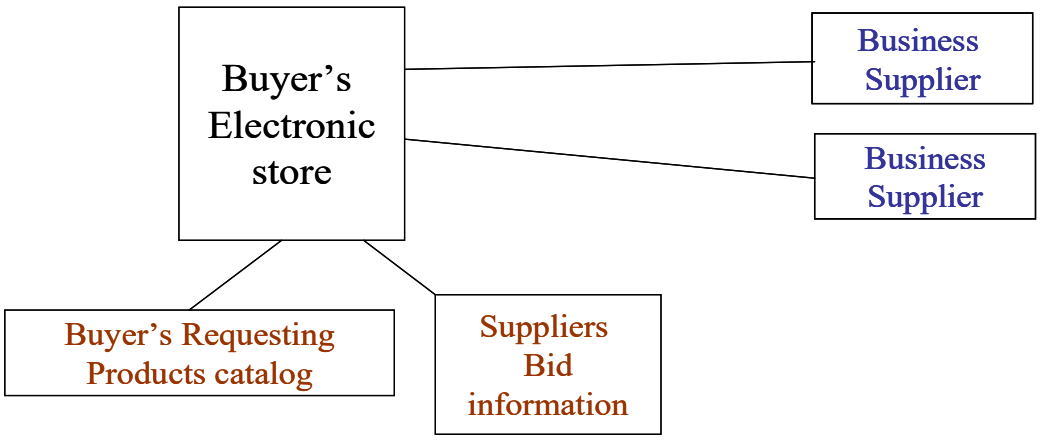
1>> <u>Supplier-Oriented B2B Marketplace Architecture</u>:

- Both individual consumers and business buyers use the same supplier provided marketplace.
- Buyer's acquisition department has to manually enter the order information into its own corporate information system.
- Searching e-stores and e-malls to find and compare suppliers and products can be very costly.



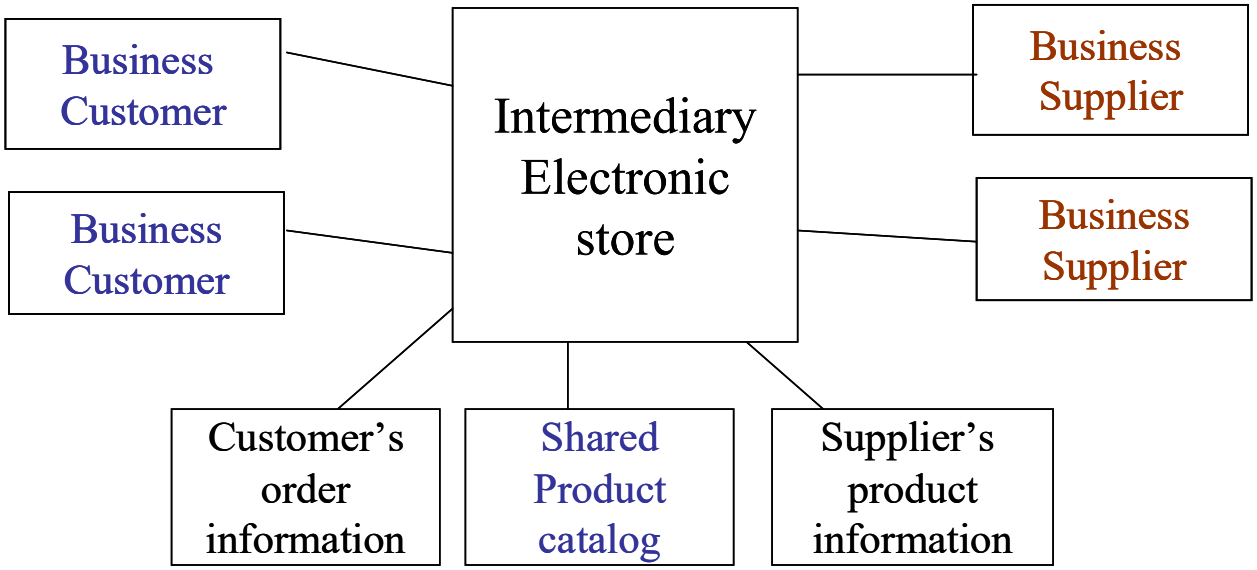
2>> <u>Buyer-Oriented B2B Marketplace Architecture</u>

- A buyer opens an electronic market on its own server and invites potential suppliers to bid on the announced RFQs (Requisitions For Quotations).
- Offers greater opportunity committed suppliers.



3>> Intermediary -Oriented B2B Marketplace Architecture

- This model is establishing an electronic intermediary company, which runs a market place where business buyers and sellers can meet.



- **Key Entities in B2B E-com**

  - Selling Company – with marketing management perspective
  - Buying Company - With procurement management perspective
  - Electronic intermediary – a third party intermediating service provider (the scope of service may be extended to include the order fulfillment)
  - Deliverer – who should fulfill the JIT delivery
  - Network platform – such as the Internet, intranet and extranet
  - Protocols and communication – such as EDI and comparison shopping, possibly using software agents
  - Back-end information system – possibly implemented using the intranet and ERP (Enterprise Resource Planning) systems.

- **Information offered by B2B applications**

  - Product – specification, prices and sales history
  - Customer – sales history and forecasts
  - Supplier – product line and lead times, sales terms and conditions
  - Product process – capacities, commitments, product plans
  - Transportation – carriers, lead times, costs
  - Inventory – inventory levels, carrying costs, locations
  - Supply chain alliance – Key contacts, partners' roles and responsibilities, scheduling
  - Competitor – benchmarking, competitive product offerings, market share
  - Sales and marketing – point of sale (POS), promotions
  - Supply chain process and performance – process descriptions, performance measures, quality, delivery time, and customer satisfaction.

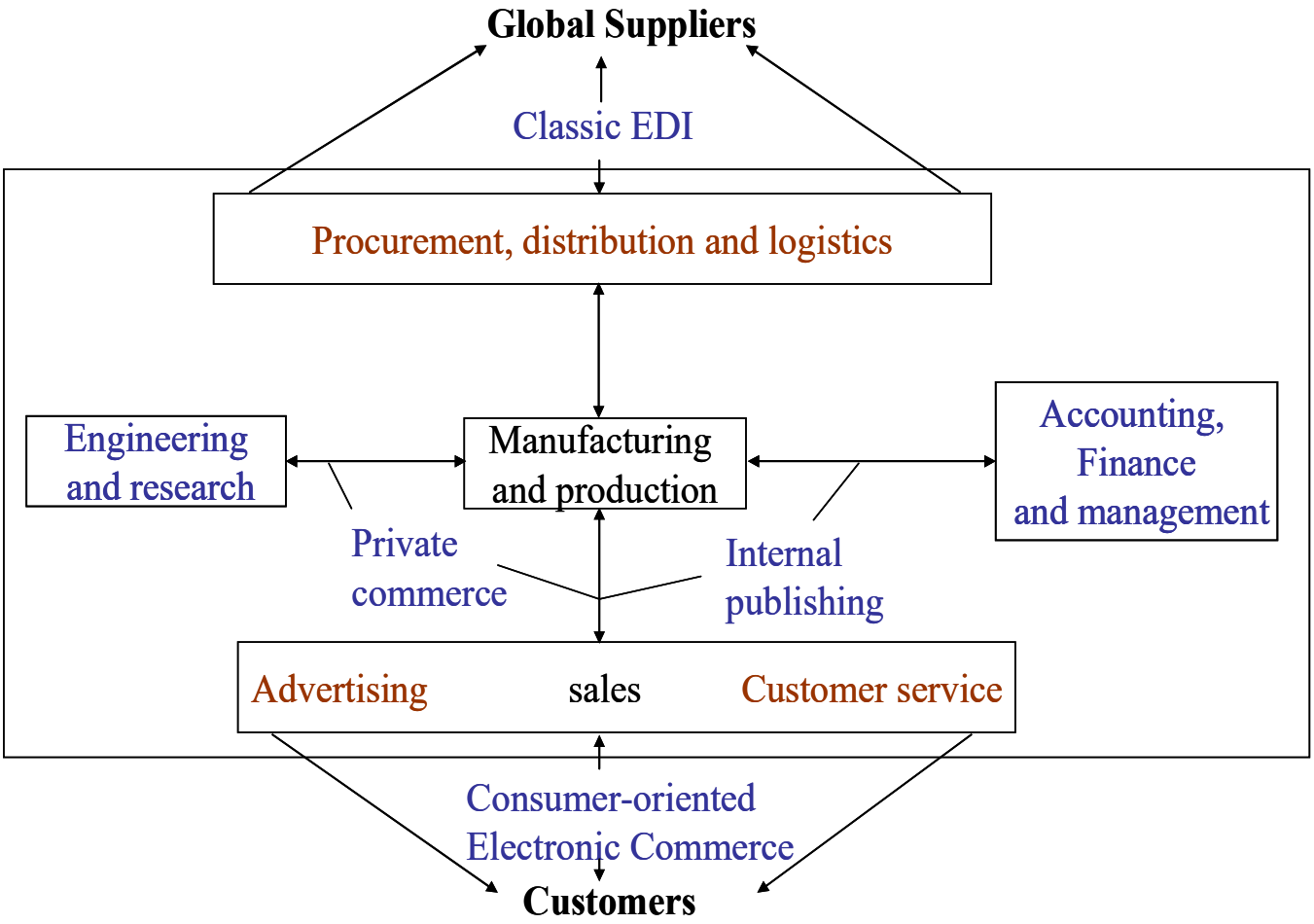
~~> Intra-organizational Transactions

- Also called market driven transactions
- A company becomes market driven by
  - dispersing throughout, the firm information about its customers and competitors
  - 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.
- A market driven business develops a comprehensive understanding of its customers' business and how customers in the immediate and downstream markets perceive value

- Three major components of market-driven transaction:

  - **Customer orientation through product and service customization.**
  - **Cross-functional coordination through enterprise integration.**
  - **Advertising, marketing and customer service.**

E-Com Application Services
Different types of E-com Applications



2… Information Brokerage and Management

- This layer provides service integration through information brokerages, the development of which is necessitated by the increasing information resource fragmentation.
- Info brokerage represents an intermediary who provides service integration between customers and information providers, given some constraints such as a low price, fast service, or profit maximization for a client.
- Info brokers are rapidly becoming necessary in dealing with the voluminous amounts of info on the networks.
- With all the complexity associated with large numbers of on-line databases and service bureaus, it's impossible to expect humans to do searching.
- Software programs - information brokers or software agents act on behalf of the searcher.

- **Information Brokerage :**

  - Addresses the issue of adding value to the info that is retrieved.
  - Supports for data management and traditional transaction services.
  - May provide tools to accomplish more sophisticated, time-delayed updates or future compensating transactions. (These tools include software agents, distributed query generator, distributed transaction generator, declarative resource constraint base - which describes a business's rules and environment information)

- At the heart of this layer lies the workflow-scripting environment built on a software agent model that coordinates work and data flow among support services.
- Software agents are mobile programs, also called **"healthy viruses", "digital butlers", "intelligent agents".**
- Agents are encapsulations of users' instructions that perform all kinds of tasks in electronic marketplaces spread across networks.
- Information brokerages dispatch agents capable of info resource gathering, negotiating deals, and performing transactions.
- Agents are intelligent and have contingency plans of action.
  - They examine themselves and if necessary change their original course of action to an alternative plans of action.
- Though software agents sounds very seductive, it will take a while to solve the problems of inter-agent communication, interoperable agents and other headaches that come with distributed computing and networking.
- Until E-com services are up and running on a large scale, it is impossible to know how well software agents will work.

3… Interface and support services

- Provide interfaces for electronic commerce applications such as interactive catalogs
- Support directory services– functions necessary for information search & access.

- **Directories**

  - Operate behind the scenes
  - Attempt to organize the enormous amount of information and transactions generated to facilitate electronic commerce.
  - Directory services database make data from any server appear as a local file.
  - E.g. telephone White Pages, which allows locating people and telephone numbers.
  - Would play an important role in information management functions.

- Interact directly with software applications
- Need not to have multimedia glitter and jazz generally associated with interactive catalogs.

- **Interactive Catalogs**

  - Customized interface to consumer applications such as home shopping.
  - Extension of the paper based catalog and incorporates additional features like sophisticated graphics and video to make advertising more attractive.
  - Deal with people
- No one common user interface that will glaze the surface of all e- com applications, but graphics and object manipulation will definitely predominate.
- Tool developers and designers might incorporate common tools for interface building.
- But, the shape of catalogs or directories will depend on the user's desires and functional requirements.

4… Secure Messaging and structured document interchange services

- Electronic messaging is a critical business issue.
- **Integrated messaging :**

  - A group of computer services that through the use of a network send, receive, and combine messages, faxes, and large data files.
  - Examples: electronic mail, enhanced fax, and electronic data exchange.

- **Messaging :**

  - Software that sits between the network infrastructure and the clients of e-com applications, masking the peculiarities of the environment.
  - A framework for the total implementation of portable applications, divorcing user form architectural primitives of system.
  - Messaging products are not applications that solve problems, but are enablers of the applications that solve problems.
  - **Types**
    - **Unstructured document messaging**
      - For communicating non formatted data – letters, memos, reports
      - Examples: fax, e-mail and form based systems like Lotus Notes
    - **Structured documents messaging**
      - For communicating formatted data – purchase orders, shipping notices and invoices
      - Consists of automated interchange of standardized and approved messages between computer applications via telecommunications lines.
      - Examples: EDI

- **Advantages of messaging**

  - Supports both synchronous (immediate) and asynchronous (delayed) message delivery and processing.
  - Not associated with any particular communication protocol.

- No preprocessing is necessary, inspite of increasing need for programs to interpret the message.
- Well suited for both client-server and peer-to-peer computing models.*
- With the messaging tools, people can communicate and work together more effectively – no matter where they are located.
- Message-enabled work-flow solutions
    - An employee sends an e-mail form; the info 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 next one and so on.

- **Disadvantages of messaging**

    - It enables new types of applications, which appear to be more complex, especially to traditional programmers.
    - It involves jungle of standards.
    - No interoperability between different messaging vendors because of lack of standards.
    - Security, privacy, and confidentiality through data encryption and authentication techniques are important issues to be resolved to ensure legality of message-based transactions themselves.

5… Middleware services

- To solve all the interface, translation, transformation, and interpretation problems.
- Middleware is the ultimate mediator between diverse software programs that enables them talk to one another.
- Since computing shifts from application centric (applications controlling data) to data centric (remote data controlling all the applications in the network), middleware services focus on three elements to achieve data-centric computing
    - Transaction security and management
    - Transparency
    - Distributed object management and services.
- Middleware acts as an integrator for the various standard protocols already in use (or soon to be available)
- These protocols include TCP/IP, Open Software Foundation's distributed computing environment and the emerging distributed object computing frameworks for creating compound documents (e.g. Common Object Request Broker Architecture – CORBA, Object linking and embedding – OLE, and OpenDoc)

- **Transaction Security and management**

    - Support to Transaction processing is fundamental to success in e-com market.
    - Security and management are essential to all layers in e-com model.
    - At transaction security level, two broad categories of security services:
        - (i) Authentication (ii) Authorization
    - For E-com, middleware provides the qualities expected in a standard Transaction processing (TP) system: ACID properties – Atomicity, Consistency, Isolation, Durability.

- **Transparency**

- It implies that users should be unaware that they are accessing multiple systems.
- It is essential for dealing with higher-level issues than physical media and interconnection (for which underlying infrastructure is in-charge)
- Ideal picture is of “Virtual Network” - a collection of work-group, departmental, enterprise, inter-enterprise LANs that appears to the end user or client application to be a seamless and easily accessed whole.
- It 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.
- Transparency is key to realizing the theoretical benefits of middleware-based architecture.
- 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.

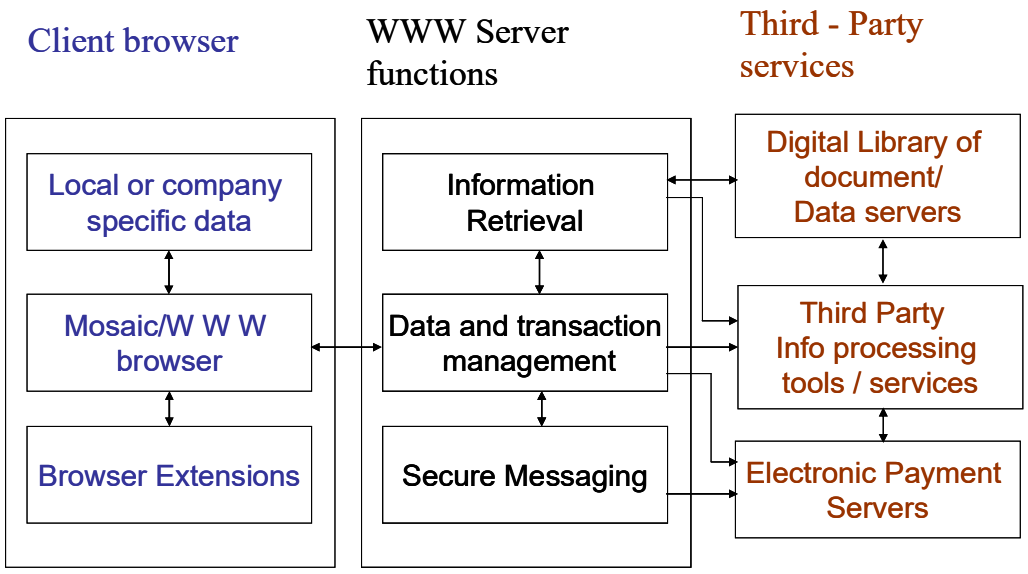
- **Distributed Object Management and Services**

  - Object orientation is proving fundamental to the proliferation of network-based applications.
  - A natural instance of an object in E-com is a document.
  - A document carries data and often carries instructions about the actions to be performed on the data.
  - The term “object” is being used interchangeably with “document” resulting in new form of computing “Document Oriented Computing”
  - The trend is to move away from single data-type documents such as text, pictures or video toward integrated documents (Compound Document Architectures)
  - Active Document (best example) – A new document that will be an integration of the spreadsheet, word processor and presentation package, in the next generation of operating systems as the document will be scrolled through, the toolbar will automatically change from a spreadsheet toolbar to a word processing toolbar to a presentation package toolbar.
  - Document orientation provides the ability to build applications from applets. (It will provide necessary ease of development through capabilities of reuse and customization).
  - Document orientation is expected to provide scalability as the addition or modification of underlying infrastructure with no impact on application logic or response time in E-com applications.

➔ World Wide Web (W W W) as the architecture

- The E-com framework is being built on the WWW architecture.
- Web provides the functionality necessary for electronic commerce.
- E-com depends on the assumption that computers cooperate efficiently for seamless information sharing.
- But, this assumption of inter-operability has not been supported by realities of practical computing.
- As the E-com applications try to impose a certain discipline on the proliferating computers and networks, the diversity of technical standards, product implementation and competing vendors in computing world causes problems.
- Real effect of computing is all too often the prevention of data sharing due to incompatibilities – architectures, data formats and communication protocols.

- E-com architecture is made of **three primary entities:**
  - **Client Browser**
  - **Web Server**
  - **Third Party services.**



E-com Architecture

- Client browser usually interacts with the WWW server, which acts as an intermediary in the interaction with third-party services.
- Client browser resides on the user's PC or workstation and provides an interface to the various types of content.
- For example, if user retrieves a graphic file from a web server, the browser automatically starts up the browser extension to display the graphic file.
- The browser has to be smart enough to understand what file it is downloading and what browser extension it needs to activate to display the file.
  (many type of graphic files are available – JPEG,GIF,TIFF, BMP)
- Browsers are also capable of manipulating local files.
- Functions of Web server –
  - **Information retrieval**
  - **Data and transaction management**
  - **Security**
- The third party services could be other Web servers that make up the digital library, information processing tools and electronic payment systems.

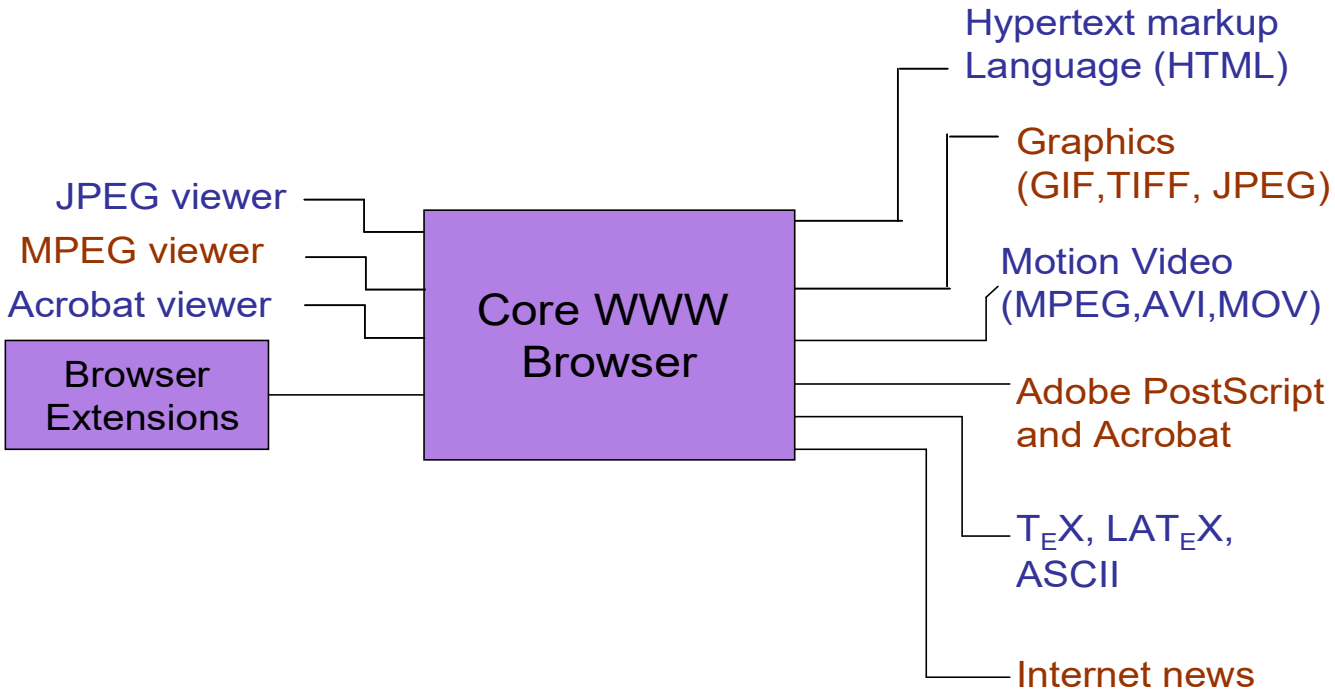
What does the Web Encompass:

- The Web has a wide range of concepts and technologies that differ significantly in purpose and scope.
- These include the global hypertext-publishing concept, universal readership concept, and client server concept.
- **Global Hypertext Publishing Concept :**
  - It promotes the idea of a seamless information world in which all on-line information can be accessed and retrieved in a consistent and simple way.

- To access info in this seamless world, the ability to address many type of data (text files, images, sound files, animation sequences) is needed.

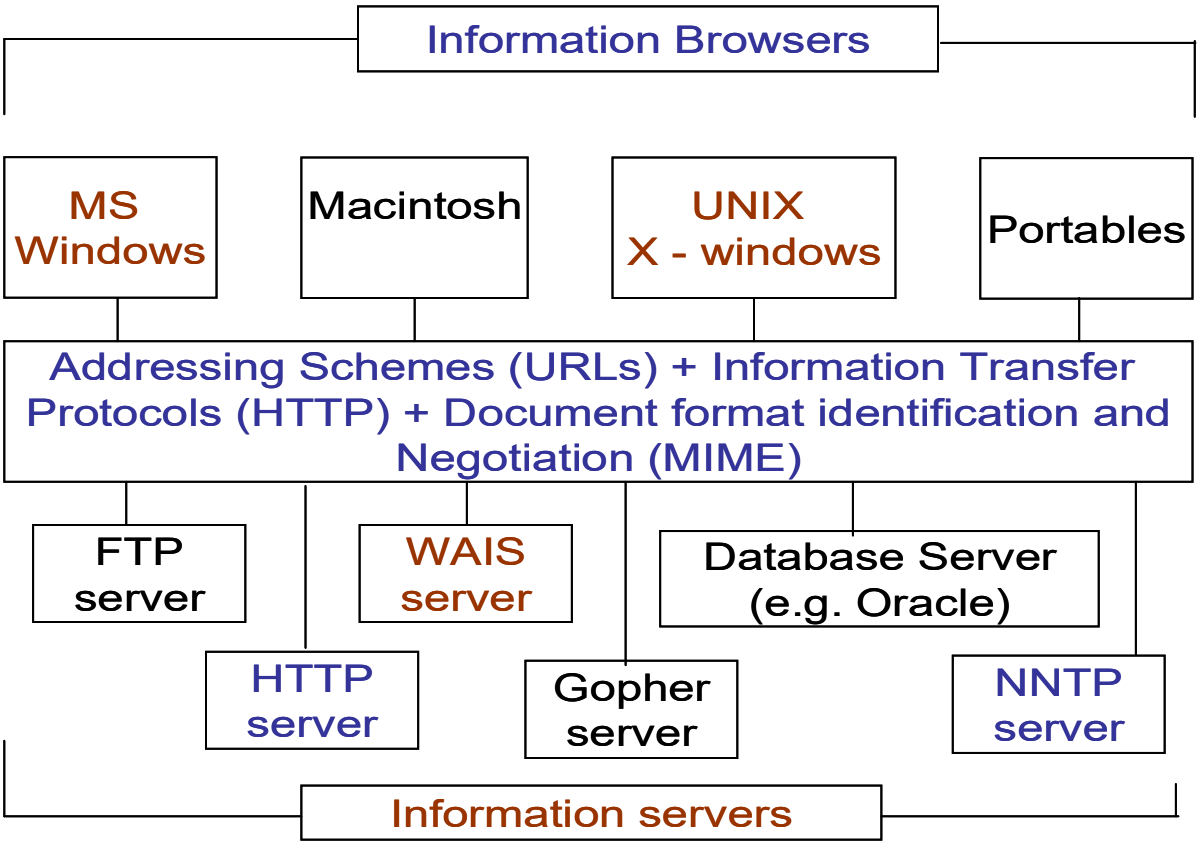
- **Universal readership Concept :**
  - It promotes the idea that one application – a universal (or common) user interface – can be used to read a variety of documents.
  - It implies that once information is published, it is accessible from any type of computer, in any country.
  - Any authorized person merely needs to use one simple program to access the published info
  - This is accomplished in Web using a core browser or application that is augmented by supporting applications.
  - Core browser implements only minimal functionality and attempts to offload more specialized work onto the supporting applications.

Universal Readership supported by core WWW browser



- **Client - Server Concept :**
  - It allows the Web to grow easily without any centralized control
  - Anyone can publish information, and anyone authorized can read and download it.
  - Publishing information requires a server program, and reading data requires a client browser.
  - Internet connects all the clients and all the servers to one another.
  - The various standard protocols allow clients to communicate with all servers.

Client sever concept



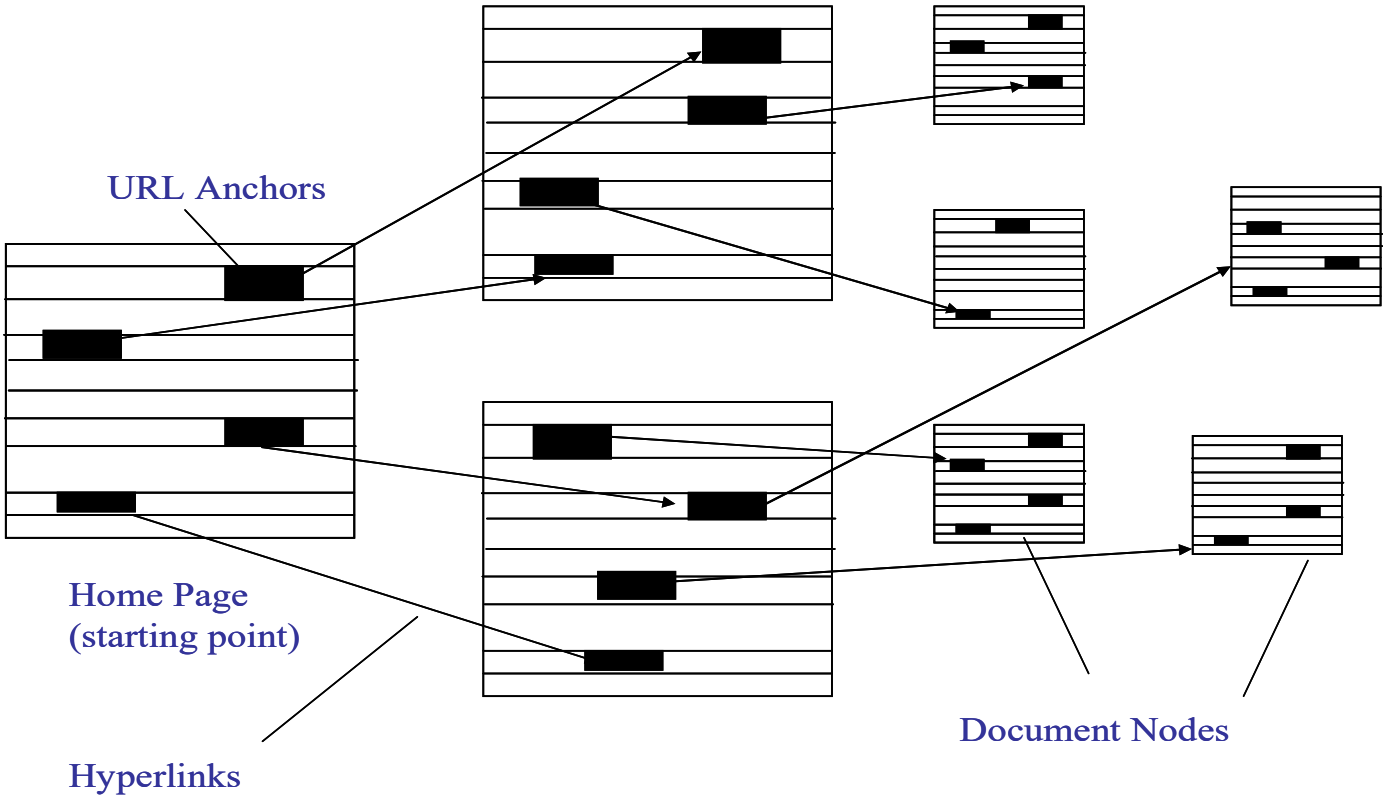
- **Web hangs on a number of essential concepts :**
  - The addressing scheme (Uniform Resource Locator – URL) makes hypermedia world possible, despite many different protocols.
  - The Hypertext Transfer Protocol (HTTP) used by the client browsers and servers offers unique performance and features.
  - Hypertext Markup Language (HTML), which every Web client is required to understand, is used for the representation of hypertext documents containing text, list boxes, and graphics information across the net.

➔ Hypertext Publishing

- Hypermedia on Internet is called Distributed or Global Hypermedia.
- **Hypertext and Hypermedia**
  - Hypertext is an approach to information management.
  - In Hypertext, data are stored in a network of documents connected by links.
  - A Hypermedia system is made of nodes (documents) and links (pointers).
  - Nodes can contain text, graphics, animation, audio, video, images or programs.
  - Nodes are connected to other nodes by links.
  - Nodes (and in some systems network itself), can be viewed through an interactive browser and manipulated through a structure editor.

- The node from which a link originates is *Anchor or Reference* and *node* at which a link ends is *Referent.*
- Hypermedia combines qualities of hypertext and multimedia.
- Hypermedia contains links not only to other pieces of text but also to other forms of media - sounds, images, movies etc.

Hypertext Information Network



~~> Benefits of Hypermedia Documents

- **More Flexible**
  - First overview and then sections can be read in different order as per the interest.
- **Convenient**
  - Offer sound, video sequences, animations and even execution of computer programs.
- **Increased power and appeal**
  - When implemented in networked computing environment with high-resolution displays and large on-line storage.
- **Dynamic organization**
  - Individual nodes can be updated, new nodes can be linked, new links can be added
- Hypermedia systems allow people to create, annotate, link together, and share information from a variety of media such as text, graphics, audio, video, animation, and programs.
- Hypermedia systems provide a non-linear, innovative way of accessing and retrieving network documents.

➔ Technology Behind the Web

- Information providers (or publishers) run programs (called servers) from which the browsers (clients) can obtain information.
- These programs can either be
  - Web servers that understand the hypertext transfer protocol (HTTP), “gateway” programs that convert an existing information format to hypertext
  - or, a non-HTTP server that Web browsers can access - anonymous FTP (File Transfer Protocol) or Gopher servers.
- Web servers are composed of two major parts:
  - Hypertext transfer protocol: for transmitting documents between servers and clients.
  - Hypertext Markup language: format for documents.
- Link between HTML files and the HTTP servers is provided by the URLs

1 >> <u>Uniform Resource Locators</u>

- URLs are the strings used as addresses of objects (documents, images) on the Web.
- URLs follow a fairly consistent pattern:
  - 1st part: Type of resource
  - 2nd part: name of the server housing the resource
  - 3rd part: full file name of the resource
- URLs are universal as they provide access to a wide range of network services, which required separate applications in the past.
- Some URL formats:
  - FTP: ftp://server.address/complete.file.name
  - Gopher: gopher://server.address: port/directory/filename
  - TELNET: telnet://server.address: port
  - HTTP: http://server.address: port/homepage.html
  - News: news: misc.stocks.invest
- Different protocols use different syntaxes, but they do have a small amount in common
  - e.g. solidus(/) as a way of representing hierarchical space, pound label (#) as a way of pointing inside the document, question mark (?) as a separator between address of an object and a query operation

2 >> <u>Hypertext Transfer protocol</u>

  - It is a simple request/response protocol currently run over TCP and is the basis of World Wide Web
  - HTTP protocol is for transferring information efficiently between the requesting client and server.
  - Data transferred may be plain text, hypertext, images or anything else.
  - When a user browses the Web, objects are retrieved in rapid succession from often widely dispersed servers.
  - HTTP is used for retrieving documents in an unbounded and extensible set of formats.
    - Client sends a list of the formats it can handle
    - Server replies with data in any of those formats that it can produce.
    - This is important for both high end users sharing data in sophisticated formats and as a method for formats yet to be invented.
  - HTTP is an Internet protocol and similar to file transfer protocol (FTP) and network news protocols (NNTP)

  - HTTP is stateless (it runs over a TCP connection held only for the duration of one operation)

- Stateless protocol returns results based on the Uniform Resource Locator (URL) but irrelevant of any previous operations performed by the client.
- HTTP request from the clients starts with an object request method and URL of the object.
- Most often used methods are:
  - GET: defined for front-end update
  - POST: for the attachment of a new document to the Web or submission of a filled-in form or other object to some processor.
- When objects are transferred over the network, information about them (Meta - information) is transferred in Hyper Text Transfer Protocol (HTTP) headers.
- Set of headers is an extension of the Multipurpose Internet Mail Extensions (MIME) set.
- In Hyper Text Transfer Protocol (HTTP), unlike in e-mail, transfer in binary, and transfer in nonstandard but mutually agreed document formats, is possible.

HTTPD servers

- These are World Wide Web Servers
- Installing and maintaining a Web server is not a trivial matter, given the security and administrative issued involved.
- More difficult is to choose a server that best fits the organization's needs. The following Issues to be considered for choosing the server:
  - Right choice of platform and operating system
  - Kind of traffic load anticipated on Web server - heavy or light
  - Kind of security features envisioned
  - Flexibility and robustness of server needed
- Flexibility, ease of administration, security features and familiarity often rank much higher in the decision process.
- A server used for Internet-based marketing and technical support tasks will need more robust servers than used internally within a firewall for memo and bulletin distribution.
- Httpd servers are ideal for companies that want to provide a multitude of services ranging from product information to technical support.
- The way to provide other services via the Web is with HTML pages and CGI scripts that allow the Web server to act as a gateway to other Internet services such as databases (Oracle or Sybase), Gopher and news.

Format/Content Negotiation and HTTP

- Format/content negotiation is the ability to serve clients of varying sophistication automatically with HTML and other document types.
- It allows the Web to be generic and distance itself from the technical and political battles that surround the various data formats.
- Here, the client (Mosaic, Netscape, or other browsers) sends a list of representations it understands or data formats it is prepared to accept along with its request.
- When information is available in multiple variants (different data formats), a server can use it to ensure it replies in a suitable way.
- A spin-off of this feature involves high-level formats (MIME application formats) for handling specific data.
- When server and client both understand such a high-level format, then data are transferred in that way.
- Other people without the special software can still view the data.

- So, Web goal of “universal readership” can be adhered to, without compromising total functionality at high level.

3 >> Hypertext Markup Language (HTML)

- A simple page description language
- A common basic language of interchange for hypertext that forms the fabric of the Web.
- It is based on an international electronic document standard (SGML - Standard Generalized Markup Language)
- HTML enables document creation for the Web by embedding control codes in ASCII text to designate tittles, headings, graphics, and hypertext links.
- HTML tags, embedded within the body of the text, are used to define a document and guide its display.
- Ways to produce HTML Documents:
  - (I) Writing at own (ii) using HTML Editor (iii) Converting documents in other formats to HTML (iv) Choosing a template and modifying it
- It is meant to be a language of communication, which actually flows over the network.
- It can be used in hypertext e-mail, news and anywhere basic hypertext is needed
- It includes simple structure elements such as several levels of headings, lists, menus, and compact lists.
- There is no rule that Httpd files are stored in HTML, servers may store files in other formats.

HTML Forms

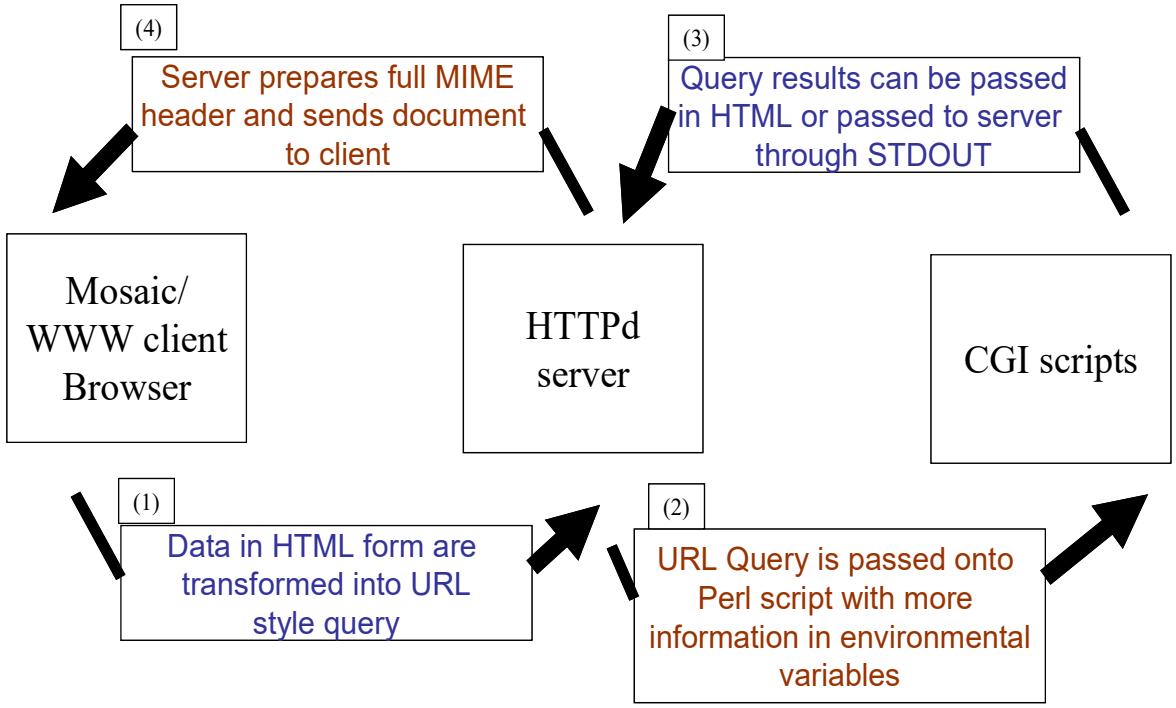
- Form support is an important element for doing on-line business
- Forms are necessary for gathering user information, conducting surveys, or even providing interactive services.
- Forms make Web browsing an interactive process for user & provider.
- Forms provide the means to collect & act on data entered by end user.
- They also open up a number of possibilities for on-line transactions (requesting specific news articles, specifying search requests, soliciting customer feedback, ordering products)
- Both server and the client for successful implementation must support forms.
- Featured available for building forms: text boxes, radio buttons, check boxes etc.
- User enter text, select item form list, check boxes etc and then submit the info to the server
- A program on server interprets data & acts on it appropriately, either by
  - Returning information in hypertext form, or
  - Downloading a file, or
  - Electronically notifying the company of the order received

- All the programs that use data submitted from an HTML form must conform to the specification CGI (Common Gateway Interface).
- Process of going from HTML forms to constructing a query to send to the server consists of four steps:
  - Form structure is read as an HTML file.
  - Form is displayed on the screen and user fills it out
  - User-entered information is aggregated and assembled into a query
  - Query is directed by the Httpd server to the specified CGI script.
- For example, if HTML code is following:

<form method = “post” action = “/cgi-bin/purchase.cgi”>
Product Name: <input name = “product name” value = “Super-bowl T-Shirts”><p>
Order Quantity: <input name = “order_quantity” value = “10”><p>

<input type =“checkbox” name=“year” checked>1999
<input type =“submit” value =“submit”><p>
Then, the query URL is assembled looks like this:
http://server/cgi-bin/purchase.cgi?product_name=Super-bowl+T-shirts&order_quantity=10&year=on

4 >> CGI Gateway Services



Form processing using CGI Script

- Important aspect of Web Server Development
- Common Gateway Interface (CGI) is a specification for communicating data between an information server (Web server) and another application.
- Common Gateway Interface (CGI) is used wherever the Web server needs to send or receive data from another application (such as database)
- A Common Gateway Interface (CGI) script is a program that negotiates the movement of data between the Web server and an outside application.
- A typical use of Common Gateway Interface (CGI) is to pass data, filled in by a user in an HyperText Markup Language (HTML) form, from the Web server to a database.
- Data can also be returned to the user’s browser via Common Gateway Interface.
- Common Gateway Interface (CGI) scripts may be written in virtually any high-level language.
- Most popularly used languages are ‘C’ and Perl

➔ Security and the Web

- Security and confidentiality are essential before businesses can conduct financial transactions over the Internet
- At present, credit card numbers, financial records, and other important information are not encrypted and can be intercepted by any savvy Internet hacker.

- Many commercial applications require that the client and server be able to authenticate each other and exchange data confidentially.
- This exchange has three basic properties:
  - Clients are confident about servers they are communicating with (server authentication).
  - Client conversation with the server is private (privacy using encryption).
  - Clients' conversations cannot be tampered or interfered with (data integrity).

1 >> <u>Categories of Internet Data and Transactions</u>

- **Public data:**
  - Have no security restrictions, can be read by anyone.
  - Should be protected from unauthorized tampering or modification.

- **Copyright data:**
  - That is copyrighted but not secret
  - Owner of data is willing to provide it but user has to pay for it.
  - Objective is to maximize revenue and security.

- **Confidential data:**
  - Material that is secret but whose existence is not secret.
  - Such data include bank account statements, personal files etc.
  - May be referenced by public or copyright data.

- **Secret data:**
  - Existence is secret, might include algorithms
  - It is necessary to monitor and log all access to secret data.
- Security and verification are necessary for all types of data because of sensitivity of information being transferred and to protect the consumer from various forms of fraud and misconduct.

2 >> <u>W W W - based Security Schemes</u>

- Several methods that can provide security in Web framework include:
- **Secure HTTP:**
  - Revision of HTTP
  - Will enable the incorporation of various cryptographic message formats (such as DSA and RSA standards) into both Web client and server.
  - Most of the security implementation will take place at the protocol.

- **Security socket layer (SSL):**
  - Uses RSA security to wrap security information around TCP/IP based protocols.
  - Benefit of SSL over S-HTTP is that SSL is not restricted to HTTP, but can also be used for security for FTP and TELNET among other Internet services.

- **SHEN:**
  - A security scheme for the Web sponsored by W3 consortium.
  - It is noncommercial or more research oriented and is similar to SHTTP.
- It is likely that in near future, three security schemes will collaborate to develop a single standard.

3 >> Existing Basic Authentication Features

- Extensions have been implemented by which the client and NCSA (National Computer Security Association) Httpd server call external programs:
  - That encrypt and decrypt their communications
  - Provide secure communications between the server and client.
  - Also provide authentication to ensure that users are who they say they are.
- This system has hooks for PEM (privacy Enhanced Mail) as well as PGP (Pretty Good Service) encryption.
- PGP and PEM programs
  - Allow a sender and a receiver to communicate in a way that does not allow third parties to read them
  - Certify that senders are really who they claim to be.
- Currently, this protocol with PEM and PGP uses local key files on the server side.
- The simple protocol is used for :
  - User name/password-level access authorization
  - Rejection or acceptance of connections based on Internet address of client.
  - A combination of these two methods.
- This protocol is insufficient for e-com needs where strong authentication and message integrity are necessary.

- Sample exchange between client and server:

I) a request without an unauthorized password rejected by server

Client :	Server :
GET/docs/protected.html HTTP/1.0 UserAgent: Mosaic/X.25	HTTP/1.0 401 Unauthorized Web-Authentic:PEM Entity=webmaster@cism.bus.utexas.edu Server:NCSA/1.1

- Once a server receives a request without an authorization field to access a protected document, it sends:
  - An Unauthorized 401 status code
  - Set of Web-authenticate fields containing valid authentication schemes and their scheme-specific parameters.
- After receiving unauthorized status code, browser:
  - Prompts for user name and password (if not already given)
  - Constructs a string containing username: password
  - Encodes this string into printable characters and
  - Sends the string along with the next request in the authorization fields as-
    - Authorization: Basic encoding string.

II) Valid exchange with a request with a PEM key being delivered in encrypted form:

Client :	Server :
GET/HTTP/1.0 Authorization: PEM entity= ram@cism.bus.utexas.edu Content-type:application/ X-Web-pem-request --BEGIN PRIVACY-ENHANCED MESSAGE – This is the real request, encrypted END PRIVACY-ENHANCED MESSAGE--	HTTP/1.0 200 OK Content-type:application/x-Web-pem-reply --BEGIN PRIVACY-ENHANCED MESSAGE – This is the real reply, encrypted END PRIVACY-ENHANCED MESSAGE--

4 >> Secure Sockets Layer (SSL)

- This security protocol, called secure sockets layer (SSL), provides data encryption, server authentication, message integrity, and optional client authentication for a TCP/IP connection.
- SSL is layered beneath application protocols such as HTTP, SMTP, TELNET, FTP, Gopher and NNTP
- It is layered above the Internet connection protocol TCP/IP.
- SSL provides a security “handshake” to initiate the TCP/IP connection.
- This handshake results in the client and server agreeing on the level of security they will use and fulfills any authentication requirements for the connection.

After handshake, SSL’s only role is to encrypt and decrypt the message stream

Electronic Commerce Applications
Secure HTTP (SHTTP)
TCP - based application protocol (HTTP, SMTP, NNTP)
Secure sockets layer (SSL)
Internet Protocol (IP)

Web Security Layers

- This protocol fully encrypts all the information in both the HTTP request and the HTTP response, including
  - The URL client is requesting
  - Any submitted form contents (including credit card numbers)
  - Any HTTP access authorization information (user names and passwords)
  - All the data returned from server to client.

- SSL provides encryption that creates
  - A secure channel to prevent third parties on the network from being able to tamper with and read messages being exchanged between client and server
  - And, authentication that uses a digital signature to verify the legitimacy of server.

- HTTP + SSL (or https) and HTTP are different protocols.
- HTTP can provide some information to all users using no security, and https can provide information securely.
- Browsers who do not implement support for HTTP over SSL will not be able to access https URLs.
- A benefit of using a different URL access method (https instead of just http) is so that non-SSL browsers can refuse to allow insecure submission of forms that expected to be submitted securely.
- The server implements server-side support for HTTP over SSL, including support for acquiring a server certificate and communicating securely with SSL- enabled browsers.

- For example:
  - A document served by a normal HTTP server contains a fill-out form that allows a user to enter his/her credit card number
  - Form's submission action is an https URL (form to be submitted securely)
  - A non-SSL browser will not even try to submit the form. (will give error message like "cannot submit")
  - If separate URL access method was not used, browser will submit the form and pass the credit card number over net.

5 >> <u>Secure Hypertext Transfer Protocol (S-HTTP)</u>

- S-HTTP assumes that the Web and the HTTP protocol are central to electronic commerce due to their installed base and ease of use.
- S-HTTP supports a variety of security mechanisms to HTTP clients and servers.
- It provides the security options appropriate to the wide range of potential end uses possible on the Web.
- The protocol provides symmetric capabilities to both client and server, while preserving the transaction model and implementation characteristics of the current HTTP.
- To ensure a secure conversation between a Web client and server, S-HTTP works by negotiating the type of encryption scheme used between client and server.
- Option negotiation is used to allow clients and servers to agree on
  - Transaction modes (should request be signed? Encrypted? What about reply?)
  - Cryptographic algorithms
  - Certificate selection (e.g. sign with VISA card certificate)

- S-HTTP secured clients can talk to S-HTTP oblivious servers vice-versa (such transactions would not use security features)
- S-HTTP does not require client-side public key certificates (or public keys)

- Spontaneous private transactions can occur without requiring individual users to have an established public key.
- While S-HTTP will be able to take advantage of common certification infrastructure, its deployment does not require it.

- **Advantage:**
  - S-HTTP supports end-to-end secure transactions
  - Multiple encryption/decryption need not be done at every intermediate point
  - Clients may initiate a secure transaction, typically using information supplied in HTML fill-out forms.
  - No sensitive data need ever be sent over the network in clear.
  -

6 >> <u>SSL versus S-HTTP</u>

- S-HTTP address different pieces of security puzzle
- But these pieces are not mutually exclusive.
- S-HTTP can be layered on top of SSL
- S-HTTP provides capabilities SSL does not and vice-versa.
- SSL layers security beneath application protocols
  (Such as HTTP, FTP, and TELNET)
  Whereas S-HTTP adds message or transaction-based security to HTTP by using message encryption standards as PEM and PGP.
- SSL simply encrypts the data in a given file.
- S-HTTP is a more comprehensive security package including authentication of the client's identity by the server through digital signal verification and other features.
- S-HTTP only works with transactions that use the HTTP transfer protocol.

7 >> <u>SHEN security scheme for the Web</u>

- Browser software with encryption algorithms cannot be sent overseas
- The W3 consortium is developing SHEN, which in many ways mirrors S-HTTP.
- SHEN provides for three separate security – related mechanisms:
  - Weak authentication with low maintenance overhead and without patent or export restrictions.
    - User identity must be established as genuine.
    - Unauthorized access must be improbable but need not be secure from all possible forms of attack.
  - Strong authentication via public key exchange
    - A user identity must be established as genuine.
    - Unauthorized access must be impossible except by random chance or by access to unknown technology
  - Strong encryption of message content.
    - Data must not be transmitted in a form comprehensible to a third party
    - An identified party acts as guarantor in this respect.

Chapter 4: --Electronic payment systems

➔ Introduction:

- Electronic payment systems are becoming central to on-line business process innovation.
- Emerging innovations in the payment for goods and services in E-com promise to offer a wide range of new business opportunities.
- Electronic payment systems and E-com are intricately linked given that on-line consumers must pay for product and services.
- Payment is an integral part of the mercantile process and prompt payment is crucial.
- Prompt and secure payment, clearing and settlement of credit and debit claims are important aspects of E-com.
- The way of payment for buying goods and services and the medium of payment (currency) is a problem faced by on-line sellers.
- Electronic replicas of the conventional payment methods (cash, check, bank draft, bills of exchange) are not well suited for speed required in e-com purchasing process.
- Conventional instruments are too slow for micro payments and the high transaction costs involved in processing
- Neo(new)-payment methods must

(i) be secure (ii) have a low processing cost and (iii) be accepted globally

➔Types of Electronic Payment Systems:

- Electronic payment systems are increasing in banking, retail, health care, on-line markets, and even government.
- Organizations are motivated by the need
  - to deliver products and services more cost effectively, and
  - to provide a higher quality of service to customers.
- In the early 1970s, emerging electronic payment technology was labeled electronic funds transfer. (EFT)
- **EFT:**

  "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 to debit or credit an account."
- EFT utilizes computer and telecommunication components both to supply and to transfer money or financial assets.
- Transfer is information based and intangible (that can not be touched).
- EFT stands in marked contrast to conventional money and payment modes that rely on physical delivery of cash or checks (or other paper orders) by truck, bus, airplane etc.

➔ Categories of EFT work

- **<u>Banking and Financial payments</u>**
  - Large scale or wholesale payments (e.g. bank-to-bank transfer)
  - Small-scale or retail payments (e.g. ATM and cash dispenser)

- Home banking (e.g. bill payments)

- **Retailing payments**

  - Credit Cards (e.g. VISA, MasterCard)
  - Private label credit/debit card (e.g. J C Penny Card)
  - Charge cards (e.g. American Express)

- **On-line electronic commerce payments**

  - Token based payment systems
    - Electronic cash (e.g. DigiCash)
    - Electronic checks (e.g. NetCheque)
    - Smart cards or Debit cards

  - Credit card based payment systems
    - Encrypted credit cards (e.g. WWW form based encryption)
    - Third –party authorization numbers (e.g. First Virtual)

➔ Digital Token based Electronic Payment System:

- Deficiencies in current banking and retailing payment methods for consumer-oriented E-com environment are the assumptions that:
  - Parties will at some time or other be in each other's physical presence.
  - There will be a sufficient delay in the payment process for frauds, overdrafts, and other undesirables to be identified and corrected.
- These payment mechanisms are being modified and used for the conduct of business over networks.
- New forms of financial instruments are being developed e.g. "Electronic Tokens" (in the form of electronic cash/money or checks).
- Electronic tokens are designed as electronic analogs of various forms of payment backed by a bank or financial institution.

- **Types of Electronic tokens**

  - **Cash or real-time**: transactions are settled with the exchange of electronic currency (e.g. Electronic cash or e-cash)
  - **Debit or prepaid**: Users pay in advance for the privilege of getting information (E.g. smart card and electronic purses that store electronic money)
  - **Credit or postpaid:** Server authenticates the customers and verifies with the bank the funds are adequate before purchase.

~~> Dimensions for analyzing the different initiatives:

- **Nature of transaction for which the instrument is designed:**

  - To handle micro-payments
  - For more traditional products
  - For specific predefined transactions
  - Or, for more general transactions

- **Means of settlement used:**
  - Tokens must be backed by cash
  - Electronic bill payments, cashier's checks, are some options
  - Most transaction methods use credit cards
  - Others use proxies for value, effectively creating currencies of uncertain amount and with interesting tax, risk and float implications.

- **Approach to security, anonymity and authentication**
  - Electronic tokens vary in the protection of privacy and confidentiality of transactions
  - Encryption can help with authentication, non-reputability and asset management.

- **Question of Risk**
  - Electronic tokens might be subject to discounting or arbitrage.
  - Risk also arises if the transaction has long lag times between product delivery and payment s to the merchants.

➔ Electronic Cash (E-cash)

- E-cash is a new concept in on-line payment system
- It combines computerized convenience with security and privacy that improve on paper cash.
- E-cash focuses on replacing cash as principal payment vehicle in consumer-oriented electronic payments.
- Cash remains dominant form of payment because of:
  - Lack of trust in banking system
  - Inefficient clearing and settlement of non-cash transactions.
  - Negative real interest rates paid on bank deposits.
- To displace cash, electronic payment systems need to have some qualities of cash that credit and debit cards lack.

- **Characteristics of cash**
  - **Negotiable:** can be given or traded to someone else
  - **Legal tender:** payee is obligated to take it.
  - **Bearer instrument**: owner is one who possesses it.
  - Can be held even without having a bank account
  - Places no risk on the part of acceptor that medium of exchange may not be good.

- **Problems with credit/debit cards or check**
  - Cards can't be given away. Technically, they are identification cards owned by the issuer and restricted to one user.
  - Cards are not legal tenders. Merchants have right to refuse to accept them
  - Cards are not bearer instruments. Usage requires an account relationship and authorization system.
  - Checks require either personal knowledge of the payer or a check guarantee system.

- **Properties of E-cash :**

  E-cash must have the following four properties:
  - **Monetary Value**:
    - It must be backed by either cash (currency), bank-authorized credit, or a bank certified cashier's check.
    - E-cash without proper bank certification carries the risk of getting returned for insufficient funds, when deposited.

  - **Interoperable:**
    - It must be exchangeable as payment for other e-cash, paper cash, goods and services, lines of credit, deposits in banking accounts, bank notes or obligations, electronic benefits etc.
    - Multiple banks are required with an international clearinghouse that handles the exchangeability issues.

  - **Storable and retrievable:**
    - Remote storage and retrieval (e.g. from a telephone or communications device) would allow users to exchange e-cash (e.g. withdraw from and deposit into bank accounts) from home or office or while traveling.
    - To prevent creating counterfeit cash from the computer, it is preferable to store cash on a dedicated device that cannot be altered.
    - This device should have
      - A suitable interface to facilitate personal authentication using passwords and other means
      - And, a display for the user to view contents of the card (e.g. Mondex card – a pocket sized electronic wallet)

  - **Security :**
    - E-cash should not be easy to copy or temper with while being exchanged.
    - This includes preventing or detecting duplication or double spending.
    - Detection is essential in order to audit whether prevention is working.
    - Preventing double spending is extremely difficult if multiple banks are involved in transaction, so most systems rely on post-fact detection and punishment.

1… E-cash In Action (Digital Signatures)

- E-cash is based on cryptographic systems called "digital signatures"
- Pair of numeric keys (very large integers) work in tandem
- One key for locking (encoding) and other for unlocking (decoding)
- Messages encoded with one numeric key can only be decoded with the other numeric key.
- Encoding key is kept private and decoding key is made public.
- Digital signature is similar to watermark in paper currency.
- Bank supplies all customers (buyers and sellers) with its public key.
- This enables customers to decode any message (or currency) encoded with the bank's private key.
- If decoding by a customer yields a recognizable message, customer can be fairly confident that only bank could have encoded it.

- Before e-cash can be used to buy products or services, it must be procured from the currency sever.

Purchasing E-cash from Currency Servers

  - Purchasing e-cash from on-line currency server (or bank) involves two steps:
    - Establishment of an account
    - Maintaining enough money in the account to back the purchase.
  - In case, customer does not have bank account or wants to maintain anonymity, e-cash can be purchased with paper currency also.
  - E-cash must be available in multiple currencies backed by several banks, so that customers should be able to access and pay for foreign as well as local services.
  - *A possible solution*: using an association of digital banks similar to organizations like VISA to serve as a clearinghouse for many credit card issuing banks.
  - Consumers use the e-cash software on the computer to generate a random number (note).
  - In exchange for money debited from customer's account, bank uses its private key to sign the note for amount requested and transmits the note back to customer.
  - Effectively, the network currency server is issuing a "bank note" with a serial number and a dollar amount.
  - By digitally signing it, the bank is committing itself to back that note with its face value in real dollars.

- This method of note generation is very secure
- Neither the customer (payer) not the merchant (payee) can counterfeit the bank's digital signature
- Payer and payee can verify that the payment is valid, since each know bank's public key.
- Bank is protected against forgery
- Payee is protected against bank's refusal to honor a legitimate note
- User is protected against false accusations and invasion of privacy.
- Example DigiCash

Problems with e-cash

- E-cash can be completely anonymous
- Anonymity allows freedom of usage (even to buy products like drugs, pornographic materials)
- It is possible because:
  - E-cash generation software masks the original note number using a random number and then transmits it to bank.
  - So it is impossible for anyone to link the payment to payer.
- It allows bank to sign the "note" without ever actually knowing how the issued currency will be used.

Protocol for Blind Signature

- Customer's software chooses a blinding factor, R, independently and uniformly at random and presents the bank with (XR) E (mod PQ), where X is the note number to be signed and E is the bank's public key.
- The bank signs it: (XRE) D = RXD (mod PQ), D is bank's private key.
- On Receiving the currency, the customer divides blinding factor: (RXD)/R = XD (mod PQ)
- The customer stores XD, the signed note that is used to pay for the purchase of products or services.

- Since R is random, the bank cannot determine X and thus cannot connect the signing with the subsequence payment.

Types of transactions

- Bilateral (two party: buyer and seller) –
  - Transactions involving cash
  - Merchant checks the veracity of note's digital signature by using bank's public key
  - If satisfied, stored digital money and later deposit in bank to redeem face value of note.
- Trilateral (Three party: buyer, seller and bank) –
  - Transactions involving financial instruments other than cash
  - Notes sent to merchant, who sends them immediately to bank, bank verifies that notes are not previously spent
  - Account of merchant is credited

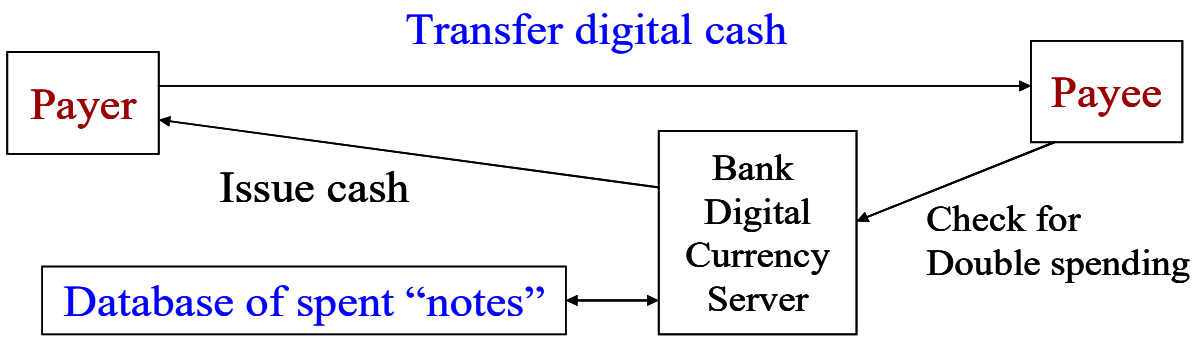
Using the Digital Currency

- The user can spend digital money at any shop accepting e-cash, without having to open an account there first or having to transmit credit card numbers.
- As soon as customer wants to make a payment, software collects the necessary amount from the stored tokens.

~~> Double Spending ::-

- Problem in bilateral transactions
- Equivalent to bouncing a check
- Possible as it is very easy to make copies of the e-cash
- if anonymity (for freedom of usage) is relaxed, double spending problem can be avoided.
- Here, a consumer is issued a bank note on his/her unique license.
- When money is transferred it is transferred to that other person's license
  - Bit of information is added to the note based on bank's serial number and old owner's license.
- If double spending is now tried, cheater can be immediately caught.
- But, bank can tell precisely the buying habits

~~> Detection of double spending:-



- **To uncover double spending**:
  - bank must check notes with database of spent notes.
  - Like unique serial numbers in paper notes, some form of registration should be there to uniquely identify all notes issued globally.
  - But for most systems, which handle high volumes of micro payments, this method will be too expensive.
  - Also, banks have to carry added overhead because of the content checking and auditing logs.

~~> <u>Change problem</u>::-

- E-cash has its inability to be easily divided into smaller amounts.
- To deal with:
  - Bank can issue users with enough separate electronic coins of various denominations
  - Payees return extra change
  - It would be cumbersome in communication and storage.
  - So customers are issued a single number called an "open check" containing multiple denomination values sufficient for transactions up to a prescribed limit.
  - At payment time e-cash software create a note of transaction value from "open check"

2… <u>Business issues</u>

- **<u>Main functions of E-cash</u>:**
  - Medium of exchange:
    - Digital money is a perfect medium of exchange
    - E-cash may help simplify the complex interlocking credit and liabilities that characterize today's commerce by:
      - Moving monetary claims quickly and
      - Effecting instant settlement of transactions.
  - Store of value
    - Human needs tend to require that money take a tangible form and be widely accepted (legal tender)
    - For e-cash every unit should have a unit of cash reserved in real economy.
    - But in an efficient system positive balances of e-cash will earn no interest, as it might be offset by the interest forgone on the real cash backing them.
- Enormous fluctuations in international finance pose another problem.
- Banks see E-money as unproductive, as they could not create new money via lending in the digital world.
- If E-cash started to bypass regulated foreign exchange markets governments might be provoked into trying to clamp down it.

3… <u>Operational Risk</u>

- Risks can be mitigated by imposing constraints such as limits on
  - Time over which a given electronic money is valid:
    - E-money has to be time-stamped, and time has to be synchronized across the network

  - How much can be stored on and transferred by electronic money
  - Number of exchanges that can take place before redeposit of money in bank
  - Number of transactions that can be made during a given period of time.
- The objective of imposing constraints is to limit the issuer's liability.
- A well-designed system could enforce a policy involving both transaction size and value with time.
- Exchanges could also be restricted to a class of services or goods.
- The exchange process should allow payment to be withheld from the seller upon the buyer's instructions until the goods or services are delivered within a specified time.
- It should allow delivery to be withheld upon the seller's instructions until the payment is received.

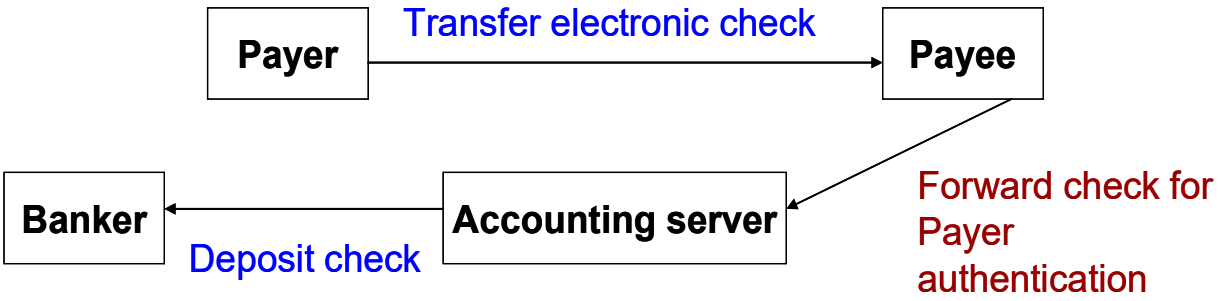
4… Legal issues

- E-cash has occupied an unstable and uncomfortable place within the existing taxation and law enforcement systems.
- Anonymous and virtually untraceable cash transactions occupy a place in underground economy confined to relatively small-scale transactions.
- As transactions get larger, the government becomes more suspicious.
- Transaction-based taxes (e.g. sales taxes) account for significant portion of government revenue.
- If e-cash is made to work bulk payments (buy car, down payment fro house) can be made in this form, which is a threat to government revenue.
- Underground economy can be prevented by powerful record keeping of all financial transactions.
- By impacting revenue-raising capabilities, e-cash cannot escape government scrutiny and regulation.

➔Electronic checks (E-check)

- Another form of electronic tokens
- Designed for individuals and entities that prefer to pay on credit but not through cash.
- Buyers must register with a third party account server (also billing server) before they are able to write electronic checks.
- Registration process varies with particular account server and may require a credit card or a bank account to back the checks.
- To complete a transaction, buyer sends a check to the seller for required amount using e-mail or other transport methods.
- When deposited, check authorizes transfer of account balances.
- Works almost similar to paper check – payer's name and account number, name of financial institution, payee's name and check amount.
- E-check will bear digital equivalent of signature (a computed number authenticating the owner of check)
- E-check will need to be endorsed by the payee, using another electronic signature before payment.
- Properly signed and endorsed checks can be electronically exchanged between financial institutions through electronic clearinghouses
- Institutions use these endorsed checks as tender to settle accounts.

1… Payment transaction sequence



- Payer puts digital signature on check and give it to payee (seller)
- On receiving the check, seller endorse the check and presents it to accounting server for verification and payment.
- Accounting server verifies digital signature on the check and transfers it to bank
- Seller's endorsed check is an order to a bank computer for fund transfer.

2… Advantages of Electronic checks

1> Simplifying customer education:

- E-check works in the same way as traditional check.

2> Well suited for clearing micro-payments:

- Uses conventional cryptography, which makes it much faster that systems based on public-key cryptography (e-cash).

3> Create float:

- Availability of float is an important requirement of commerce.
- Third party accounting server can make money by charging buyer and seller a transaction fee or flat rate fee.
- Or, it can act as a bank and provide deposit accounts and make money on the deposit account pool.

4> Easier acceptance:

- Financial risk is assumed by accounting server.

5> Reliability and scalability:

- Using multiple servers.

6> Inter-account server protocol:

- Allow buyer and seller to belong to different domains, regions and countries.

3… Prototype Electronic check system : NetCheque

- Developed at Information Sciences Institute
- Will include software for writing and depositing checks independent of other applications and application-programming interface.
- "Accounting server" software will allow organizations to set-up their own in-house, on-line "banks"
- These banks accept paper checks or credit card payments in exchange for crediting a customer's NetCheque account.
- Accounting servers will enable large organizations to pay bills and settle accounts with NetCheque written with their own banks
- NetCheque can be used as a resource management tool inside organizations, a form of internal cash.
    - Each user in organization could be given an account and allowed to use various resources and be billed for it.

➔ Smart Cards (Smart card based Electronic payment systems)

- Hold promise for secure transactions using existing infrastructure.
- Smart cards are credit or debit cards and other card products enhanced with microprocessors capable of holding more information than traditional magnetic stripe.
- Chip, at its current state of development can store significant amount of data.
- Smart card technology is widely used in France, Germany, Japan, and Singapore etc to pay for public phone calls, transportation and shopper loyalty programs.

- **Two types:**

    - **Relationship based smart credit cards**
    - **Electronic purses – debit cards / electronic money.**

1… Relationship based Smart Cards

- Traditional credit cards are fast evolving into smart cards as consumers demand payment and financial services products that are user friendly, convenient and reliable.
- Relationship based smart card is an enhancement of existing card services and/or addition of new services.
- The financial institutions deliver services to customers via a chip-based card or other device.
- These services include access to multiple financial accounts, value-added marketing programs, or other information storage.
- It addresses each individual's specific financial and personal requirements.
- Enhanced credit cards store cardholder information including name, birth date, personal shopping preferences, and actual purchase records.
- This information will enable merchants to accurately track consumer behavior and develop promotional programs designed to increase shopper loyalty.
- Despite the increasing flexibility, relationship –based cards are credit based and settlement occurs at the end of the billing cycle.

- **Offers from Relationship-based products**

    - Access to multiple accounts - such as debit, credit, investment or stored value for e-cash on one card or electronic device.
    - A variety of functions - such as cash access, bill payment, balance enquiry or funds transfer for selected accounts.
    - Multiple access options at multiple locations using multiple device types – such as an ATM, a screen phone, a PC, a PDA or interactive TVs
- These services can be incorporated into a personalized banking relationship for each customer.
- Financial and non-financial services with value-added programs can be packaged to:
    - Enhance convenience
    - Build loyalty and retention
    - Attract new customers.
- Services can be customized on smart cards offering a menu of services.
- Banks may link up with health care providers, telephone companies, retailers and airlines etc to offer frequent shopping, flyer programs and other services.

2… Electronic Purses and Debit Cards

- Electronic purse – Wallet-sized smart cards embedded with programmable microchips.
- E-purse stores sums of money for people to use instead of cash for everything from buying food, to making photocopies, to paying subway fares.
- **Working:**

    - Purse is loaded with money at an ATM or through use of special telephone.
    - It can be used to pay for some thing in a machine equipped with a card reader.
    - Machine only verifies that a card is authenticated and there is enough money available for buying the thing.
    - Then, the value of purchase is deducted from the balance on the card and added to an e-cash box in the machine.
    - Remaining balance on the card is displayed on the machine or can be checked at an ATM or balance-reading device.
    - When balance on e-purse is depleted, it can be recharged with more money.
    - Vendor can collect the receipts periodically in person, or by telephone and transfer to bank account.
- **Advantages:**

    - It would virtually eliminate:
        - Fumbling for change or small bills in a busy store or rush hour tollbooth.
        - Waiting for a credit card purchase to be approved.
    - Allows a customer to pay for rides and calls with a prepaid card that “remembers” each transaction.

➔ Smart Card Readers and Smart Phones::

- Smart card reader that can communicate with the chip on a smart card.
- It can read from and write to smart cards and can also support a variety of key management methods.
- Some readers combine elements of a PC, a point-of-sale terminal and a phone to allow customers to quickly conduct financial transactions without leaving their homes.

- In simplest form, card reader has a two-line by 16-character display that can show both a prompt and a response entered by the user.
- Efficiency is enhanced by color-coded function keys that can be programmed to perform the most frequently used operations in a single keystroke.
- It can communicate via an RS-232 serial interface with the full range of transaction automation systems (including PCs and Electronic Cash Registers (ECRs).
- Can be customized for specific requirements.
- Operating environment allows programmers to use 'C' language to create and modify applications without compromising device's security functions.
- Card readers in the form of screen phones are becoming more prominent because:
  - Of consumer familiarity with phones
  - It features a four-line screen, a magnetic stripe card reader and a phone keypad (folds away to reveal a keyboard).
    - Phone prompts users through transactions using menus.
  - More convenient to use than PC based home banking applications (no booting and modem connection required)
  - Include advanced telephone functions (two-way speaker phone capability, a dialing directory, phone log for tracking calls)

➔ **Business issues::**

- For merchants, smart cards are a very convenient alternative to handling cash.
- Cash is expensive to handle, count and deposit and incurs slippage (theft, fraud or misplacement)
- As per estimations, 4 percent cash value deposited is eaten up in handling costs.
- Since embedded microchip is harder to tamper with, bank and card issuers expect to cut down on fraud.
- There is enormous potential for a debit card with a prepaid feature that replaces coins and small bills.
- A more advanced usage of smart cards (Mondex) – electronic purses that can be loaded with five currencies at one time – is under trial
- The banks that issue Mondex cards will not be able to keep track of who makes or receives payments.
- While bankers are concerned with fraud and abuse, others want anonymity and flexibility.
- Most extensive deployment of electronic purses in Denmark.
- Danmont (consortium of banks and telephone companies), has issues 150,000 stored-value cards.
- Danmont makes money by interest on the money it holds on the cards (called float)

➔ Credit card-based electronic payment systems

- To avoid the complexity associated with digital cash and electronic checks.
- If consumers want to purchase a product or service, they simply send their credit card details to the service provider involved; credit card organizations will handle the payment like any other.

- **<u>Categories of credit-card payment on on-line networks :</u>**

  - Payments using plain credit card details
  - Payments using encrypted credit card details

- Payments using third – party verification

- **<u>Payments using plain credit card details</u> :**

  - Easiest method of payment is the exchange of unencrypted credit cards over a public network (telephone lines or Internet)
  - Low level of security makes this method problematic
  - Authentication is also a significant problem and without encryption, there is no way to do this.

- **<u>Payments using encrypted card details</u> :**

  - Encrypting the credit card details before sending them out.
  - But there will be credit card transaction cost involved
  - Such costs would prohibit low-value payments (micro payments) by adding cost to the transactions.

- **<u>Payments using third party verification</u> :**

  - Introduction of a third party is one solution to security and verification problems.
  - Third party is a company that collects and approves payments from one client to another.
  - After a certain period of time, one credit card transaction for the total accumulated amount is completed.

- **Some companies/consortiums attempting to provide infrastructure for on-line credit card processing:**

  - First Virtual Holdings
  - Interactive Transaction Partners
  - Master Banking
  - VISA Interactive
  - Block Financial
  - Prodigy.

➔ Encryption and credit cards

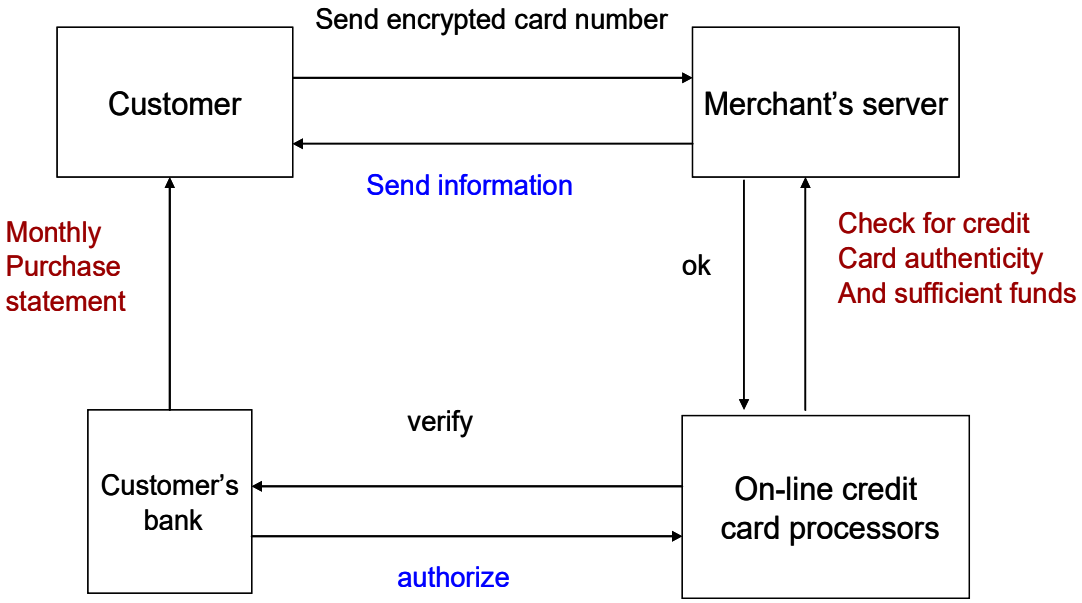
- Encryption is instantiated
  - when credit card information is entered into a browser or other e-com device
  - And, sent securely over the network from buyer to seller as an encrypted message.

- This practice does not meet the requirements such as :
  - (**i) Nonrefutability**
  - **(ii) Speed**
  - **(iii) Safety**
  - **(iv) Privacy**
  - **(v) Security**

- To make a credit card transaction truly secure and nonrefutable, the following steps must occur before actual goods, services or funds flow:
  - A customer represents credit card information (plus authenticity signature and other information e.g. maiden name) securely to merchant

  - Merchant validates customer's identity as owner of that credit card account
  - Merchant relays credit card charge information and signature to its bank or on-line credit-card processors.
  - Bank or processing party relays the information to customer's bank for authorization approval
  - Customer's bank returns credit card data, charge authentication, and authorization to the merchant.
- Credit card systems will have to develop distributed key servers and card checkers.
- Support for Privacy Enhanced Mail (PEM) and Pretty Good Privacy (PGP) encryption has been built into several browsers
- When credit card companies do decide to accept digital signatures, they will need to maintain public servers with all of the public keys.
- Electronic payment system is not an inexpensive proposition, but neither is fraud.
- Encrypted credit card transactions may not be micro enough for purchasing information.
- Providing credit card processing service for numerous half-dollar and one-dollar transaction may not be financially attractive.
- To solve this problem, third party payment processors are entered into.

~~> <u>Processing payments using encrypted credit cards</u>:



Processing payments using encrypted credit cards

- Each consumer and vendor generates a public key and a secret key.
- Public key is sent to credit card company and put on its public key server
- Secret key is re-encrypted with a password and unencrypted version is erased.
- Credit Card Company sends a credit card number and a credit limit to customer.
- To buy something from vendor X, consumer sends the message signed encrypted with the public key, using own password:
  "It is now time T, I am paying D dollars to vendor X for item Z."
- Vendor signs the message with own secret key and send to credit card company
- Company bills the consumer for D dollars and give same amount (less fee) to X.
- No cheating is possible in this system
- Consumer can't claim that he didn't agree to transaction, because he signed it
- Vendor can't invent fake charges, because he doesn't have access to consumer's key.

- Same charge can't be submitted twice, because consumer included precise time in message

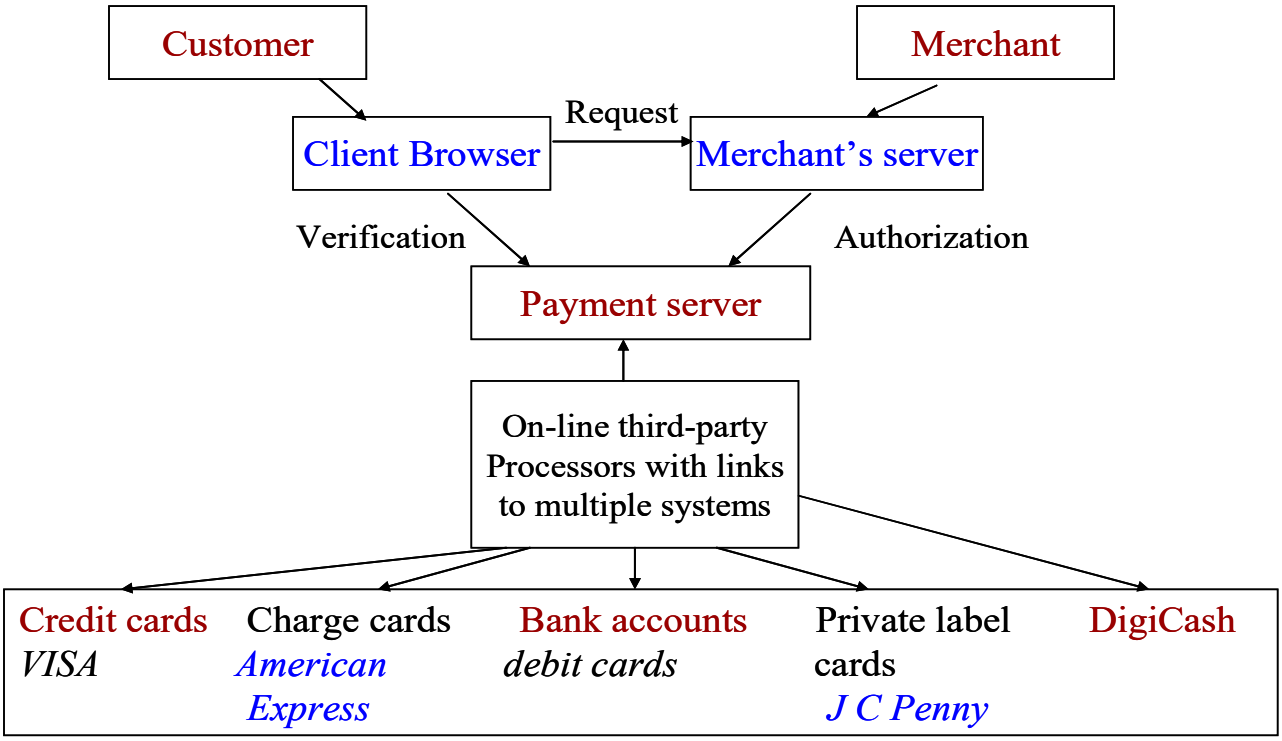
➔ Third Party Processors and Credit Cards

- In third party processing, consumers register with a third party on the Internet to verify electronic micro transactions
- Verification mechanisms differ from electronic token systems as :
  - They depend on existing financial instruments.
  - They require on-line involvement of at least one additional party to ensure extra security.
- Examples of companies providing third-party payment services: First Virtual, Open Market
- Payments can be made by credit card or by debiting a demand deposit account via the automated clearinghouse.
- Third party processors can be referred to as On-line Third-Party Processors (OTTPs)
- OTTPs have created seven steps process for a fast and efficient way to buy information on-line.
- To use this system, both customers and merchants must be registered with the OTTP.

OTTPs' seven-step process

1. Consumer acquires an OTTP number by filling out a registration form
   - so that OTTP have customer information profile backed by a traditional financial instrument (e.g. credit card)
2. To purchase product/information, consumer requests item from merchant by quoting OTTP account number. Purchase can be in one of the two ways:
   - Merchant is authorized via browser settings to access customer's OTTP account automatically and bill the customer.
   - Customer can type the account number.
3. Merchant contacts OTTP payment server with customer account number
4. OTTP payment server verifies the account number for the vendor and checks for sufficient funds.
5. OTTP server sends electronic message to buyer through e-mail or automatic WWW form. Buyer responds in one of three ways:
   - Yes, I agree to pay
   - No, I will not pay
   - Fraud, I never asked for this.
6. If OTTP server gets a Yes from buyer, merchant is informed and customer is allowed to download the information.
7. OTTP will not debit buyer's account until it receives confirmation of purchase completion. If consumers receive information. product and decline to pay, account can be suspended.

On-line process using a third-party processor



- Two key servers: **payment server & merchant server.**
- A user makes a purchase from merchant server using client browser
  - User clicks on payment URL (hyperlinks attached to product on a WWW page)
  - Payment URL encodes purchase details: item price, target URL (order status page/information) and duration (time to access target URL)
  - Payment URL sends encoded information to payment server
  - Payment server authenticates user by asking account number and other identification information
  - If information valid and funds available, payment server processes the payment transaction.
  - Payment server then redirects user's browser to purchased item with an access URL (digital invoice stamped 'paid'), which encodes the payment transaction details (amount, item purchased, duration).
  - Access URL is original URL sent by merchant + details of access (expiration time – optional, user's address – to prevent sharing)
  - Merchant runs HTTP server that checks validity of URL and grants access if expiration time has not passed, else user is given a chance to repurchase the item.
  - Once customer is authenticated, payment is automatically processed.
  - Payment server implements a modular payment architecture (accounts can be backed by different types of financial instruments – credit card, prepaid, billed debit cards accounts or other mechanisms)
  - For credit card accounts, payment system has real-time connection to credit-card clearing network
  - All transactions are recorded in user's on-line statement that is a summary of recent purchases
  - Each summary line is a hypertext link:
    - Back to purchased item, if information goods

    - To an order status or summary page, if non-information goods.
- Third party processors are chartered to give credit accounts to individuals and act as bill collection agencies for businesses.
- Consumers use credit cards for payment and then paying an aggregate bill once a month
- A flat fee or individual transaction charges for the service.
- Merchants get paid for credit card drafts they submit to Credit Card Company.
- Businesses get charged a transaction charge for each draft submitted.

➔ Business processes and Consumers

- Third party processors are chartered to give credit accounts to individuals and act as bill collection agencies for businesses.
- Consumers use credit cards by presenting them for payment and then paying an aggregate bill once a month
- Consumers pay either by flat rate or individual transaction charges for this service
- Merchants get paid for credit card drafts that they submit to the credit card company
- Businesses get charged a transaction charge.
- **Advantages of credit cards over e-checks**
    - Credit card company assumes a large share of financial risk for both buyer and seller in a transaction
    - Credit card transactions are usually quicker and easier than check transactions
    - Implementing payment policies will be simpler when credit rather than the cash makes payment.
    - Record keeping with credit cards is one of the features consumers value most because of disputes and mistakes in billing.
- **Disadvantage**
    - Transactions are not anonymous, and credit card companies compile valuable data about spending habits.
- Complexity of credit card processing takes place in the verification phase
- If there is a lapse in time between the charging and delivery of goods or services, customer verification process is simple, as it does not have to be done in real time.
- However, many message relays and authorizations take place in real time, while the customers wait.
- Such exchanges may require sequence-specific operations such as staged encryption and decrypting and exchanges of cryptographic keys.
- Encryption and transaction speed must be balanced
- On-line credit card users must find the process to be accessible, simple, and fast
- Speed will have design and cost implications as it is a function of network capabilities, computing power, availability at every server, and specific form of transaction
- Infrastructure supporting the transaction must be reliable

➔ Infrastructure for On-line Credit Card Processing

- On-line retail transaction processing on the I-way is an extremely lucrative business.
- Regional EFT networks, credit card associations, equipment vendors, data processors, software developers, bill payment companies, and telecommunication providers all wooing banks with the goal of building the transaction-processing infrastructure on Internet.
- Competition is based on:
    (i) Service quality
    (ii) Price

(iii) Processing system speed
(iv) Customer support
(v) Reliability

- Most third party processors market their services directly to large regional or national merchants rather than through financial organizations or independent sales organizations
- Barriers to entry include:
  - Large initial capital requirements
  - Ongoing expenses for establishing and maintaining an

  Electronic transaction processing network
  - Ability to obtain competitively priced access to an existing network
  - Reluctance of merchants to change processors.
- In the emerging world of e-com, the companies that own the transaction infrastructure will be able to charge a fee.
- E-com transaction architectures on which other e-com applications are developed will be very profitable
- Companies are developing advanced electronic services for home based financial transactions
- Software companies are increasing allying with banks to sell home banking.
- Goal would be to offer everything from mutual funds to brokerage services over the network.
- Electronic payment on the Internet can have a substantial effect on transaction processing in "real" world.
- If software companies and other inter-opers become electronic toll-takes, bank could become mere homes for deposits, not the providers of lucrative value-added services.
- Banks could lose the all-important direct link to be the customer's primary provider of financial services.

➔ Risk (Risks and Electronic Payment Systems)

- One essential challenge of E-com is Risk Management. Major risks are
  - **<u>Fraud or mistake</u>:**

    - Requires improvements in the legal framework
    - Virtually all-electronic payment systems need some ability to keep automatic records.
    - Once information has been captured electronically, it is easy and inexpensive to keep.
    - The record feature is an after-the-fact transcription of what happened
    - Features of these automated records include:
      - Permanent storage
      - Accessibility and traceability
      - Payment system database
      - Data transfer to payment maker, bank, or monetary authorities.
    - Record keeping for the purpose of risk management conflicts with the transaction anonymity of cash.
    - Anonymity has to be addressed through regulation covering consumer protection in electronic transactions.
    - An anonymous payment system without automatic record keeping will be difficult for bankers and governments to accept

- **Privacy issues:**

    - Requires improvements in the security framework.
    - Electronic payment system must ensure and maintain privacy.
    - All details of consumer's payments can easily be aggregated: where, when, and sometimes what the consumer buys is stored.
    - This collection of data tells much about the person and as such can conflict with the individual's right to privacy.
    - Users must be assured that knowledge of transactions will be confidential, limited only to the parties involved and their designated agents (if any).
    - Privacy must be maintained against eavesdroppers on the network and against unauthorized insiders.
    - Users must be assured that they cannot be easily duped, swindle or falsely implicated in the fraudulent transaction.
    - For many types of transactions, trusted third party agents will be needed to vouch for authenticity and good faith of the involved parties.

- **Credit risk:**

    - Devising procedures to constrict or moderate credit and reduce float in the market.
    - Credit or systemic risk is a major concern in net settlement systems
    - A bank's failure to settle its net position could lead to a chain reaction of bank failures.
    - A digital central bank guarantee on settlement removes the insolvency test from the system.
        - As banks will more readily assume credit risks from other banks?
    - If the central bank does not guarantee settlement, it must define, at least internally, the conditions and terms for extending liquidity to banks in connection with settlement.

➔ Designing (Designing Electronic Payment Systems)

- **Factors to be considered before designing :**

    - **Privacy:**
        - A user expects to trust in a secure system
        - Electronic commerce must merit equal trust as telephone system.

    - **Security:**
        - Secure system verifies identity of two-party transactions through "user authentication"
        - It reserves flexibility to restrict information/services through access control.
        - Tomorrow's bank robbers will just need a computer terminal, a phone call and little ingenuity.

    - **Intuitive interfaces:**
        - Users value convenience more than anything.

    - **Database integration:**

- To date, separate accounts have been stored on separate databases
- The challenge is
  - To tie together these separate databases together and
  - To allow customers access to any one of them

  While keeping data up-to-date and error free.

- **Brokers:**
  - A "network banker" must be in place to:
    - Broker goods and services
    - Settle conflicts
    - Facilitate financial transactions electronically.
    - Electronic commerce must merit equal trust as telephone system.

- **Pricing:**
  - How to price payment services?
  - Should subsidies be used to encourage users to shift the payment mode (cash to bank payments, paper cash to e-cash)
  - With subsidies there may be wastage of resources, if money invested in systems that will not be used.
  - On the other hand, it must be recognized that without subsidies, it is difficult to price all services affordably.

- **Standards :**
  - Without standards, welding of different payment users into different networks and different systems is impossible.
  - Standards enable interoperability
    - Giving users the ability to buy and receive information, regardless of which bank is managing their money.

Glossary of terms

Application Programs
Software programs that perform a useful function for the end user as opposed to Systems Programs that enables the computer to operate properly.

Application Service Provider (ASP)
Organization that offers a set of application programs and/or services from a central site via communications connections of some sort.

Back-End Systems
The operational software programs that record and account for the transactions that are handled online.

Browser
Client application program that is able to access and display various kinds of Internet resources, for example Netscape's "Communicator" and Microsoft's "Internet Explorer".

Client
Generally any application program that uses data or other network resources. Can refer to a user's desktop or laptop PC or a program that runs on one.

Database
Collection of data formatted in a special way, to make it easier to retrieve a particular piece of information or direct promotional or informational material to a particular subset of customers.

E-business
All types of business conducted on the Internet, not only buying and selling but also servicing of customers and collaborating or communicating with business partners and employees.
Note: The definitions for E-business and E-commerce are very much under development. Those given above closely follow the definitions used by the Queen's University School of Business and are generally consistent with those used by many Canadian organizations. Industry Canada (and therefore other Canadian government departments and agencies) tend to use E-business and E-commerce interchangeably with E-commerce the more frequently used term although their underlying definition is consistent with the E-business definition given above. The U.S. Census Bureau, on the other hand, uses a much wider definition - "Electronic business (E-business) is any process that a business organization conducts over a computer-mediated network". Market size reports and projections from leading market research firms vary significantly at least partly because of inconsistent definitions. For example, the use of email, fax, and telephone to place orders is included in some definitions of E-commerce but not in others.

EDI (Electronic Data Interchange)
An older technology used for the inter-organizational computer-to-computer exchange of structured information.

Electronic Mail
The exchange of digital documents via the Internet.

Ethernet
A technology for connecting computers on an Intranet.

Extranet
Extended Intranets to share information with business partners over the Internet in a very secure way.

Firewall
A tool to separate an Intranet from the Internet by disallowing connections on certain ports, making the Intranet very secure.

Global Internet
The computer network for business and leisure based on the TCP/IP protocol (see page 12 for definition). All other computer networks have become irrelevant.

HTML
HyperText Markup Language - standard descriptors used to build a web page by defining the size, shape, colour and position of the graphic and text elements of the page.

Internet
A series of technical standards that allow data to be exchanged with high reliability between any two computers anywhere in the world. The three key standards are HTTP for data exchange, HTML to display information graphically and the WWW to hyperlink it all together.

Intranet
A private network that is based on the same technologies as the Internet, but restricted to a certain user group.

LAN
Local Area Network - a group of interconnected computers in a single location. Typically the communication connections are high speed.

Legacy Systems
Older computer applications that were designed to process batches of information (transactions). These were usually designed to serve the needs of a specific customer. Many are still in use for critical business applications and need to be accessed (data updated in and/or extracted from) by new E-business systems.

HTTP HyperText Transfer Protocol - the underlying communications protocol of the Internet.
Network The connection of two or more computers in order to share resources.
Offline Not connected to the Internet.
Online Connected to the Internet.
Protocols Rules (technical definitions) that determine how computers and applications interact.

Port (the verb)
Convert the logic of an application program that runs on one standard computer platform (e.g., Intel/Microsoft) to run on another platform (e.g., Apple).

Portal
Point of entry website to the Internet that aggregates access to information and services for a specific audience. It is typically aimed at a community of special interests (e.g., an industry group, a religious group, a hobby group, etc.).

Search Engine
Web service that allows you to query a database for keywords and returns matching web pages.

Server
A computer that provides one or more services to one or more clients over a network. Examples are a fax server that handles incoming and outgoing fax traffic for a large organization or a database server that stores all corporate records for a firm and distributes it to any application program that asks for it (and is authorized to get it).

SME Small and Medium-size Enterprises.

Systems Programs
Software programs that enable the computer to operate properly as opposed to Application Programs that perform a useful function for the end user.

Transmission Control Protocol/Internet Protocol (TCP/IP)
A set of protocols that are the foundation of the Internet, which enable communication between computers.

Universal Resource Locator (URL)
The unique address for every page of information on the WWW.

VAN
Value Added Network - a communications network that provides services beyond the interchange of data (e.g., processes billing data as well as communicating it).

Vortal
A Portal with a vertical focus on the special interest group or industry it is targeting.

VPN
Virtual Private Network - A special case of an Intranet, often with additional security and/or service features.

WAN
Wide Area Network - An interconnection of LANs, often in a campus location.

Webmaster
The person in charge of a web server. Most web servers will allow mail to be sent to the Webmaster. The web master of http://www.foobar.org/ can be reached at webmaster@foobar.org, for example.

World Wide Web
The part of the Internet, which is accessible through a web browser. The Web is not the Internet, but a subset. Often referred to as **WWW** or **3W**.

XML
Extended Markup Language - An enhanced and extended version of HTML.