E-COMMERCE AND ITS INFRASTRUCTURE

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e-Commerce = Trade + Aids to trade

= Buying and selling + financing, banking, insurance, warehousing, transportation, marketing research, etc over the net.

e-business = Commerce + Production related activities over the net
DEFINITIONS

‘E-commerce’ is the process of buying and selling or exchanging of products, services, and information via computer networks including the internet.
-- Ravi Kalakota and Whinston, USA, 1997
(Cisco Systems, in 1995, was the first frm to use the term e-commerce)

‘E-business’ refers to not only buying and selling but also servicing customers and collaborating with business partners on the net.
-- www. Wikipedia.org
(IBM, in 1997, was one of the first firm to use the term e-business)
FORMS OF E-COMMERCE

E-commerce can take various forms depending on the degree of digitization of the product or service sold, the process (delivery and payment), and the delivery agent or intermediary.

Figure 1.1: The dimensions of e-commerce

• According to Choi model, a product can be physical or digital, an agent can be physical or digital, and the process can be physical or digital. These create eight cubes \((2 \times 2 \times 2 = 8)\), each of which has three dimensions.

• In traditional commerce all dimensions are physical (lower left cube), while in pure EC all dimensions are digital (upper right cube). All other cubes include a mix of digital and physical dimensions.

• If there is at least one digital dimension we will consider the situation partial EC, but not pure one.
Examples for pure Vs partial EC:

1. Buying a book from a book store – It is traditional commerce

2. Buying a book from Amazon.com (USA)— Though it is digitally ordered on net, it is a partial EC, because the book is delivered by BlueDart, courier service.

3. Buying software from Egghead (USA)- It is pure EC, because the product, payment, and delivery agent are digital.
Applications of e-commerce can include the following:

1. **Electronic fund transfer**: Extending and completing the procurement process by providing buyers with ability to rapidly and cost-effectively make payments to sellers and shippers with less financial risk and fewer errors, while reducing paper-handling and storage requirements (this is more typical of EDI and banking networks). Ex: NEFT, RTGS.

2. **Enterprise integration**: Extending integration throughout a company, including other trading partners. Business process reengineering can be employed to improve communication within a company or by outsourcing to other companies and using e-commerce like tools to manage the relationship. The result is the virtual corporation; this provides **vertical integration** of companies with their suppliers, as well as **horizontal integration** of segments of a company.

3. **Computer-supported collaborative work**: Expanding collaborative activities, such as supporting joint development of requirements, maintenance of documents, and so forth, within or across companies. Teaming may take place at either the company or individual level, creating a just-in-time virtual resource for delivery of the right human and business resources for a job.

4. **Govt. regulatory data interchanges**: Collecting data from (and returning data to) various communities to enable the government to carry out its mandated responsibilities.
5. **Marketing of goods and services:** The target marketing (isolating and focusing on a segment of the population), **relationship marketing** (building and sustaining a long-term relationship with the existing and potential customers), **event marketing** (setting up a virtual booth where interested people come and visit), and **interactive marketing** (via interactive multimedia catalogs) are accomplished in e-markets.

6. **Supply chain management:** It includes:

i. **Supplier management:** The benefits are seen in reduced purchase orders (PO), processing costs, increased number of POs processed by fewer employees, and reduced order processing cycle times.

ii. **Inventory management:** The goal is to shorten order-ship-bill cycle and to reduce the inventory levels, improve inventory turns, and eliminate out-of-stock occurrences.

iii. **Distribution management:** The e-commerce can be applied to move documents related to shipping, such as bills of lading, purchase orders, advanced ship notices, and manifest claims in moments and accurate data, thus allowing improved resources planning.
iV. **Channel management:** The technical, product, and pricing information to trading partners by posting them to e-bulletin boards, thus allowing instant access.

V. **Payment management:** This aims at increasing the speed (productivity) at which companies can compute invoices, reducing clerical errors and lowering transaction fees and costs while increasing the number of invoices processed.

Vi. **Financial management:** The need to assess the risk and exposure in global financial markets based on global rather than local market information.

Vii. **Sales force productivity:** 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 relationship, and service quality.

7. **Work group collaboration:** The easy and inexpensive connection of various organizational segments to improve communications and information sharing among employees and to gather and analyze competitive data in real-time. Ex: Video conferencing in medical transcription, Para-medical services.
CHARACTERISTICS OF INTERNET, INTRANET AND EXTRANET:

<table>
<thead>
<tr>
<th>Network type</th>
<th>Typical users</th>
<th>Access</th>
<th>Type of information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Internet</td>
<td>Any individual with dial-up access or LAN</td>
<td>Unlimited public; no restrictions</td>
<td>General, public, and advertorial</td>
</tr>
<tr>
<td>2. Intranet</td>
<td>Authorized employees only</td>
<td>Private and restricted</td>
<td>Specific, corporate, and proprietary</td>
</tr>
<tr>
<td>3. Extranet</td>
<td>Authorized groups from collaborating companies</td>
<td>Private and authorized outside partners</td>
<td>Shared in authorized collaborating groups</td>
</tr>
</tbody>
</table>
## INFRASTRUCTURE OF E-COMMERCE

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Infrastructure</th>
<th>Particulars</th>
<th>Players</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hardware</td>
<td>a. Internet backbone</td>
<td>IBM, Sun, Compaq, Dell</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Inter-connected access points</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Internet service providers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Server software</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Firewalls</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Networking</td>
<td>a. Routers</td>
<td>Cisco</td>
</tr>
<tr>
<td>4.</td>
<td>Client-server applications</td>
<td>a. SMTP, b. FTP, c. UsenetNews Groups, d. WWW</td>
<td>IBM, Microsoft</td>
</tr>
<tr>
<td>5.</td>
<td>Security</td>
<td>a. Encryption software</td>
<td>Checkpoint, VeriSign</td>
</tr>
<tr>
<td>6.</td>
<td>E-payment systems</td>
<td>a. E-payment software</td>
<td>PayPal, CyberCash</td>
</tr>
<tr>
<td>6.</td>
<td>Databases</td>
<td>a. DBM software</td>
<td>Oracle, Sybase</td>
</tr>
<tr>
<td>7.</td>
<td>ERP software</td>
<td>a. S&amp;D, HR, CRM, F&amp;C, P&amp;P, etc</td>
<td>PeopleSoft, Oracle, SAP</td>
</tr>
</tbody>
</table>
• The **Internet backbone** refers to the principal data routes between large, strategically interconnected networks and core routers on the Internet. These data routes are hosted by commercial, government, academic and other high-capacity network centers, the Internet exchange points and network access points, that interchange Internet traffic between the countries, continents and across the oceans of the world. Internet service providers (often Tier 1 networks) participate in Internet backbone exchange traffic by privately negotiated interconnection agreements, primarily governed by the principle of settlement-free peering.
E-COMMERCE INFRASTRUCTURE

- Virtually all EC sites rest on the same network structure, communication protocols, Web standards, and security systems, whether it is a B2B site or B2C site. Hence, the e-marketers make a focus on the basic hardware and software infrastructure underlying the EC site.

I Hardware infrastructure

It consists of:

1. Inter-connected backbones* which are run by the Network Service Providers (NSPs). Ex: MCI, AOL, AT&T each backbone handling several terabytes per month.
   BSNL, MTNL, Reliance Com, Tasta DoCoMo, etc.
2. Inter-connected Network Access Points (NAPs). Ex: Pacific Bell NAP (San Francisco) and Ameritech NAP (Chicago); National Internet Exchange of India.
3. A multitude of access/delivery sub-networks provided by the local and regional Internet Service Providers (ISPs). Ex: BSNL, Dishnet.

* Internet Backbone: One of the super fast networks crisscrossing the globe from one major metropolitan area to another, provided by a handful of national Internet Service Providers (ISPs). These companies and organizations provide connections running at approximately 45 MB per second. Local ISPs connect to this backbone through routers so that data packets can be carried through the backbone to its destination.
• **NSP** → **NAP** → **ISP**

• **A network service provider (NSP)** is a business or organization that sells bandwidth or network access by providing direct backbone access to the Internet and usually access to its network access points (NAPs). For such a reason, network service providers are sometimes referred to as *backbone providers* or *internet providers*. Ex: AT&T of USA, BT of UK, NTT of Japan, SingTel of Singapore.

• **A Network Access Point (NAP)** is a public network exchange facility where Internet Service Providers (ISPs) are connected with one another in peering arrangements.

• **An Internet service provider (ISP)** is a company that provides access to the Internet. Access ISPs directly connect customers to the Internet using copper wires, wireless or fiber-optic connections. Hosting ISPs lease server space for smaller businesses and host other people servers (colocation). Transit ISPs provide large amounts of bandwidth for connecting hosting ISPs to access ISPs. Ex: ISPs in India: BSNL (Except in Mumbai and Delhi, MTNL in Mumbai and Delhi, Sify, Reliance communications, Idea, Vodafone, Hathway, MTS India, Tata Indicom, Tata DoCoMo, Tikona Digital Networks, Spectranet, You Broadband, etc (all national ISPs). BeamTelecom in Hyderabad(regional ISP).
Fig. 1.1 Internet Network Architecture
When a user issues a request on his computer, it will traverse an ISP network, move over one or more of the backbones, and across another ISP network to the computer containing the information of interest. The request is broken into packets, and the paths traversed by them are determined by special computers called routers (produced by premier provider Cisco), the load balancers. The response to the request will follow a similar sort of path. The response to the request will follow a similar sort of path.
II Software infrastructure

1. **Internet protocols**: A protocol is a set of rules that determines how two computers communicate with each another over a network. These rules are implemented in two parts in the network software and are called Transmission Control Protocol (TCP) and Internet Protocol (IP). TCP divides the data into little data packets along with special information, like the packet position, error correction code, etc to make sure that packets at the destination can be reassembled correctly and without any damage to data. The IP puts destination addressing information on such packets. The current version of IP is 6 (IPv6) in which internet addresses are 32 bits long and written as four sets of numbers separated by period, eg., 130.211.100.5 which is called dotted quad addressing. Ex: www.yahoo.com, (domain name, ex: .com, .edu, .gov, .mil, .net, .org are top level domains) behind which there is a 32-bit numerical address. Following is TCP/IP architecture:

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Physical Layer</td>
<td>Consists of routines for accessing physical networks. (Ethernet–physical data link technology like routers, hubs, Multi-station access units – physical &amp; virtual, token rings, etc.)</td>
</tr>
<tr>
<td>2. Network Layer</td>
<td>Defines the datagram and handles the routing of data. (IP)</td>
</tr>
<tr>
<td>3. Transport Layer</td>
<td>Provides end to end data delivery services. (TCP)</td>
</tr>
<tr>
<td>4. Application Layer</td>
<td>Consists of applications and processes that use the network. (FTP, HTTP, Telnet, NNTP)</td>
</tr>
</tbody>
</table>
2. **Client/server applications**: Besides the lower level protocols like TCP/IP, the end users interact with the internet also through one of the following several client (software resides on end-user’s desktop providing navigation and display)/server (resides on a workstation or server class machines providing back-end access to files and relational databases) applications:

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Application</th>
<th>Protocol (access method)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>E-mail</td>
<td>Simple Mail Transport Protocol (SMTP)</td>
<td>Allows the transmission of text messages and binary attachments across the internet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multipurpose Internet Mail Extensions (MIME)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>File Transfer</td>
<td>File Transfer Protocol (FTP)</td>
<td>Enables files to be uploaded and downloaded across the internet.</td>
</tr>
<tr>
<td>3.</td>
<td>Chat</td>
<td>Internet Relay Chat Protocol (IRCP)</td>
<td>Provides a way for users to talk to one another in real time over the internet. The real time chat groups are called channels.</td>
</tr>
<tr>
<td>4.</td>
<td>UseNet Newsgroups</td>
<td>Network New Transfer Protocol (NNTP)</td>
<td>Discussion forums where users can asynchronously post messages and read messages posted by others.</td>
</tr>
<tr>
<td>5.</td>
<td>World Wide Web (WWW)</td>
<td>Hyper Text Transport Protocol (HTTP)</td>
<td>Offers access to hypertext documents, executable programs, and other internet resources.</td>
</tr>
</tbody>
</table>
Technology solutions to security threats to E-commerce website

1. **ENCRYPTION**: It is the process of transforming plain text into cipher text that can not be read by outside of the sender and the receiver to secure stored information and information transformation to provide:

   a. **Message integrity**: assurance that the message has not been altered.
   b. **non-repudiation**: prevents the user from denying he sent the message.
   c. **Authentication**: verification of the identity of the sender.
   d. **Confidentiality**: assurance that the message was not read by others.

**Cipher can be either:**

**Substitution cipher.**: Replacing letters with a new one.
   ex: Replacing ‘HELLO’ with ‘JGNNQ’

**Transposition cipher**: ex: Replacing letters in reverse order.
   ex: ‘HELLO’ with ‘OLLEH’
Methods of encryption:

1. **Symmetric key encryption:** Both the sender and the receiver use the same key to encrypt and decrypt the message. But the message of 8-bit key can be deciphered easily as there are only $2^8$ or 256 possibilities.

2. **Public key encryption:** Both private and public keys are used. Public key is widely made known, whereas private key is kept secret by sender. But once the keys are used, the same key cannot be used for decryption.
## FIGURE 5.6 PUBLIC KEY CRYPTOGRAPHY — A SIMPLE CASE

<table>
<thead>
<tr>
<th>STEP</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The sender creates a digital message. The message could be a document, spreadsheet, or any digital object.</td>
</tr>
<tr>
<td>2.</td>
<td>The sender obtains the recipient’s public key from a public directory and applies it to the message. Public keys are distributed widely and can be obtained from recipients directly.</td>
</tr>
<tr>
<td>3.</td>
<td>Application of the recipient’s key produces an encrypted cipher text message. Once encrypted using the public key, the message cannot be reverse-engineered or unencrypted using the same public key. The process is irreversible. The encrypted message is broken into packets and sent through several different pathways, making interception of the entire message difficult (but not impossible).</td>
</tr>
<tr>
<td>4.</td>
<td>The encrypted message is sent over the Internet. The only person who can decrypt the message is someone who has possession of the recipient’s private key. Hopefully, this is the legitimate recipient.</td>
</tr>
<tr>
<td>5.</td>
<td>The recipient uses his/her private key to decrypt the message.</td>
</tr>
</tbody>
</table>

In the simplest use of public key cryptography, the sender encrypts a message using the recipient’s public key, and then sends it over the Internet. The only person who can decrypt this message is the recipient, using his or her private key. However, this simple case does not ensure confidentiality or an authentic message.
A more realistic use of public key cryptography uses hash functions and digital signatures to both ensure the confidentiality of the message and authenticate the sender. The only person who could have sent the above message is the owner or the sender using his/her private key. This authenticates the message. The hash function ensures the message was not altered in transit. As before, the only person who can decipher the message is the recipient, using his/her private key.
A digital envelope can be created to transmit a symmetric key that will permit the recipient to decrypt the message and be assured the message was not intercepted in transit.
The public key infrastructure (PKI) includes certification authorities who issue, verify, and guarantee digital certificates that are used in e-commerce to assure the identity of transaction partners.
Popular online credit/debit cards in the world:

Credit cards:
MasterCard, Visa, JCB, American Express, Discover, China UnionPay.

Debit cards:
Maestro (Switch, Solo), Visa Debit (Delta, Connect), Visa Electron, Carte Bleue, China UnionPay, Dankort, Girocard (EC), Laser.

Major Indian online payment gateways:
CCAvenue, DirectPay (operated by TimesMoney group), EBS (collaboration with Axis bank), ABC Payments (operated by IndiaMart), HDFC, ICICI, Pay seal(ICICI), and Transecute.
How an Online Credit Card Transaction Works?

1. Consumer makes purchase
2. SSL provides secure connection through Internet to merchant server
3. Merchant software contacts clearinghouse
4. Clearinghouse verifies account and balance with issuing bank
5. Issuing bank credits merchant account
6. Monthly statement issued with debit for purchase