Knowledge Update Course
for Secondary School Computer and IT Teachers
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**Computer Networking and Data Communication**

Internet Applications and E-commerce Concept

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## Internet Applications

- World Wide Web
  - Client-server interaction
  - Hypertext transfer protocol
  - Browser architecture
- Electronic mail representation and transfer
  - Electronic mailbox and address
  - Electronic mail message format
  - The simple mail transfer protocol
- File transfer
  - The file transfer protocol
  - File types and transfer modes
- Basic e-commerce concept

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## Client-Server Computing

- Network
  - Operates at application's request
- Applications
  - What to send
  - When to send
  - Where to send
  - the interpretation of bits
- Internets
  - Provide a general communication infrastructure
  - Two application programs must participate in any communication, one initiates communication and the other accept it.

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## Client-Server Computing

- Internet protocols provide
  - Facilities for reliable data transfer
  - Mechanism for host communication
- Applications
  - Use internet protocols to interact other applications
    - Information display format
    - Define symbolic names to identify both the physical and abstract resources available on an internet
      - e.g. for physical resources: computers, I/O devices
      - e.g. for abstract resources: files, electronic mail & databases
  - Provide user-level services

## Client-Server Computing

Client Characteristics:
- Arbitrary application program, temporary remote access client and performs other computation locally
- Invoked directly by user, and executes only for one session
- Runs locally on user's computer
- Actively initiates contact with a server
- Contacts one server at a time, but can access multiple services as needed
- Special hardware or a sophisticated operating system is not required
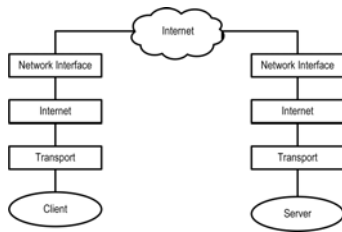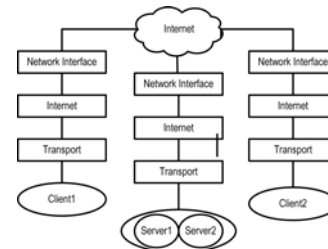
## Client-Server Computing

Server Characteristics:
- A privileged program dedicated to providing one service, and at the same, can handle multiple remote clients.
- Automatically invoked when a system boots, and continues to execute through many sessions
- Runs on a shared computer
- Waits passively for arbitrary remote clients contact
- Accepts contact from arbitrary clients, but offers a single service
- Powerful hardware with a sophisticated operating system is required

## Client-Server Computing



A client and server using TCP/IP protocols to communicate across an internet. The client and server each interact with a protocol in the transport layer

## Client-Server Computing



- Each server offers one service
- One server can handle multiple clients
- Server program only uses computational resources when serving a request
- Powerful hardware required to handle many services simultaneously

## Client-Server Computing

Identifying a service
- Each service is identified by a unique protocol port number P
- Server
  – Informs operating system the port P is being used
  – Waits for service request
- Client
  – Initiates a request
  – Send request to port P on server computer

## Client-Server Computing

- Protocol port numbers are used as service identifiers
- Needs an uniform numbering for arbitrary client to contact any arbitrary server machine
- Port numbers are set standard bodies and uniform throughout Internet
- Each transport session has two unique identifiers:
  – (IP address, port number) on server
  – (IP address, port number) on client

## Client-Server Computing

Basic sequence for Internet Applications to communicate:
- Server application starts first, and waits for contact from a client
- Client contacts the server by specifying its location and requesting communication
- The client and server exchange messages
- The client and server each send an end-of-file to terminate communication after finishing sending data

## Client-Server Interaction

Application Program Interface (API)

| Operation | Meaning |
|---|---|
| await_contact | Server wait for client contact |
| make_contact | Client contact a server |
| cname_to_comp | Translate a computer name to an internal binary value |
| appname_to_appnum | Translate a program name to an equivalent internal binary value |
| send | Used by either client or server to send data |
| recv | Used by either client or server to receive data |
| Send_eof | Used by both client and server after they have finished sending data |

## Client-Server Interaction

- A server begins by calling **await_contact** to wait for contact from client
- The client begins by calling **make_contact** to establish contact
- Client and server exchange messages with **send** and **recv** once connection is made
- Both sides should know whether to send or receive else if both sides try to receive without sending, the communication will be blocked forever
- After it completes sending data, an application calls **send_eof** to send the end-of-file condition
- On the other side, **recv** returns a value zero to indicate that the end-of-file has been reached

## Client-Server Interaction

- Browser/WWW model
  - Browser is a client and WWW server is a server
  - Short duration for client/server connection
- Browser
  - Application program
  - User's interface to web
  - Web client to fetch information from web server
  - Displays information for user
  - Makes TCP connection
  - Sends request for page
  - Reads page

## Client-Server Interaction

- Web Server
  - Running program
  - Stores web documents
  - Responds a request from browser by sending a copy of document
- Uniform Resource Locator
  - URL=Uniform resource locator
    = protocol://site/directory/file or mailto:email_address
  - Protocol=http, ftp, telnet, smtp
    - ftp://enc.ic.polyu.edu.hk/computer.html
    - http://www.polyu.edu.hk/~enc/network.html
    - mailto: icjwong@polyu.edu.hk

## Hypertext Transfer Protocol (HTTP)

- Hypertext transfer protocol is a client-server protocol used to transfer web document
- The Hypertext Transport Protocol is defined by RFC2616 and others of the Internet Engineering Task Force (IETF)
- http://www.w3.org/Protocols/
- HTTP is an application layer protocol using TCP
- When a browser interacts with a web server, the two programs follow the Hypertext Transfer Protocol
- HTTP Request Format
  - The protocol sends requests and responses in ASCII characters
  - The request is always terminated by a blank line
  - The format is: <Method><file><version><options> CRLF

## HTTP Methods

| | |
|---|---|
| **GET** | Get a file from the server |
| **HEAD** | Get information about a file from the server |
| **POST** | Send information to the server |
| **PUT** | Send a file to be stored on the server |
| **DELETE** | Delete a file on the server |
| **OPTIONS** | Request the available server options |
| **TRACE** | Invoke a loop-back of the request message |

## HTTP Request Headers

| Header | Description |
|---|---|
| From | Email address of user |
| Use-agent | Client s/w |
| Accept File | File types that client will accept |
| Accept-encoding | Compression methods |
| Accept-Language | Languages |
| Referrer | URL of the last document the client displayed |
| If-Modified-Since | Return document only if modified since specified |
| Content-length | Length (in bytes) of data to follow |

## HTTP Status Code

| Code | Text |
|---|---|
| 2xx | Success |
| 3xx | Redirection |
| 301 | Moved |
| 302 | Found |
| 4xx | Client Errors |
| 400 | Bad Request |
| 401 | Unauthorized |
| 404 | Not found |
| 5xx | Server Errors |
| 500 | Internal Error |
| 502 | Service Overloaded |

## Hypertext Transfer Protocol (HTTP)

Example HTTP header returned by a server. The status code 200 indicating that the server honored the request

HTTP/1.0 200 OK
Date: SAT, 25 JAN 2003 01:30:30 GMT
Server: Apache/1.2.4
Last-Modified: Fri, 16 JAN 2003 02:30:15 GMT
ETag: "130fe-81-3883bbe9"
Content-Length: 129
Accept-Ranges: bytes
Connection: Close
Content-Type: text/plain

## Browser Architecture

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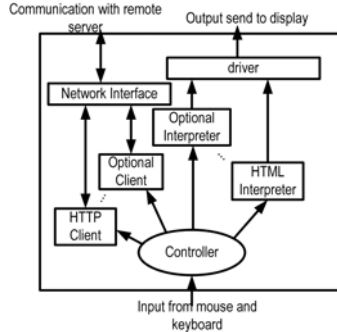
## Browser Architecture

- A browser contains several software components and handles most of the document access and display
- Major components of a Web browser
  - Display driver for the screen
  - HTML interpreter for HTML-formatted documents
  - Other interpreters (e.g. shockwave) for other items
  - HTTP client to fetch HTML documents from WWW server
  - Other clients with other protocols e.g. ftp
  - Controller for accepting user inputs and calling components to perform user operations
- Must be multi-threaded

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## Electronic Mail
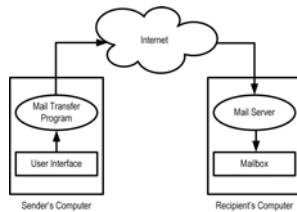


- Email is a file with specific header format and is transferred to the mailbox of the recipient
- Two components
  - Sending an email
  - Viewing and editing an email

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## Electronic Mail

- Electronic mailbox
  - Consists of a passive storage area such as file on disk
  - Is private with permissions set to allow mail software to add incoming message to an arbitrary mailbox, deny anyone except the owner to the right to examine or remove messages
  - is unique and identified by an e-mail address (mailbox@computer)
  - The mailbox consists of 2 parts:
    - 1st part is user's mailbox
      - Can be user's name or login account
    - 2nd part is the computer
    - E-mail software on the sender's computer uses the 2nd part to select a destination

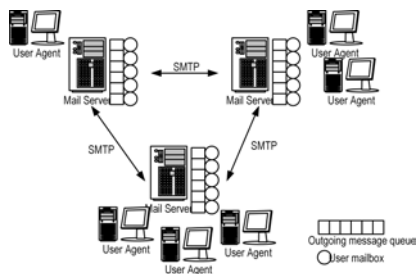## Electronic Mail Message Format

- Message consists of ASCII text separated into 2 parts
  - Header includes delivery information: sender, recipient, date message sent and content format; standard form that e-mail software used
  - Body carries text of message
  - Header and body is separated by blank line
- E-mail headers
  - Lines of text in format keyword: information
  - Keyword identifies information and can be appeared in any orders
  - Essential information e.g. To
  - Useful information e.g. Reply-to

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## Electronic Mail Message Format

| Keyword | Meaning |
|---|---|
| From | Sender's address |
| To | Recipients' addresses |
| cc | Addresses for carbon copies |
| Date | Date on which message was sent |
| Subject | Topic of the message |
| Reply-To | Address to which reply should go |
| X-charset | Character set used (usually ASCII) |
| X-Mailer | Mail software used to send the message |

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## Electronic Mail System

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## Electronic Mail System

- User agents
  - Such as Eudora, Outlook or Netscape's messenger
  - Allows users to read, reply to, forward, save, and compose messages
  - A user sends his message to the outgoing message queue of his mail server
  - His recipient reads the message from the mailbox of his mail server
- Mail Server
  - The core of e-mail infrastructure
  - Each sender and each recipient hold a mailbox in their mail server
  - Mail server containing the mail box will check the user's identity
  - If the recipient's mail server fails, the sender's server will hold the message in his message queue and attempts to transfer later
  - If not success after some attempts, the server will remove the message and notify the sender with an e-mail

## Simple Mail Transfer Protocol (SMTP)

- Simple Mail Transfer Protocol (SMTP)
  - Internet standard for mail delivery
  - Provides mail and message exchange between TCP/IP hosts
  - Is a combined set of three standard protocols
- SMTP itself STD10/RFC821
- STD11 contains RFC 822 and RFC1049
  - RFC822 describes syntax of mail header fields and defines a set of header fields
  - RFC 1049 describes how a set of document types other than plain text ASCII can be used in mail body
- RFC974 is a standard for Domain Name mail routing, DNS-MX

## Simple Mail Transfer Protocol (SMTP)

- STD10/RFC821
  - Data sent is 7-bit ASCII text with leading bit zero
  - Inadequate for non-English or non-textual data
  - 2 approaches: MIME and  SMTP extension
- Multipurpose Internet Mail Extensions (MIME)
  - Defined in RFC1521 and RFC1522
  - Supporting multimedia message
  - Mechanism for encoding text and binary data such as images, audio and video  or for non ASCII text formats as 7-bit ASCII within the envelope defined by RFC822
  - Sending program identifies the components so receiving program can automatically extract and inform mail recipient

## Simple Mail Transfer Protocol (SMTP)

- 2 key headers
  - Content-type header allows user agent to take an appropriate action on the message
  - Content-Transfer-Encoding header indicating message body is ASCII-encoded and the type of encoding
  - Example:
    MIME-Version: 1.0
    Content-Transfer-Encoding: base64
    Content-Type: image/jpeg
- MIME is extensible – sender and receiver agree on encoding scheme
- MIME is compatible with existing mail systems
  - Everything encoded as ASCII
  - Headers and separators ignored by non-MIME mail systems

## Mail Gateways
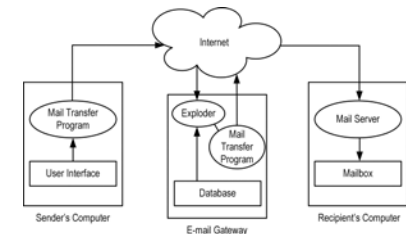


- Message passes from a sender's interface through a gateway
- On the gateway computer, an exploder handles incoming e-mail
- A conventional mail transfer program sends a copy to each recipient

## Mail Gateways

- In a large organization, mailing list processing may take a lot of resources
- A computer dedicated to processing electronic mail is called mail gateway, e-mail gateway or e-mail relay
  - Provide a single mail destination for all incoming mail
  - Mailing list maintained on most of mail gateway are public
  - Can use MX records in DNS to cause all mails to be delivered to gateway
- Message may make multiple hops for delivery
- Hops may be recorded in header

## Mailbox Access
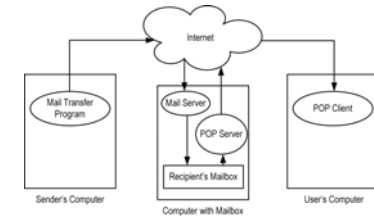


- E-mail path when POP is used to access a mailbox
- The mail can arrive from the sender's computer or a mail gateway
- A user runs a client program of the POP server to retrieve messages from the mailbox

## Mailbox Access

- A computer cannot be on a desktop computer unless it runs a mail server
  - require continuous running
  - Require multitasking operating system
  - Require local disk storage
  - Require powerful hardware
- TCP/IP protocols provides remote access to an electronic mailbox
- The protocol allows user's mailbox to reside on a computer that runs a mail server and allows the user to access items in the mailbox from another computer

## Mailbox Access

- The protocol is known as POP (Post Office Protocol)
  - Requires an additional server to run on the computer with the mailbox
  - A user runs e-mail software is called POP client of the POP server
  - A mailbox must run two servers
    - mail server to accept incoming e-mail and stores it in the mailbox
    - POP server allows a user on a remote machine to access the mailbox
- Difference between mail server and POP server
  - Mail server uses SMTP protocol, while POP server uses POP protocol
  - Mail server accept message from arbitrary sender while POP server only allows a user to access the mailbox after authentication
  - Mail server transfer only e-mail while POP server can provide mailbox information

## File Transfer Protocol (FTP)

- FTP is a TCP/IP standard for internet file transfer services
- http://www.w3.org/Protocols/rfc959/Overview.html
- A general purpose protocol
  - Permits transfer of an arbitrary file
  - Accommodates file ownership and access restrictions
  - Accommodates file transfer between different computer systems
    - Different operating systems
    - Different hosts
    - Different file systems
    - Different character sets
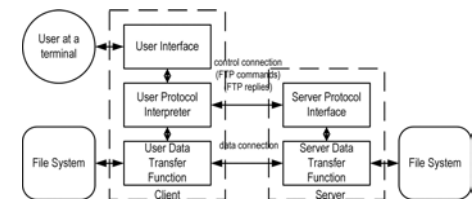
## File Transfer Protocol (FTP)

- FTP is designed to permit interactive or batch transfer
- Interactive transfer
  - User initiates a transfer program
  - lists directories and transferring files
  - User can immediately transfer files
  - Immediate alert for transfer errors
- Batch transfer
  - User creates a batch of files for transfer through an interface program
  - Request dropped in queue
  - Transfer program reads requests and performs transfers
  - Retries file transfer until successful
  - Suitable for unreliable and slow transfers

## File Transfer Protocol (FTP)

- Two-step process
  - Launch ftp
  - Connection to remote host
    - Remote host account and password
    - Anonymous ftp account permits an arbitrary user minimal access to files. Usually the ftp requests an user email address as a password
- File name
  - File name syntaxes may be incompatible
  - BSD ftp allows rules for filename translation

## File Transfer Protocol Model



- FTP uses two TCP connections to transfer a file
  - A control connection
  - A data connection

## File Transfer Protocol Model

- Control Connection
  - established in a client-server fashion
  - A server does a passive open on TCP port 21 and waits for a client connection
  - A client does an active open to TCP port 21 to establish the control connection
  - The control connection stays up for the entire time that the client communicates with the server

## File Transfer Protocol Model

  - The connection is used for commands from client to the server for server's replies
  - The connection should be "minimize delay" since the commands are normally typed by a user
- Data Connection
  - Created each time a file is transferred between client and server
  - The connection should be "maximize throughput" since the connection is for file transfer

## FTP Data Representation

- File type
  - ASCII file type
    - default text file is transferred across the data connection in Network Virtual Terminal NVT ASCII
    - Sender converts the local text file into NVT ASCII and the receiver converts the NVT ASCII to the local text file
    - End of each line is transferred using the NVT ASCII representation of a carriage return followed by a linefeed
  - EBCDIC file at both ends of the EBCDIC systems
  - Image file: a contiguous stream of binary data

## FTP Data Representation

  - Local file: transferring binary files between hosts with different byte sizes; a byte size of 8 is equivalent to an image file
- Format Control: available only for ASCII and EBCDIC file types
  - Nonprint: default file contains no vertical format information
  - Telnet format control: contains Telnet vertical format controls to a printer
  - Fortran carriage control: the first character of each line is the Fortran format control character

## FTP Data Representation

- Structure
  - File structure
    - Default file structure is a contiguous stream of bytes
  - Record structure
    - Only used with text files ASCII or EBCDIC
  - Page structure
    - Each page is transmitted with a page number to let the receiver store the pages in a random order
- Transmission Mode
  - Stream mode
    - Default file mode is transferred as a stream of bytes
    - For file structure, end-of-file indicates end of connection
    - For record structure, 2-byte sequence indicates the end-of-record and end-of-file

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## FTP Data Representation

  - Block mode
    - The file is transferred as a series of blocks, each preceded by one or more header bytes
  - Compressed mode
    - A simple compressed bytes. A text file would be compressed into strings of blanks. A binary file would be compressed into strings of 0 bytes
- Common Unix implementations:
  - Type: ASCII or image
  - Format control: nonprint only
  - Structure: file structure only
  - Transmission mode: stream mode only
- Non-Unix implementations provide FTP capabilities to handle their own file formats

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## FTP Commands

| ! | cr | macdel | proxy | sendport |
|---|---|---|---|---|
| $ | delete | mdelete | put | status |
| account | debug | mdir | pwd | struct |
| append | dir | mget | quit | sunique |
| ascii | disconnect | mkdir | quote | tenex |
| Bell | form | mis | recv | trace |
| Binary | get | mode | remotehelp | type |
| Bye | glob | mput | rename | user |
| Case | hash | nmap | reset | verbose |
| Cd | help | ntrans | rmdir | ? |
| cdup | lcd | open | runique | |
| close | ls | prompt | send | |

- ftp client interface from BSD Unix is de facto standard
  - Common used: cd, dir, ls, get, put, pwd, lcd

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## E-Commerce

- Commerce is a basic economic activity involving trading or the buying and selling of goods
- In E-commerce, commercial transactions and business functions carried out electronically.
- Earliest example is electronic funds transfer
- Later, electronic data interchange (EDI) was introduced to facilitate interbusiness transactions
- The advent of internet technologies and advanced cryptographic techniques accelerate the development of e-commerce
- E-commerce
  - Business focused e-commerce
  - Consumer focused e-commerce

## Key Drivers for E-Commerce

Data networks
Intense competition
Globalization
Information age
Technologies
Automation
Low cost high quality products/services

→ **DIGITAL**

- **Data Networks**
  – Advent of LAN & Internet allows seamless flow of information
- **Intense competition**
  – For survival, companies are looking for more effective ways to provide better customer services. E-commerce is one the effective ways

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## Key Drivers for E-Commerce

- **Globalization**
  – E-commerce provides an effective "vehicle" for companies to move to international market for maintaining  profit growth
- **Information age**
  – Information becomes a valuable asset
  – Companies are looking for more effective ways to collect, update and manipulate various types of information for marketing purposes
- **Technologies**
  – Many business ideas can be realized from the advent of technologies which are the enabler for e-commerce
- **Automation**
  – E-commerce provides an attractive solution for reducing paper transaction and message flow
- **Low cost high quality products/services**
  – It becomes one of the major business philosophies due to competitions and high customer expectations

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## Types of E-Commerce

|  | Business (organization) | Consumer (individual) |
|---|---|---|
| **Business (organization)** | B2B (e.g. TPN) | B2C (e.g. Amazon) |
| **Consumer (individual)** | C2B (e.g.  Priceline) | C2C (e.g. eBay) |

- Different types of e-commerce from the perspective of the buyer and seller relationship
- Used to categorize e-commerce applications
- E-commerce applications can be divided into four categories: B2C, B2B, C2C and C2B

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## Types of E-Commerce

- Business-to-consumer (B2C)
  – Seller is a business organization whereas the buyer is a consumer
  – Emulates the physical retailing and is called electronic retailing
  – Typically, electronic stores are setup on internet to sell goods to consumers
  – Example: Amazon.com (www.amazon.com)
    - E-commerce site in general Internet bookseller
    - Sells finished products to consumers directly on the internet
    - Books listed in different sections for ease searching
    - Search facility is available
    - Consumer can put the selected book into his shopping cart
    - Make use of data mining techniques to promote books
    - Payment is made by credit cards in most of cases
    - Books are sent by mail or courier

## Types of E-Commerce



Amazon.com (www.amazon.com)

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## Types of E-Commerce

- Business-to-business (B2B)
  - Both buyers and sellers are business organizations
  - 3 types of systems
    - Buyer-oriented system
    - Seller-oriented system
    - Virtual market
  - Related to supply chain management
  - Example, Global eXchange Services (www.geis.com/index.jsp)
    - Internet-base trading network for buyers and sellers to carry out B2B e-commerce
    - Buyer-driven
    - Buyer can prepare requirements, Request for quotation, invite potential sellers, negotiate the bids online and finally select the best bids to complete the purchase

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## Types of E-Commerce



Global eXchange Services (www.geis.com/index.jsp)

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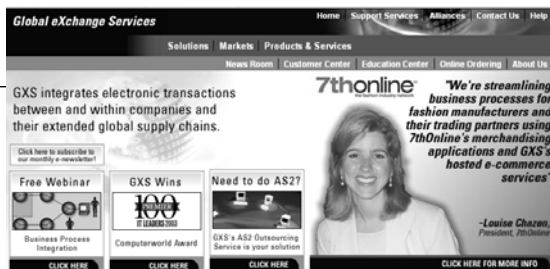
## Types of E-Commerce

- Consumer-to-business (C2B)
  - Consumer specifies the requirements to a business which provides a product based on the requirements
  - There is strong element of customization
  - Example: Priceline (www.priceline.com)
    - Introduce an e-commerce application "demand collection system"
    - Allows consumer to post the requirements, the Priceline will search a supplier to meet the requirements. If it is found, the consumer will make the payment by credit card and the deal is made
    - Priceline handles the products/services: cars, hotels, air-tickets, etc

## Types of E-Commerce



Global eXchange Services (www.geis.com/index.jsp)

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## Types of E-Commerce

- Consumer-to-consumer (C2C)
  - Both sellers and buyers are consumers
  - On-line auctions provide an effective means for supporting C2C e-commerce
  - Example: eBay (www.eBay.com)
    - Largest online trading service through online auctions
    - A user places an item on the eBay site for bidding,
    - Interested parties bid for it before due day, highest bid wins
    - Currently eBay has over 30 million members
    - Participants trading a wide range of items including books, stamps, coins and etc
    - eBay creates a virtual community for "talk"

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## Types of E-Commerce



eBay (www.eBay.com)

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## Changes Brought About By E-Commerce

| Traditional Commerce | E-commerce | Remarks |
| --- | --- | --- |
| Marketplace | Marketspace | •Marketplace has physical constraints<br>•Marketspace almost unlimited movement |
| Mostly fixed pricing | Dynamic, customized and group pricing | •Dynamic pricing  e.g. online auction<br>•Buyer-oriented pricing e.g.  Priceline |
| Standard Product | Customized Product | •Standard products are manufactured through mass production<br>•Products can be tailor-made according to customers' requirements |
| Physical catalogue (fixed & inflexible) | Digital catalogue (dynamic & flexible) | •Digital catalogues<br>•Easy to update<br>•Direct link to order process |

## Changes Brought About By E-Commerce

| | | |
|---|---|---|
| Primarily mass marketing, one-to-many selling | Multifunctional marketing, one-to-one selling & many-to-many selling | •In traditional commerce, mass media is used to convey marketing message<br>•In e-commerce, marketing message is based on profiles and buying behavior |
| Supply (seller) driven | Demand (buyer) driven | •In e-commerce, buyers pull the goods down the demand chain<br>•Companies manage a "demand chain" instead of a "supply chain" |
| Physical goods | Digital goods | •Some goods can be made digital and downloaded instantly |
| Hierarchical organization | Networked organization | •More effective and productive |
| Tend to expand horizontally | Tend to expand vertically | •Many dot.coms tend to be extremely specialized rather generalized |

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## E-Commerce Framework

- Information Super-highway
  - Telecom based
  - Cable-TV based
  - Wireless based
  - Internet based
- Standards and legislative supports
  - Law and policy
    - Access, privacy, information pricing
  - Technical standards
    - Information publishing, user interface
    - Compatibility across the entire network

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## E-Commerce Framework

- Multimedia message distribution
  - www/html - message between client/server
  - CGI – execution on server
  - Java – execution on client
  - Java applet – execution on both client and server
  - Push – information driven by client
- Common business Infrastructure
  - Security – encryption
  - Authentication – certification authorities
  - Electronic payment - e-cash
  - Directories & catalogues services

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## E-Commerce System Architecture

- Requirement
  - Proper execute the required functions or services
  - Cope with the services demand changes
  - Scalable to meet the business plan/services
- Infrastructure consideration
  - Hardware
    - Servers, networks, proxy server, firewall
  - Software
    - Commerce server, transaction server, database server, web server
  - Management and operation system
  - Required service level
  - Shared applications
    - Software distribution, backup, recovery and capacity planning
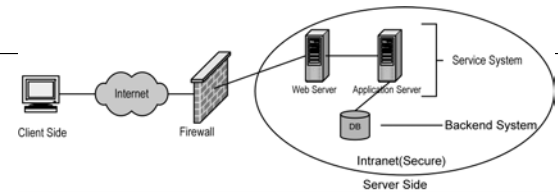
## E-Commerce System Model
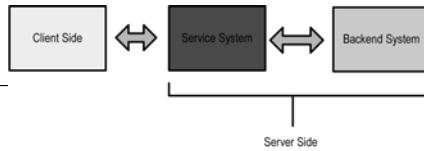


The three-tier model for an e-commerce system

- The client side provides customer interface
- The service system handles business logic (users' request)
- The backend system provides the necessary information to complete a transaction
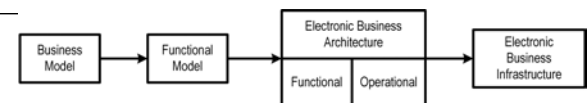
## E-Commerce System Model



A web-based e-commerce system architecture

## E-Commerce System Model

- Service system includes web server and application server
  - Web server is responsible for interacting with the web client and the application server and the backend system
  - Web server 's response is dynamic or is dependent on the user's input
- The web client or web browser is the client side
  - Web client issues a request to the web server and web server returns a response to the web client
- The database is the backend system
- The internet is a nonsecure public network
  - need to employ various cryptographic techniques

## E-Commerce Infrastructure



Model for E-Commerce Infrastructure

## E-Commerce Infrastructure

- Business Model
  - Infrastructure specification
  - Provides basic data for biz system and service level for obtaining detailed business system characteristics
    - No. of customers, Orders per day, Average/peak volume of biz transactions
  - Other business characteristics
    - Situation, purpose, outcome, functions, resources, locations

## E-Commerce Infrastructure

- Functional Model
  - Specification for business processes and applications needed to accomplish the services and functions offered to customers
  - Functional model is important:
    - The processes of defining and setting service levels is critical to the nature of business processes and applications
    - Business applications are implemented using infrastructure services

## E-Commerce Infrastructure

- Electronic Business Architecture
  - Components
    - Services provided by hardware and software
    - Third-party services
    - Services interaction methodology
  - Two descriptors
    - Functional
      - Structure, components, their interactions and interfaces
    - Operational
      - Focuses on operational view of the system
      - Network topology, geographical locations, applications service levels
      - Performance, availability, security

## E-Commerce Infrastructure

- Electronic Business Infrastructure
  - Design and implementation at minimum cost is based on:
    - Nature of e-business
    - Quantitative information about the business
    - Functional model of the applications
    - Architecture requirements
- Factors for providing quality of information services
  - Performance
  - Availability and maintainability
  - scalability

## E-Commerce Infrastructure

- Performance
  - Biz site must be perform fast and reliable
    - Bandwidth and server capacity
    - Response time
      - Complex web-based commerce applications
        » Unpredictable nature of traffic
        » Execution of web transaction demands information from other sites
  - Problem areas
    - End user : obsolete system technology, lack of bandwidth link to ISP
    - Internet Service Provider (ISP): inadequate server and network capacity
    - Backbone provider: excess traffic being congestion and delays
    - E-commerce sites

## E-Commerce Infrastructure

- Availability and maintainability
  - Availability is one of the main goals of e-business
  - Low availability can cost an e-business lost revenue, reduced market share and bad publicity
  - High availability depends on
    - Infrastructure reliability
    - Software robustness
    - Geographically separate sites load balancing mechanism
    - Redundant networks
    - Monitoring system and measurement procedures
  - Key concept in maintainability is the ease of replacing or upgrading hardware and software components

## E-Commerce Infrastructure

- Scalability
  - Provides adequate service levels even when the workload increases above the expected levels
  - Infrastructure of e-business should be designed for information service scale with demand and avoid errors
  - Improved by
    - Distributed search engine
    - A web server acts as a broker to distribute queries among data servers
    - Large storage for a data server

## Organizational Structure
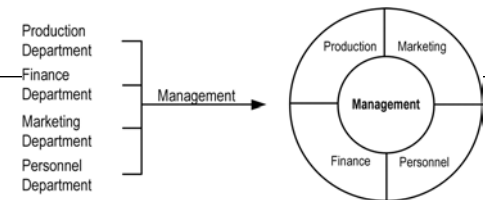


**Transformation from a compartmentalized organization into an Integrated organization**

## E-Commerce Implementation

- E-commerce involves the integration of hardware , software, "peopleware" and business process
- Senior management
  - defining the strategic vision of an e-commerce project
- Procurement department
  - new procurement channels,
  - e.g. virtual marketplace to save cost and to improve efficiency
- Production department
  - redefine the production process to support buyer driven supply chain

## E-Commerce Implementation

- Marketing department
  - make use of new marketing techniques
  - Links to the ordering process
- Finance department
  - Building secure electronic payment system
- Personnel department
  - Provide training to the employees for the e-commerce systems
- Customer support department
  - Use electronic customer supporting software for better service
- Organization Transformation

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