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ISBN 978-93-47966-59-0

Published: 08th April 2026
Printed with care by Imaginex Inks Printing

Imaginex Inks Publication
https://www.imaginexinkspublication.com/

Contact Number : 9750663871
9962991057

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08th April, 2026

Price: Rs. 450/-

ISBN: 978-93-47966-59-0

Published by and copies can be had from:

Imaginex Inks Publication

71A 71B First Street, RKV Avenue,

Old Pallavaram, Chennai 600117, India.

Phone:9750663871, 9962991057

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Preface

E-Commerce in Project Management has been prepared to provide a clear and practical understanding of how electronic commerce principles and digital business practices can be effectively integrated with project management. In today's rapidly evolving business environment, organizations increasingly depend on digital platforms, online transactions, cloud-based tools, data analytics, and technology-enabled communication to plan, execute, monitor, and complete projects successfully.

This book presents the fundamental concepts of e-commerce and project management in a simple, systematic, and application-oriented manner. It explains how digital technologies support various project management activities, including project planning, budgeting, scheduling, resource allocation, procurement, risk management, communication, quality control, and performance evaluation.

The chapters are designed to help students, academicians, researchers, entrepreneurs, project managers, and business professionals understand the relationship between e-commerce and modern project management practices. Special attention has been given to emerging areas such as digital project platforms, online supply-chain management, electronic procurement, virtual teams, customer relationship management, cybersecurity, digital payments, data-driven decision-making, and agile project management.

The book also highlights the challenges associated with managing e-commerce projects, including technological uncertainty, data privacy, security risks, changing customer expectations, global competition, and rapid innovation. Practical examples and contemporary business perspectives have been incorporated to help readers connect theoretical concepts with real-world project situations.

We hope this book will serve as a valuable resource for learning, teaching, researching, and applying e-commerce concepts in project management. It is expected to equip readers with the knowledge and skills required to manage technology-driven projects effectively and contribute to sustainable organizational growth in the digital era.

Dr. T. Sujatha
Dr. B. Sanjeevan
Dr. E. Brindha Devi

Acknowledgments

We express our sincere gratitude to **Vels Institute of Science, Technology and Advanced Studies (VISTAS), Chennai**, for providing the academic environment, encouragement, and support for the preparation of this book.

We are deeply thankful to the management, authorities, and academic leadership of VISTAS for their continuous motivation and guidance. We also extend our heartfelt thanks to our colleagues, faculty members, research scholars, and students for their valuable suggestions, cooperation, and encouragement throughout the development of this work.

We are grateful to our families and well-wishers for their constant support and inspiration. Finally, we thank the publisher for their assistance and cooperation in bringing out this book successfully.

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UNIT – 1
Introduction to E-Commerce and Technology Infrastructure

Objectives

Upon completing this unit, students will be able to:

- Define and explain the concept of electronic commerce
- Describe the major classifications of e-commerce
- Trace the growth and evolution of e-commerce over time
- Evaluate the advantages and limitations of e-commerce
- Describe the technology infrastructure supporting e-commerce
- Distinguish between intranets and extranets

Introduction to Electronic Commerce

Electronic commerce, commonly abbreviated as e-commerce or EC, refers to the act of transacting business — both buying and selling goods and services — over digital networks, primarily the Internet and the World Wide Web. Over recent years, the term has broadened in scope, and is frequently used synonymously with the related concept of e-business, which encompasses a wider range of digitally mediated business activities beyond simple trade.

At its core, e-commerce transforms traditional market interactions by shifting them onto digital platforms that operate continuously and globally. Businesses, consumers, and governments alike can participate in these transactions, giving e-commerce a remarkable reach that conventional commerce cannot match.

Fundamental Nature of E-Commerce

Three foundational ideas define how e-commerce functions as a commercial and technological phenomenon:

- E-commerce facilitates the management of commercial transactions and their associated costs by leveraging online tools and digital networks, making trade faster and more cost-effective than conventional methods.
- It involves the systematic redesign of business workflows into structured, ordered sequences of activities, ensuring that transactions are carried out with maximum efficiency using internet-based platforms.
- E-commerce enables flexible working arrangements by supporting telecommuting and remote collaboration among employees, thereby creating distributed yet productive workforces.

Categories of Electronic Commerce

E-commerce does not operate in a single form. Depending on the nature of the parties involved in a transaction, it falls into one of the following major categories:

➢ B2C – Business-to-Consumer

➢ B2B – Business-to-Business

➢ C2C – Consumer-to-Consumer

➢ B2G – Business-to-Government

➢ BP – Business Processes

Business-to-Consumer (B2C): In this form, businesses sell their products or services directly to individual customers through the internet. It mirrors the functioning of a retail store, but in a virtual

environment. A widely cited example is Walmart.com, which makes its full range of merchandise available for purchase via its website, allowing consumers to shop from the convenience of their homes.

Business-to-Business (B2B): This category covers commercial transactions conducted between two businesses rather than between a business and an individual consumer. It encompasses activities such as outsourcing and off-shoring. Grainger.com is a representative example, supplying industrial and maintenance products to both large corporations and small enterprises through its online storefront.

Consumer-to-Consumer (C2C): In C2C transactions, individual consumers trade with each other, often facilitated by a commercial intermediary platform — hence the expanded label C2B2C. Online auction sites such as eBay and matrimonial portals operate on this principle, connecting buyers and sellers who are themselves private individuals rather than commercial entities.

Business-to-Government (B2G): Here, businesses supply goods or services to government bodies and public agencies. This segment is often treated as a sub-domain of B2B commerce. Portals such as CAL-Buy, which connects vendors to procurement offices in the state of California, are illustrative examples.

Business Processes: Beyond direct trading, e-commerce supports the broader organisational processes of information management, supplier evaluation, and customer relationship building. Dell Technologies, for instance, uses secure online channels to share real-time production forecasts with component suppliers, enabling a tightly synchronised supply chain.

Growth and Development of Electronic Commerce

The origins of e-commerce can be traced to the adoption of Electronic Data Interchange (EDI) and Electronic Funds Transfer (EFT) technologies, which first made it possible to conduct structured business transactions between computers. These early systems served as the technological foundations upon which modern e-commerce was subsequently built. By the early 1990s, the scope of digital commerce had widened to include enterprise resource planning (ERP), data warehousing, and data mining.

The period between 1998 and 2000 saw rapid expansion as businesses across North America and Western Europe launched their first commercial websites. However, the year 2000 brought the collapse of the dot-com bubble, wiping out thousands of internet-based ventures. Despite this contraction, the sector recovered quickly: within a year, B2B transactions alone exceeded $700 billion in volume, demonstrating the lasting commercial potential of online trade.

Early Leaders in E-Commerce

Companies such as Amazon and eBay, both established in 1994, were among the earliest to build recognisable and trusted digital brands. Their success helped validate the e-commerce model for a wide range of industries. Today, the categories registering the highest online sales volumes include computing hardware, literature, office consumables, music, and consumer electronics.

Defining Characteristics of E-Commerce

- Technology-driven: E-commerce is inseparable from the infrastructure and innovation of digital networks.

- Disintermediation: Online platforms often remove the need for traditional middlemen, connecting buyers and sellers more directly.
- Friction-free commerce: The digital marketplace tends to equalise access to information, diminishing unfair competitive advantages.
- First-mover advantage: Companies that established an online presence early gained significant market share that proved difficult for later entrants to displace.
- Network effects: The value delivered by a digital platform grows proportionally with the number of its participants, creating powerful incentives for adoption.
- Business-driven: Commercial imperatives of profitability and earnings growth remain central.
- Regulatory evolution: Stronger frameworks of governance and consumer protection are progressively being applied to digital commerce.
- Market entry by large firms: As e-commerce matured, established corporations entered the space, intensifying competition.
- Imperfect market conditions: Despite the appearance of transparency, information asymmetries and market concentrations persist.

Advantages of E-Commerce

1. Enhanced Sales Performance: The ease with which consumers can compare products, evaluate prices, and make informed choices online translates into increased purchase rates and higher overall sales volumes for businesses.
2. Continuous Availability: An online store operates without interruption — 24 hours a day, seven days a week, throughout

the entire year — allowing businesses to serve customers across different time zones without incurring the costs of extended physical operating hours.

3. Speed of Payment: Electronic payment systems, including credit cards and digital wallets, make financial settlement immediate, benefiting both merchants who receive prompt payment and consumers who enjoy a smooth checkout experience.
4. Expanded Market Reach: By operating online, a business ceases to be constrained by its physical location. It can serve customers anywhere in the world, transforming what was once a local market presence into a global one.
5. Cost-Effective Advertising: Digital platforms offer flexible and measurable advertising tools. Establishing an online presence and accepting electronic payments also raises a business's perceived credibility and trustworthiness in the eyes of consumers.

Disadvantages of E-Commerce

1. Low Consumer Awareness: Particularly in developing markets, a significant portion of potential customers and merchants remain unfamiliar with digital commerce. Overcoming this barrier requires sustained educational and promotional effort.
2. Payment Security Risks: Fraudulent credit card transactions remain a serious concern in e-commerce. Financial institutions are often cautious about approving online transactions, and the absence of robust security mechanisms can erode consumer confidence.
3. Inventory Shortfalls: It is a common frustration that products prominently featured in online catalogues are unavailable when

consumers attempt to purchase them. Poor synchronisation between marketing and stock management undermines trust.

4. Network Reliability Issues: Dependence on internet infrastructure means that network outages or system failures can render an e-commerce platform completely inaccessible, resulting in lost sales and reputational damage.
5. Absence of Comprehensive Legal Frameworks: Many jurisdictions lack adequate cyber laws to govern digital commerce, electronic payments, and data protection. The development of appropriate legislation remains an urgent priority for governments.

Economic Forces Driving E-Commerce

One of the clearest economic arguments for e-commerce lies in its ability to reduce the costs of doing business. Communicating electronically is substantially cheaper than maintaining physical infrastructure. Transactions with suppliers can be processed more quickly and at lower cost; advertising can be targeted precisely; and customer support can be delivered at scale through automated and self-service tools. These efficiencies translate into improved profit margins and competitive pricing for consumers.

Market Forces

Global competition encourages firms to use the internet as a vehicle for reaching new markets beyond their domestic boundaries. The web also transforms how companies interact with their customers, making it possible to provide detailed product information, personalised recommendations, and responsive after-sales support without the need for face-to-face engagement. This shift in customer service capability is a powerful competitive differentiator.

Technology Forces

Advances in information and communication technology (ICT) have been central to e-commerce growth. Progress in digitisation, data compression, and open standards has enabled the convergence of previously separate communication networks — telephone, cable television, and internet access — onto unified digital platforms. This convergence dramatically lowers the cost of communication infrastructure for both businesses and consumers, making high-quality digital interaction accessible to a far wider audience.

Identifying E-Commerce Opportunities

Several sectors have demonstrated particular readiness to embrace digital commerce and offer significant growth potential:

1. Financial Services: An expanding base of internet users seeks financial guidance, investment tools, and insurance products online, creating fertile ground for digital financial service providers.
2. Stock Trading: Online brokerage services have democratised investment, enabling individuals to trade equities and securities at competitive transaction costs without requiring a physical visit to a brokerage office.
3. Banking: Internet banking has moved from novelty to mainstream, with major financial institutions like ICICI Bank and HDFC Bank in India offering comprehensive digital account management services.
4. Legal and Professional Services: Increasing regulatory complexity around digital business creates demand for online legal and compliance advisory services. Law firms and consultancies can serve clients more efficiently through digital platforms.

5. Tourism and Travel: Airlines, railways, and hotels have embraced online reservation systems, reducing distribution costs and providing customers with convenient self-service booking capabilities.
6. Healthcare: The healthcare sector uses internet-based platforms to streamline administrative workflows, improve communication between providers and patients, and integrate clinical information systems across institutions.

Technology Infrastructure of E-Commerce

A well-structured e-commerce system rests on a layered technological framework. This framework encompasses both the applications that users interact with and the deeper infrastructure that supports those applications. The following components constitute this framework:

- Common Business Services Infrastructure: This layer encompasses the technologies required to conduct secure transactions, including authentication systems, smart card readers, digital payment gateways, and business directories and catalogues.
- Messaging and Information Distribution Infrastructure: Protocols such as EDI, electronic mail, and HTTP fall within this layer. They govern how information is packaged, transmitted, and received across the network.
- Multimedia Content and Network Publishing Infrastructure: Technologies such as HTML, Java, and VRML — along with the web itself — enable rich, interactive content to be delivered to end-users.
- Network Infrastructure: The physical and logical communication channels through which data flows, including telecommunications networks, cable TV systems, wireless

networks, the Internet, VANs, WANs, LANs, intranets, and extranets.

The successful deployment of this infrastructure relies on four interdependent pillars:

- People: The buyers, sellers, service intermediaries, IT professionals, and management teams who participate in and oversee e-commerce activities.
- Public Policy: Legislation, taxation, privacy regulations, domain name governance, and freedom of expression norms that shape the legal environment for digital commerce.
- Technical Standards: Agreed-upon specifications for documents, communication protocols, security mechanisms, and payment systems that ensure interoperability.
- Organisations: The companies, industry associations, government agencies, and regulatory bodies that form the broader ecosystem within which e-commerce operates.

Effective e-commerce management involves coordinating all these applications, infrastructure layers, and supporting pillars into a coherent and responsive whole.

The Internet and the World Wide Web

Historical Development of the Internet

While some historians trace the conceptual origins of interconnected communication back to the advent of the telegraph in the nineteenth century, the technological development of the Internet as we know it began in the mid-twentieth century. The driving force was the need to connect computers, first at point-to-point level and eventually across large and geographically dispersed networks.

A pivotal moment came with the development of packet-switching technology, which allowed data to be fragmented into manageable units, routed independently across shared networks, and reassembled at the destination. Networks built on this principle — including ARPANET in the United States, the Mark I network at the National Physical Laboratory in the United Kingdom, and CYCLADES in France — emerged during the late 1960s and 1970s. In 1982, the standardisation of the TCP/IP protocol suite created the technical foundation for a globally interconnected network of networks: the Internet. By 1995, the last barriers to commercial use of this infrastructure had been removed, and the modern era of the commercial internet began.

From the mid-1990s onward, the impact of the Internet on commerce and culture has been transformative. Electronic mail became a primary channel of communication; the World Wide Web made information universally accessible through a graphical interface; and the emergence of social networking fundamentally altered how individuals interact with one another. Data volumes and transmission speeds have continued to grow, with modern fibre-optic backbones capable of handling speeds of 10 Gbps and beyond.

ARPANET

The first operational packet-switched network, ARPANET, was initiated under the direction of Robert Taylor at the Defense Advanced Research Projects Agency (DARPA), who brought in Larry Roberts from the Massachusetts Institute of Technology to lead the technical effort. On the night of 29 October 1969, the first ARPANET message was sent from the University of California, Los Angeles to the Stanford Research Institute. By year's end, a four-node

network had formed, with the University of Utah and the University of California, Santa Barbara also connected.

By 1981, the ARPANET had grown to include 213 host computers, with new hosts joining at a rate of approximately one every three weeks. The network played a central role in developing the communication protocols and collaborative practices that would underpin the future Internet. Crucially, the Request for Comments (RFC) process — a mechanism for proposing and refining technical standards — was established through ARPANET and continues to guide Internet engineering to this day. International participation, while limited, included research groups in Norway, Sweden, and the United Kingdom.

NPL Network

Independent of the American effort, Donald Davies of the National Physical Laboratory (NPL) in the United Kingdom proposed a nationally deployed packet-switched data network in 1965. Although the broader proposal was not adopted at the national level, Davies proceeded to design and construct the Mark I network within the NPL to demonstrate the viability of packet-switching technology. By 1976, this network interconnected twelve computers and seventy-five terminal devices, remaining operational until 1986.

X.25 and Public Data Networks

Drawing on the research conducted in both the United States and the United Kingdom, the International Telecommunication Union (ITU) developed X.25 — a suite of packet-switching standards that offered a commercially deployable alternative to the government-restricted ARPANET. Unlike ARPANET, which relied on fully connectionless routing, X.25 employed virtual circuits that emulated the behaviour

of traditional telephone connections. In 1974, the SERCnet academic network in the United Kingdom was built on X.25 principles; this later evolved into JANET.

In 1978, the British Post Office, Western Union International, and Tymnet jointly established the International Packet Switched Service (IPSS), the first international commercial packet-switched network. By 1981 it had extended its coverage to Canada, Hong Kong, and Australia, and by the early 1990s had grown into a truly worldwide infrastructure. Major commercial services of the era — including CompuServe and Prodigy — used X.25-based backbones to deliver email, real-time chat, and online content to paying subscribers. CompuServe notably became the first service to offer electronic mail to personal computer users in 1979, and the first to offer real-time chat the following year.

UUCP and Usenet

A different approach to networked information sharing emerged in 1979 when Tom Truscott and Jim Ellis, graduate students at Duke University, used Unix shell scripts to exchange messages and news files with the nearby University of North Carolina over a serial UUCP (Unix-to-Unix Copy Protocol) connection. The resulting system — later known as Usenet — grew rapidly as institutions around the world adopted UUCP to join the distributed network. Unlike ARPANET, which required government authorisation to join, Usenet imposed no such restrictions, making it especially popular among commercial organisations, universities, and enthusiast communities. By 1981 over 550 UUCP hosts were connected; by 1984 that number had nearly doubled to 940. Sublink Network, established in Italy in 1989, was an early example of UUCP-based connectivity diffusing through the broader public.

TCP/IP: Unifying the Networks

By the early 1970s the proliferation of incompatible networking systems had created a pressing need for a unified communication protocol. Robert Kahn of DARPA and Vinton Cerf of Stanford University collaborated on developing a solution. Their approach relocated responsibility for reliable transmission from the network itself to the communicating endpoints, and used a common internetworking protocol to bridge the differences between underlying network technologies. The resulting specification, published as RFC 675 in 1974, introduced the term 'internet' as shorthand for 'internetworking'. After years of refinement, the TCP/IP protocol suite emerged in near-final form in 1978 and was formally adopted across all ARPANET hosts on 1 January 1983 — a transition known as 'Flag Day'. This standardisation made it technically feasible to interconnect virtually any two networks, regardless of their individual characteristics.

From Federal Networks to the Commercial Internet

Following the establishment of TCP/IP, several U.S. government agencies developed their own wide-area networks on its foundation. NASA's Science Network connected space researchers globally; the National Science Foundation's NSFNET became the primary high-speed backbone for academic and research computing in the United States; and the Department of Energy's ESNet served the scientific community's computing needs. Meanwhile, the military component of ARPANET was separated into the dedicated MILNET, which later became the classified and unclassified networks SIPRNET and NIPRNET respectively.

Throughout the 1980s and early 1990s, commercial interest in the Internet grew steadily despite restrictions on its use for profit-making activities. The Scientific and Advanced-Technology Act of 1992

permitted the NSFNET to interconnect with commercial networks, opening the way for businesses to participate. Companies such as PSINet, UUNet, and Netcom began offering commercial internet access. By April 1995, the NSF had formally ended its role as the primary backbone operator, removing the last formal barrier to commercial internet traffic. Commercial networks, interconnected through the Commercial Internet Exchange (CIX) and a series of Network Access Points (NAPs), took over the role of routing global internet traffic.

Electronic Mail and Usenet Newsgroups

Electronic mail predates the Internet and served as one of the key drivers of early network adoption. Originally developed in 1965 to allow users of mainframe time-sharing systems to leave messages for one another, email evolved into a cross-network communication tool. In 1971, Ray Tomlinson established the now-universal convention of separating the user's name from the host machine's identifier using the @ symbol, giving the email address its characteristic form. Protocols including UUCP and SMTP enabled email to travel across multiple networks simultaneously, reaching ARPANET, BITNET, and NSFNET users alike.

Usenet newsgroups, developed by Steve Daniel and Tom Truscott in 1979, created another dimension of networked communication by allowing themed public discussions to be distributed across thousands of servers worldwide. These discussion forums covered technical, scientific, and cultural topics and served as an early model for the collaborative knowledge-sharing communities that characterise much of the present-day internet. For users in countries with limited internet connectivity, FTP email gateways provided a workaround, allowing software and files to be requested by email, encoded, and received in

fragmented pieces — a method that fell out of use once the World Wide Web and HTTP became widely accessible.

The Rise of Web Search Engines

Before the development of the World Wide Web, navigating the internet required a degree of specialist knowledge. Early search tools such as Archie (1990), WAIS, and Gopher (both 1991) helped users locate files on remote servers, but offered limited scope for discovery. The launch of WebCrawler in 1994 — the first full-text search engine for the Web — transformed this, enabling searches based on the actual content of pages rather than just their titles. Lycos, also launched that year, achieved the first commercial success in this space. By the late 1990s, Yahoo! and AltaVista had established themselves as dominant directories and search engines respectively, but both were eventually overtaken by Google, founded in 1998, whose PageRank algorithm delivered search results ordered by relevance in a way that set a new benchmark. The commercial significance of search engine rankings gave rise to an entire field of practice — search engine optimisation (SEO) — that continues to be an important component of digital marketing strategy.

Packet-Switched Networks

A packet-switched network operates by decomposing all transmitted data into discrete units of a standard size, known as packets. Each packet is then routed independently through the shared network infrastructure from its source to its destination. The network allocates bandwidth on demand, packet by packet, rather than reserving a dedicated channel for the entire duration of a communication session. This approach maximises the utilisation of available network capacity and provides resilience, since packets can be re-routed around congested or failed nodes.

The development of packet-switched networks passed through three broadly defined phases: the experimental era preceding the adoption of X.25 and the OSI reference model; the X.25 era, during which telecommunications operators standardised commercial packet networks; and the Internet era, marked by the removal of restrictions on commercial traffic and the global expansion of TCP/IP networks.

Circuit-Switched Networks

In a circuit-switched network, a dedicated communication path is established between two endpoints before any data transmission takes place. This dedicated path remains reserved for the exclusive use of those two parties for the entire duration of the session, even during periods when no actual data is being exchanged. The Public Switched Telephone Network (PSTN) is the most familiar example of a circuit-switched system.

The principal advantage of circuit switching is predictability: because the channel is reserved, transmission delay is constant and communication quality is assured. The significant disadvantage is inefficiency: bandwidth that is reserved but idle — for example, during pauses in a telephone conversation — cannot be used by other parties. This makes circuit switching considerably more expensive than packet switching for data-intensive applications.

Virtual circuit switching offers a compromise: although data is broken into packets, a logical path is reserved before transmission begins, and packets are guaranteed to arrive in order. This approach is used in some telecommunications networks to combine the predictability of circuit switching with the efficiency of packet switching.

Examples of Circuit-Switched Networks

- Public Switched Telephone Network (PSTN)
- ISDN B-channel
- Circuit Switched Data (CSD) and High-Speed Circuit-Switched Data (HSCSD) in GSM cellular networks
- Datakit
- X.21 network systems used in DATEX services in Germany and Scandinavia
- DisplayPort

Comparing Packet Switching and Circuit Switching

The key distinction between these two technologies lies in how network resources are allocated. In circuit switching, a dedicated path is locked in for the duration of a session, whether or not data is flowing. This guarantees performance but wastes capacity. Voice telephony is the canonical application because call quality demands consistent latency. In packet switching, bandwidth is shared dynamically and allocated only when packets are actually being transmitted. This greatly increases overall network efficiency and reduces cost, but introduces variability in delay. Voice over IP (VoIP) demonstrates that packet switching can handle real-time voice communication acceptably well, since human hearing can tolerate modest levels of delay variation and occasional minor packet loss.

Network Paths and Packet Structure

In any complex network, the physical or logical route between sender and receiver consists of intermediate devices called nodes — routers, switches, and gateway devices that inspect each packet's addressing information and forward it toward its destination. In circuit-switched networks, this path is predetermined and remains fixed throughout the session. In packet-switched networks, each packet independently

determines its route, potentially taking a different path from other packets in the same data stream. IP packets carry the source and destination addresses, a sequence number, and error-checking information within a structured header, enabling routers to make forwarding decisions without any prior knowledge of the session as a whole. Once all packets arrive at their destination, the receiving device reassembles them in the correct sequence to reconstruct the original data.

Message Switching

Message switching preceded packet switching as an approach to store-and-forward digital communication. In a message-switched network, an entire message is received in full at each intermediate node, stored temporarily, and then forwarded to the next node along the path. This approach is tolerant of delays, making it suitable for non-real-time applications such as electronic mail, where latency of minutes or even hours is acceptable. The term 'store-and-forward' aptly captures its working principle.

Because each message must be stored in its entirety at every intermediate node before being forwarded, message switching introduces end-to-end delays that increase proportionally with message length and with the number of nodes in the path. These propagation and transmission delays compound at each hop. Nonetheless, within its domain of application, message switching remains effective: it is tolerant of network congestion (messages are simply queued), it supports prioritisation (urgent messages can be forwarded before routine ones), and it enables efficient multicast delivery, since a single message can be forwarded to multiple destinations without duplication of network effort.

Advantages of Message Switching

- Network bandwidth is used more efficiently because transmission links are shared among multiple communicating parties.
- Messages can be queued at switching nodes during periods of congestion, providing a natural buffer against temporary network overloads.
- Traffic prioritisation mechanisms allow high-priority messages to be forwarded ahead of lower-priority ones.
- Broadcast delivery is efficient, since a single message stored at a node can be distributed to multiple recipients without re-transmission from the originating source.

Internet Protocols

The Internet Protocol (IP) is the foundational communications protocol of the Internet. It governs how data packets are addressed, encapsulated, and routed across interconnected networks. IP operates at the network layer of the protocol stack and is responsible for delivering packets from their originating host to their destination host, potentially traversing many intermediate networks along the way.

IP was originally developed as the connectionless, datagram-based component of the TCP/IP protocol suite introduced by Vinton Cerf and Robert Kahn in 1974, where TCP provided the connection-oriented, reliable transmission layer above it. The dominant version in use today is IPv4, which provides 32-bit addressing. Its successor, IPv6, uses 128-bit addressing and is steadily being adopted worldwide to address the exhaustion of IPv4 address space.

Functions and Services of IP

The primary functions of the Internet Protocol are addressing and routing. Each device connected to an IP network is assigned a unique address that serves as both an identifier and a locator. When a packet is transmitted, it carries the source and destination IP addresses in its header, alongside sequence information and error-detection data. This header information is added through a process called encapsulation. Routers read each packet's destination address and forward it through the network toward its target, with each router making an independent forwarding decision based on its routing table.

Reliability Characteristics of IP

IP was deliberately designed as a best-effort delivery protocol, meaning it makes no guarantees that packets will arrive at their destination in the order they were sent, without duplication, or at all. The rationale for this design choice was to keep the network infrastructure simple, placing the burden of error correction and re-ordering on the communicating endpoints rather than on intermediate routers. As a consequence, a range of delivery failures are possible under IP: data corruption may occur in transit; packets may be lost due to congestion or node failures; duplicate copies of packets may arrive; and packets may arrive out of their original sequence.

IPv4 partially mitigates these risks by including a checksum in the packet header, which allows routing nodes to detect and discard corrupted headers immediately. IPv6 has dispensed with this header checksum in favour of faster forwarding. Error correction, re-ordering, and reliable delivery are the responsibility of higher-level protocols; TCP, for instance, implements acknowledgment, retransmission, and sequencing to provide a reliable communication channel over the unreliable foundation provided by IP. Where applications are tolerant of occasional data loss (such as streaming

audio or video), UDP provides a lightweight alternative that bypasses these overhead mechanisms.

Another practical constraint of IP is the maximum transmission unit (MTU) — the largest packet size permitted on a given network link. IPv4 can automatically fragment packets that exceed the MTU of an intermediate link, reassembling them at the destination. IPv6 requires the sender to perform path MTU discovery before transmission and adjust packet sizes accordingly. This distinction has implications for application performance and network efficiency.

IP Addressing and Routing

IP addressing defines how the namespace of the internet is structured and how individual devices are identified within it. Addresses are allocated hierarchically, with large blocks assigned to regional internet registries, then to internet service providers, and finally to individual organisations and end-users. Subnetting allows large address blocks to be subdivided into smaller, more manageable groups. Routing within a single organisation is typically managed through interior gateway protocols (IGPs), while routing between autonomous systems is coordinated using exterior gateway protocols (EGPs) such as the Border Gateway Protocol (BGP), which is the backbone protocol of the global internet.

Types of Internet Protocols and Services

The Internet supports a family of application-layer protocols, each designed to serve a specific category of user need. Web browsers are capable of accessing many of these services through a unified interface.

File Transfer and Remote Access Protocols

FTP (File Transfer Protocol): FTP was among the earliest application protocols designed for the Internet and remains in

widespread use. It allows a user to connect to a remote server, browse its file system, and transfer files in either direction. FTP sessions require a username and password, and the file contents being transferred are visible only as filenames without embedded descriptions.

Gopher: Gopher preceded the World Wide Web as a means of organising and accessing information on remote servers. It presented files in a hierarchically structured menu system, making navigation more intuitive than raw FTP. While it has been largely superseded by the Web, Gopher servers continue to operate in niche communities.

Telnet: Telnet allows a user's computer to act as a terminal connected to a remote system. Once connected, the user can operate applications residing on the remote machine as though they were interacting directly with it. Because Telnet transmits data in unencrypted plain text, it has been largely replaced by Secure Shell (SSH) in contemporary practice.

Markup Languages

A markup language is a formal system for embedding instructions within a text document in a manner that is syntactically distinct from the document's content. These instructions — typically enclosed in delimiters such as angle brackets — inform the system that will process or display the document how to interpret, render, or structure its contents. The concept originates in traditional editorial practice, where editors marked up paper manuscripts with handwritten notations to guide typesetters.

Markup languages differ in their purpose: some prescribe the visual appearance of content (presentational markup), some encode instructions for processing software (procedural markup), and some describe the logical structure and meaning of content without

specifying how it should be displayed (descriptive or semantic markup). The most widely used markup language in the world today is HTML, the foundational document format of the World Wide Web.

HTML

Hypertext Markup Language (HTML) was devised by Sir Tim Berners-Lee at CERN in the early 1990s, drawing on the syntax of SGML (Standard Generalised Markup Language). Berners-Lee's insight was to combine SGML's structured tagging system with the concept of hypertext links, creating a document format that could not only present information but also connect documents to one another across the network. The result was the web page — a self-describing, navigable document that could be rendered by any browser on any platform.

HTML tags define the structure and meaning of content: for example, the h1 tag denotes a top-level heading, the p tag delimits a paragraph, and the em tag marks emphasised text. A browser reads these tags and applies its own rendering rules, displaying the structured content visually. This separation of structure from presentation has been progressively refined through Cascading Style Sheets (CSS), which control visual styling independently of content markup. HTML is continuously updated through the W3C standards process, with HTML5 the current major version.

Categories of Markup

- Presentational markup embeds visual formatting instructions directly into the document. Traditional word processors use this approach internally; the formatting choices are applied by the software without exposing the markup to the author.
- Procedural markup instructs a processing programme on how to handle the document. Tools such as LaTeX and troff use this

approach; the author embeds commands that the formatting engine interprets sequentially to produce output.

- Descriptive (semantic) markup labels the nature and meaning of content elements, leaving the question of how they should be rendered entirely to the processing environment. HTML's structural tags and XML are examples of this approach, which promotes portability and accessibility.

In modern practice, the distinctions between these categories are not always sharp. Word processors save documents in XML-based formats that use descriptive markup, then apply stylesheet transformations to produce visual output. LaTeX authors define their own high-level descriptive commands that expand into lower-level procedural instructions. The development of lightweight markup languages — used in wikis, forums, and documentation systems — has further broadened the range of tools available to authors.

Historical Development: GenCode, GML, and SGML

The intellectual lineage of modern markup languages begins with William W. Tunnicliffe, who presented the concept of generic coding at a conference in 1967. He argued that formatting instructions in documents should describe the logical role of content elements (heading, paragraph, footnote) rather than their physical appearance (bold, 12-point, indented). Tunnicliffe later led the development of GenCode, a publishing industry standard built on this principle.

Working independently, IBM researcher Charles Goldfarb developed the Generalised Markup Language (GML) in 1969 while designing a document management system for legal practitioners. GML was deployed commercially by IBM in 1978 and influenced the subsequent development of SGML. Goldfarb further formalised and generalised GML into SGML, which the International Organization

for Standardization published as ISO 8879 in 1986. SGML established the metalanguage framework from which both HTML and XML are ultimately derived.

In 1980, Brian Reid's doctoral dissertation introduced Scribe, the first markup language to cleanly separate document structure from its visual presentation, prefiguring the principle that would later underpin CSS. Scribe served as a direct conceptual ancestor to both HTML and LaTeX. The SGML committee, chaired by Goldfarb with contributions from Sharon Adler, Anders Berglund, and James A. Marke, codified the Document Type Definition (DTD) mechanism, enabling authors to specify formally what elements and structures a conforming document may contain.

SGML achieved wide adoption in industries with large-scale documentation needs — defence, aerospace, and publishing — but its complexity and flexibility made it difficult to implement. When Berners-Lee drew on it to create HTML, he produced a simplified subset tailored to the specific needs of a hypertext-linked document system, and in doing so made structured markup accessible to a global audience of ordinary web authors.

Features of HTML Markup

A distinctive characteristic of HTML (and most markup languages) is that the markup and the content it describes coexist within the same file. Tags are enclosed in angle brackets and interspersed with the textual content they annotate. For example, the following fragment illustrates basic HTML structure:

```
<h1> Home page </h1>
<p> This page includes navigation menus and toolbars,
but <em>does not</em> include any CSS files. </p>
```

In this example, h1 identifies a primary heading, p identifies a paragraph, and em identifies text that should receive visual emphasis. A rendering engine interprets these semantic labels and applies appropriate styling. The i tag, by contrast, is a presentational tag that specifies italic text without conveying anything about the reason for the emphasis.

Basic Structure of an HTML Document

Every HTML document follows a standard structural template. The DOCTYPE declaration identifies the document type; the html element contains the entire document; the head section holds metadata, title information, and links to stylesheets and scripts; and the body section contains the visible content of the page:

```
<!DOCTYPE html>
<html>
  <head>
    <title>Page Title</title>
  </head>
  <body>
    <h1>Main Heading</h1>
    <p>Paragraph text goes here.</p>
  </body>
</html>
```

Intranets and Extranets

Intranet

An intranet is a private, organisation-internal network that applies internet technologies — including web browsers, web servers, and database-backed information systems — to support communication and information sharing among employees. Unlike a public website, an intranet is accessible only to authorised members of the organisation. A firewall separates it from the public internet, ensuring

that proprietary internal information remains inaccessible to outside parties.

The value of an intranet lies in its ability to give every employee a single, consistent point of access to corporate information, applications, and collaboration tools, regardless of their physical location or the department they work in. By centralising information distribution, organisations can reduce printing and administrative costs while improving the speed with which policies, announcements, and knowledge resources reach their intended audiences.

Extranet

An extranet is an extension of an organisation's intranet that selectively grants access to external parties — such as business partners, suppliers, or customers — for specific purposes. Rather than exposing the full intranet, an extranet creates a controlled boundary zone in which designated external users can access only the resources and applications relevant to their relationship with the organisation. Security is maintained through authentication mechanisms, encrypted connections, and carefully defined access permissions. The extranet thus achieves the collaboration benefits of the public internet while preserving the confidentiality and governance properties of a private intranet.

Comparison: Intranet vs. Extranet

Network Type	Typical Users	Access	Type of Information
Intranet	Authorised employees only	Private and restricted	Specific, corporate, and proprietary

Network Type	Typical Users	Access	Type of Information
Extranet	Authorised personnel from partner organisations	Controlled access for outside collaborators	Shared data among approved partner groups

Internet Connectivity Options

Organisations seeking Internet connectivity face several architectural choices that determine how their private network traffic and public internet traffic are managed, separated, and secured. The fundamental decision involves whether to procure connectivity directly from an Internet Service Provider (ISP) or as part of a bundled MPLS (Multi-Protocol Label Switching) VPN service.

Organisations that manage their own Internet gateway must address several technical and operational considerations, including: routing policy design; selection of an appropriate demarcation point for internet access within the internal network; implementation of Network Address Translation (NAT) where private addressing is used; security hardening; and ongoing monitoring and management responsibilities.

At the infrastructure level, three primary configurations are available for combining MPLS VPN services with internet connectivity:

1. Shared MPLS VPN and Internet Connectivity: Internet and VPN traffic traverse common infrastructure, simplified management but requiring careful quality-of-service controls.
2. Partially Shared: A hybrid arrangement in which some network segments are dedicated to internet traffic while others are shared.

3. Full Separation: Internet and VPN traffic are carried over completely independent infrastructure, providing maximum security isolation but at higher cost.

The Semantic Web

The Semantic Web is an extension of the existing World Wide Web designed to make web content machine-interpretable as well as human-readable. Whereas a conventional web page presents text and images in a form designed for the human eye, the Semantic Web adds structured, machine-readable metadata that describes the meaning and relationships of the information on the page.

This metadata enables software agents — automated programmes acting on behalf of users — to navigate, query, and reason about web content with a level of sophistication that keyword-based search engines cannot achieve. The Semantic Web was conceived and named by Tim Berners-Lee, who developed the standards governing it through the World Wide Web Consortium (W3C). In Berners-Lee's formulation, it is 'a web of data that can be processed directly and indirectly by machines,' complementing rather than replacing the human-centred web.

Review Questions

1. Define e-commerce and explain its fundamental nature.
2. What are the advantages and disadvantages of e-commerce?
3. Explain the major categories of e-commerce with examples.
4. Describe the technology infrastructure that supports e-commerce operations.

5. Distinguish between an intranet and an extranet with the help of a comparison table.

UNIT – 2
Legal Environment, Revenue Models and Web Presence

Objectives

Upon completing this unit, students will be able to:

- Understand the legal and ethical dimensions governing e-commerce operations
- Explain how internet taxation principles apply to online businesses
- Identify and compare the principal revenue models employed in digital commerce
- Describe the process of creating and maintaining an effective web presence
- Explain web usability and its commercial significance

Use and Protection of Intellectual Property

Intellectual property (IP) describes a collection of legally recognised entitlements attached to original creations of human intellect. The holder of an IP right is granted exclusive authority to use, reproduce, and commercially exploit the protected creation for a defined period, giving innovators and creators a meaningful economic return on their investment of time, effort, and skill. The major categories of IP protection relevant to digital commerce are copyright, patents, trade marks, industrial design rights, and trade secrets. Each operates under its own statutory framework, confers different rights, and applies to a different class of creative or commercial output.

Copyright Infringement

A copyright violation takes place whenever a protected work is used in a way that falls within the exclusive rights of its owner — such as reproduction, public display, or adaptation — without the owner's authorisation. Digital networks have made infringement far easier and more widespread than was possible in a pre-internet world, because content can be perfectly copied and globally distributed at essentially zero cost. Whether or not the infringing party sought financial gain is irrelevant to the legal analysis; unauthorised exploitation of protected material is actionable regardless of motive.

Cyber Crimes

The growth of digital connectivity has produced a category of criminal conduct that either targets computer systems directly or uses them as instruments to harm individuals and organisations. Typical cyber offences include online financial fraud; cyber stalking, in which digital communication tools are used to intimidate or threaten victims; the deliberate spread of hate content targeting specific communities; the distribution of prohibited material; and organised attacks on network infrastructure. A persistent legal challenge is jurisdictional: because perpetrators, victims, and intermediary infrastructure may be located in entirely different countries, determining which legal system applies and which courts may claim authority is frequently unresolved. Governments worldwide are amending existing criminal codes or enacting specialist cyber legislation to address these gaps.

Global Legal Issues of E-Commerce

Patent Infringement

A patent is an exclusive right granted by a public authority entitling the holder to prevent others from manufacturing, using, or selling the described invention without authorisation, usually for twenty years

from the filing date. To qualify, an invention must be novel, represent a non-obvious advance, and be capable of industrial application. In e-commerce, patenting software programs has proven expensive and slow, leading many firms to rely on copyright registration instead. Of greater commercial significance are business method patents, which protect proprietary approaches to conducting commercial activities online. Patented examples include specific one-click purchasing procedures and dynamic reverse-pricing systems. Critics argue that broad business method patents can create unjustified monopolies; courts in multiple jurisdictions continue to define their appropriate scope.

Trade Mark and Domain Name Conflicts

A trade mark is any distinctive sign — a word, logo, colour, or symbol — that identifies the commercial source of a product or service and sets it apart from competitors. A trade name is the identifier under which a business operates publicly. Domain names are the unique web addresses through which websites are reached. Conflict arises because trade mark law historically permits the same mark to exist in multiple countries and product categories simultaneously, whereas domain names are globally unique — no two websites may share an identical address. Four recurring conflict patterns have been identified:

Cyber squatting: A party pre-emptively registers domain names that include the well-known trade marks or brand names of established businesses, then demands payment to release the address. This is treated as a legal offence in most jurisdictions and can result in compulsory transfer of the domain without compensation.

Concurrent use: Two parties with independently legitimate claims to the same name both apply for the corresponding domain. Trade

mark law would ordinarily accommodate both; domain name uniqueness cannot. A legal determination of relative priority is required.

Parasitic domains: A web address is registered that closely mimics a well-known brand's address — often by substituting a single character or exploiting a common misspelling — with the aim of intercepting misdirected traffic. This practice is sometimes termed typosquatting.

Top-level domain conflicts: The same second-level name may be registered across different top-level domains (.com, .org, .net) by different parties, allowing one operator to benefit commercially from users who enter the wrong suffix when navigating to a well-known site.

ICANN's Uniform Domain-Name Dispute-Resolution Policy (UDRP) provides a streamlined arbitration mechanism for these disputes. The World Intellectual Property Organization (WIPO), headquartered in Geneva, is one of the designated UDRP service providers. Decisions are binding on domain registrars and may compel cancellation or transfer of contested addresses.

Online Defamation

Defamation is the publication of a false factual assertion that damages the reputation of an identifiable person or organisation. Where the target is a product or commercial offering rather than a person, the specific legal term is product disparagement. Online communication amplifies both the reach and the risk of defamatory content: statements may be published to a global audience instantly and persist indefinitely, and the perceived anonymity of the internet emboldens

some individuals to make assertions they would not make in person. Commercial websites must ensure that any critical commentary on competitors or industry figures is defensible as fair comment grounded in fact, and that image manipulation does not portray real individuals in a false or demeaning light.

The liability of internet service providers for defamatory content hosted on their platforms is determined by whether the ISP exercises editorial control. An ISP that actively curates the content it carries is treated as a publisher and may be held liable. One that functions as a passive conduit, transmitting content created by third parties without editorial intervention, is generally shielded from liability provided it removes infringing material promptly when given valid notice.

Online Privacy

Privacy in the digital environment refers to the right of individuals to control how information about them is gathered, stored, and used by organisations with which they interact online. Web technologies enable silent and comprehensive data collection: browsing history, search queries, purchase patterns, location data, and demographic inferences can all be accumulated without users' active awareness. If this data is exploited beyond the purposes for which it was collected, or shared without consent, individual privacy interests are violated.

Regulatory responses vary markedly by jurisdiction. The European Union's General Data Protection Regulation (GDPR) imposes strict requirements: data must be collected for specified legitimate purposes, stored securely, not retained beyond necessity, and not exported outside the EU without equivalent protections in the destination country. Canada's PIPEDA establishes comparable

standards. The United States has generally preferred voluntary self-regulation by businesses, supplemented by sector-specific rules.

Organisations collecting user data typically adopt one of two consent frameworks. Under opt-out, data use is permitted by default unless the user actively objects. Under opt-in, data use beyond the immediate service context is prohibited unless the user explicitly approves it. Authoritative privacy scholarship identifies four minimum standards that any sound data governance framework should satisfy:

- Collected data should be used to enhance service delivery and not diverted to undisclosed secondary purposes.
- Personal information should not be shared with or sold to external parties without the user's explicit and informed consent.
- Users should have the right to obtain a clear account of what data an organisation holds about them and how it has been used.
- Users should be able to request permanent deletion of personal data held by an organisation about them.

Internet Taxation

E-commerce businesses are subject to the same categories of tax as conventional firms: income tax on profits, transaction taxes such as sales tax and customs duties, and property tax on business assets. The distinguishing complication is the potential exposure to multiple overlapping tax jurisdictions simultaneously. A single business may incorporate in one country, operate servers in a second, serve customers across dozens of others, and fulfil orders through logistics networks spanning still more. No single jurisdiction's rules adequately govern such an enterprise.

The operative concept is nexus: the legally defined threshold of presence or economic connection that a business must have within a jurisdiction before that jurisdiction may exercise taxing authority over it. Nexus criteria differ between countries and have been progressively broadened in many jurisdictions to capture online sellers who generate significant revenue from local customers without maintaining any physical presence there. Businesses engaged in cross-border digital commerce must monitor their nexus status in all relevant jurisdictions and seek specialist advice wherever exposure is material.

Revenue Models in E-Commerce

A revenue model defines the mechanism by which a digital business converts its operations and assets into income. The selection of a revenue model is a foundational strategic decision that shapes pricing, customer acquisition, and cost structure. Six principal models are recognised in the e-commerce literature:

Web Catalogue Revenue Model

The catalogue model is the most familiar and widely deployed approach. A business presents a structured range of products or services through a commerce-enabled website and earns income from customer purchases. Its digital advantages over physical retail include global reach, continuous availability, and the ability to manage very large product ranges efficiently through database-driven catalogues. Success requires a well-organised, searchable product presentation and a frictionless purchasing process.

Digital Content Revenue Model

Here the platform charges users for access to information or media delivered digitally: legal databases, financial intelligence services,

academic publications, and premium news are representative examples. The economics are compelling because digital content can be reproduced and delivered to an unlimited number of subscribers at negligible marginal cost. Publication cycles are instantaneous, distribution costs are eliminated, and pricing can be adjusted rapidly in response to market conditions.

Advertising-Supported Revenue Model

Under this model the platform provides content or services to users without direct charge and recovers costs through advertiser payments. The audience's attention is effectively the product being sold; the content or service is the mechanism for attracting that attention. The model requires a large, engaged, and demographically attractive audience to sustain the advertising revenue stream. Search engines, social networks, and content aggregators are archetypical implementations.

Advertising-Subscription Mixed Revenue Model

The hybrid model combines subscription income with advertising revenue by offering a tiered service. Fee-paying subscribers typically receive an enhanced, lower-advertisement experience and access to exclusive content, while a free, advertising-supported tier functions as an accessible entry point that builds audience scale. Digital news publications and streaming media services commonly employ this structure, using the free tier to grow reach and the paid tier to generate predictable recurring income.

Fee-for-Transaction Revenue Model

In this model the platform earns a fee or commission proportional to the transactions it facilitates between other parties. The platform itself typically does not hold the underlying assets being traded; its value

lies in the matching, information, and trust infrastructure it provides. Online travel agents, securities brokers, marketplace platforms, and payment processors exemplify this approach.

Fee-for-Service Revenue Model

This model charges users directly for the value of a service delivered by the platform itself, not for a transaction between third parties. Professional advisory services provided online (legal, medical, financial), subscription entertainment platforms, and online gaming services are illustrative examples. Pricing may take the form of per-session charges, hourly rates, or recurring subscriptions depending on the nature of the offering.

Creating an Effective Web Presence

A web page is a structured digital document, typically authored in HTML or XHTML, that is served over the internet and rendered by a browser on any connected device. Pages may be static — pre-authored files delivered unchanged to every visitor — or dynamic, assembled by a server application at the time of each request in response to user input or database queries. A website is a collection of interlinked pages published under a common domain name.

Browsers and Accessibility

A web browser retrieves, interprets, and renders HTML, CSS, and JavaScript to produce the visual and interactive experience the user encounters. Differences in browser implementations require that pages be tested across multiple environments. Accessibility is a design requirement, not an optional refinement: users may have visual, auditory, or motor impairments that require assistive technologies; others may be using small-screen mobile devices or

low-bandwidth connections. The W3C's Web Accessibility Initiative publishes internationally recognised guidelines recommending that all web content be perceivable, operable, understandable, and robust across all user contexts.

Page Content Elements

The content of a web page divides into directly perceived elements and hidden functional elements. Perceived content includes text, static and animated images, audio and video media, and interactive components such as forms and buttons. Hidden elements include document metadata, CSS presentation rules, JavaScript behavioural logic, and links to external resources. Together these layers determine both the experience the user receives and the ability of search engines, assistive technologies, and automated agents to process the page's content correctly.

Page Rendering, URLs, and Saving

Browsers render pages within the visible display area, providing scroll mechanisms for content that exceeds the screen dimensions. Vertical scrolling is the accepted convention; horizontal scrolling impairs usability. Every web resource is ideally addressable through a stable, human-readable URL. Dynamic pages whose URLs contain complex query parameters can be made more discoverable through URL rewriting. Users may save local copies of pages in various formats: plain text, HTML source, complete resource archives, or self-contained MHTML files. Print-specific CSS stylesheets allow designers to control how page content is rendered when printed, suppressing navigation and other screen-only elements.

Web Design History and Strategy

Tim Berners-Lee published the first website in August 1991. Early HTML supported only basic text structure and hyperlinks. Progressive enrichment of the HTML specification, the introduction of CSS for visual styling, and the development of JavaScript for interactivity transformed the web from a document-retrieval system into a platform for sophisticated interactive applications. Today, responsive design frameworks, content delivery networks, and component-based front-end architectures have made web development a mature engineering discipline.

Effective web development begins with deliberate planning: defining the site's purpose, identifying its audience, specifying the content that will serve that audience's needs, and mapping the functional requirements. Sites built without this foundation tend to be technically functional but commercially ineffective. A persistent design tension exists between visual ambition and functional performance: pages loaded with large images and complex animations may fail to load quickly, obscure navigation, or underperform on conversion metrics. The most effective designs treat aesthetics as a vehicle for communication rather than an end in itself.

Content Management Systems

A Content Management System (CMS) provides non-technical contributors with a graphical editing environment — typically WYSIWYG — through which content can be created, revised, and published without writing code. Beyond text editing, modern CMS platforms manage media libraries, navigation structures, user permissions, publication workflows, and integration with analytics and marketing platforms. Selecting an appropriate CMS is a significant architectural decision with long-term implications for the organisation's capacity to manage its digital presence efficiently.

Practical Guidelines for Effective Web Presence

1. Provide genuine informational value rather than promotional content alone; visitors reward substantive sites with return visits and referrals.
2. Balance visual richness with load performance; each additional media asset adds to page weight and load time.
3. Provide descriptive text alternatives for all meaningful images, supporting users who browse without graphics.
4. Test systematically across browsers and devices; rendering discrepancies invisible in one environment may be glaring in another.
5. Make contact information accessible from every page, providing multiple channels to serve different user preferences.
6. Link generously to relevant external resources; doing so signals authority and earns user trust.
7. Communicate the site's value proposition clearly and immediately on the home page.
8. Maintain content currency through a regular publication and review schedule; outdated content erodes credibility.
9. Design navigation using the language of users rather than the internal structure of the organisation.
10. Actively promote the site through search optimisation, directory registration, and relevant partnership links.
11. Consistently deliver more than visitors expect; this builds loyalty that is difficult for competitors to erode.

Web Usability

Web usability is the quality of a website's design that determines how readily its intended users can accomplish their objectives during an interaction. A usable site demands no specialised knowledge from its

users; it applies familiar interaction conventions, communicates clearly, and makes the available choices and their consequences transparent. The four central dimensions of usability are: clarity of information presentation; ease of decision-making; elimination of ambiguity around significant actions; and placement of the most important elements in the most prominent positions.

For e-commerce specifically, usability has a direct and measurable relationship with commercial performance. Conversion rate — the proportion of visitors who complete a desired action — is highly sensitive to usability quality. Research following the early 2000s market contraction demonstrated conclusively that simplicity, speed, and clarity of the purchase pathway were stronger predictors of commercial success than visual sophistication. This finding permanently elevated usability from an optional refinement to a primary strategic priority in digital commerce.

Review Questions

1. What are the principal ethical and legal issues that arise in e-commerce?
2. How is internet taxation applied to online businesses, and what does the concept of nexus mean?
3. Describe and compare the main revenue models available to e-commerce businesses.
4. What steps should a business follow to build an effective web presence?

UNIT – 3

Web Marketing and Business-to-Business Strategies

Objectives

Upon completing this unit, students will be able to:

- Define internet marketing and describe its principal strategies
- Explain market segmentation and consumer behaviour models
- Describe advertising formats used on the web
- Explain e-mail marketing, permission marketing, and opt-in approaches
- Understand technology-enabled customer relationship management
- Explain brand management and viral marketing on the web
- Describe Electronic Data Interchange, its standards, and supply chain applications
- Identify the main types of electronic marketplaces and web portals

Marketing on the Web

Internet marketing — also described as digital marketing, web marketing, or online marketing — refers to the use of the Internet and associated digital channels to promote products and services and to manage commercial relationships. Its scope extends beyond the World Wide Web alone to encompass email campaigns, wireless and mobile communications, and the systems used to manage digital customer data and electronic customer relationships (ECRM).

What distinguishes internet marketing from its conventional counterpart is its capacity to combine creative communication with precise targeting, measurable performance tracking, and rapid iterative improvement. Campaigns that would take months to plan and execute through conventional media can be designed, launched, and optimised within days online. Internet marketing integrates the design of marketing content, its technical deployment across digital channels, and the analysis of resulting commercial outcomes into a unified discipline.

Advantages of Internet Marketing

The cost efficiency of internet marketing is among its most compelling attributes. Digital campaigns can reach audiences of millions at a fraction of the cost of equivalent television, radio, or print placements, and can be targeted far more precisely to the demographic and behavioural characteristics of prospective customers. Measurement is another key advantage: virtually every aspect of an online campaign — impressions served, links clicked, pages visited, and purchases completed — can be tracked in real time, enabling continuous optimisation. Payment models such as cost-per-click, cost-per-thousand-impressions, pay-per-play, and pay-per-action allow advertisers to structure their expenditure around the specific outcomes they value most. The immediacy of online response data means that campaigns can be adjusted or discontinued almost instantaneously if they are not performing, a flexibility unavailable to advertisers committed to traditional media.

Limitations of Internet Marketing

Internet marketing is not without constraints. The inability of online shoppers to physically examine products before purchase — to

handle, smell, or try on goods — remains a persistent inhibitor of conversion in many product categories. The industry has responded with liberal return and exchange policies, virtual try-on tools, detailed product descriptions, and customer review systems that partially substitute for the tactile evaluation possible in physical retail. Click fraud and ad viewability concerns also present challenges to the accuracy of digital performance measurement. Additionally, the growing use of ad-blocking software by internet users is progressively reducing the reach of display advertising formats.

Web Marketing Strategies

A marketing strategy for an online business specifies the high-level approach through which the organisation will attract, convert, and retain customers, and positions its offerings relative to those of competitors. Strategy formation must precede tactical execution; organisations that begin building websites or placing advertisements before they have defined their objectives, audiences, and positioning typically produce incoherent and ineffective results.

The classical marketing mix — the four Ps framework — retains its relevance as an organising structure in the digital environment:

- Product: The specific goods or services the business offers, including their features, quality, branding, and the needs they satisfy.
- Price: The amount customers are asked to pay, including pricing strategy (premium, competitive, penetration), discount structures, and dynamic pricing mechanisms.
- Promotion: The totality of communicative activities through which the organisation makes its offerings known and motivates purchase: advertising, content marketing, SEO, social media, and email campaigns.

- Place: The channels through which products reach customers, including the website itself, digital marketplaces, apps, and the logistics infrastructure that fulfils orders.

Product-Based Marketing Strategy

When a business launches a product into a market, its marketing strategy must address four fundamental questions: Who constitutes the target audience for this product? What specific benefits are members of that audience seeking? How should the product be positioned relative to competitive offerings in the market? And what differentiating characteristics will give the product a meaningful advantage over its rivals? The answers to these questions determine not only the content of marketing communications but the pricing, channel, and product development decisions that surround them. Marketing's fundamental purpose is not to describe products but to demonstrate the benefits they deliver to specific categories of customer.

Customer-Based Marketing Strategy

An alternative strategic orientation builds the business around the needs and relationships of existing customers rather than around specific products. This orientation is grounded in two empirical observations: that retaining an existing customer is typically far less costly than acquiring a new one, and that different customer segments differ substantially in their profitability and strategic value. Customer-based strategies employ loyalty programmes, personalised offerings, and dedicated account management to deepen existing relationships, and use segmentation analysis to identify the customer groups most worthy of investment. Rather than treating all customers equivalently, customer-based strategies differentiate the service experience in proportion to the commercial value of the relationship.

Communicating with Market Segments

For online businesses, which often lack any physical presence and may never meet their customers face to face, the image projected through digital media and the website itself is frequently the sole basis on which potential customers form their impressions. Selecting the appropriate media vehicles, message formats, and communication tones for each target segment is therefore a particularly consequential decision. The absence of a physical store, branch network, or salesforce means that digital communication must accomplish unaided much of the persuasive work that conventional businesses distribute across multiple customer touchpoints.

Marketing Segmentation

Market segmentation is the analytical process of dividing a broad population of potential customers into distinct sub-groups whose members share similar characteristics, needs, or behaviours, and who can therefore be addressed effectively through a common marketing approach. The rationale for segmentation is that heterogeneous markets cannot be served optimally by a single undifferentiated strategy: a message, product configuration, or price point that resonates with one group may be irrelevant or alienating to another.

A valid market segment possesses four properties: its members are measurably distinct from those of other segments; they are reasonably homogeneous in their needs and responses within the segment; they respond consistently to targeted marketing stimuli; and they can be reached cost-effectively through available marketing channels. Segmentation can be conducted on several bases:

- Geographic segmentation divides the market by location — country, region, city, climate zone — on the premise that geographical context systematically shapes needs and preferences.

- Demographic segmentation classifies customers by measurable personal attributes including age, gender, income, educational attainment, occupation, and household composition.
- Psychographic segmentation groups customers by lifestyle characteristics, personal values, interests, and personality traits that are associated with different product affinities.
- Behavioural segmentation categorises customers by their observed patterns of product usage, brand loyalty, purchase occasion, and responsiveness to promotional offers.

Organisations pursuing segmentation must weigh multiple inputs simultaneously: the differing needs across identified segments; their own internal strengths and resource constraints; competitive dynamics; regulatory and social factors; and their strategic objectives. The objective is to identify a set of segments whose needs the organisation can serve better than its competitors, and to concentrate its resources accordingly. Micromarketing — the practice of targeting very small, precisely defined segments — has become feasible at scale through the analytical capabilities of digital platforms, enabling one-to-one personalisation that was previously achievable only in high-value business-to-business relationships.

Consumer Behaviour

Consumer behaviour is the field of study concerned with the processes through which individuals and groups select, acquire, use, and dispose of products and services. It draws on psychology, sociology, economics, and anthropology to develop explanatory models of the purchase decision. These models address the influences that act on buyers — from broad cultural forces to immediate situational factors — and the cognitive and emotional processes through which they evaluate alternatives and commit to choices.

Behavioural segmentation in e-commerce distinguishes between usage occasions and usage patterns. A single customer may visit a website in very different modes at different times — browsing without a specific purchase intent, comparing alternatives, or arriving with a definite and immediate purchase objective. Customising the site experience to match these different modes — usage-based market segmentation — can substantially improve both the user experience and the probability of conversion.

The Black Box Model

The black box model of consumer behaviour represents a buyer as a system that transforms marketing and environmental inputs into observable purchase responses, with the internal psychological processes that mediate this transformation treated as largely opaque. Marketing stimuli — product features, price, promotional messages, and distribution convenience — combine with broader environmental factors — economic conditions, social norms, cultural context — to activate a decision process within the buyer that ultimately produces a behavioural outcome. The model is useful for identifying the inputs that marketers can influence and for predicting the aggregate direction of behavioural responses, even without complete knowledge of the internal mechanisms involved.

Information Search and Evaluation

When a consumer recognises a need, they typically engage in an information search that populates an evoked set — the group of alternatives they will seriously consider. Alternatives are then evaluated against criteria that reflect the mix of functional benefits (performance, reliability, price) and psychological benefits (status, identity, enjoyment) the consumer seeks. Marketing's role at this stage is to ensure that its brands are included in the evoked set and that the

criteria on which they are competitively strong are salient in the consumer's evaluation. Clear and credible communication of a brand's relevant attributes, supported by reviews and comparisons, addresses this need.

Purchase Decision and Influences

A purchase intention does not automatically produce a purchase: situational factors, last-minute hesitations, and the friction of the checkout process can all intervene. Marketers can reduce friction by providing credit facilities, streamlining the checkout process, and using limited-time offers or other urgency mechanisms to encourage immediate conversion. Once the buyer has integrated the available information and committed to a choice, the persuasive challenge shifts to confirmation and reassurance: reinforcing the quality of the decision and managing post-purchase experience to maximise satisfaction and repeat purchase probability.

Consumer behaviour is shaped by both internal psychological factors — motivation, perception, attitudes, personality, and knowledge — and external social factors — family, peer groups, social class, cultural norms, and the influence of aspirational reference groups. Effective marketing strategies account for both dimensions.

Online Buyer Typologies

Research into online consumer behaviour has identified several recurring profiles:

- Buyers arrive with a firm and immediate purchase intention. The priority for site design is eliminating any obstacle between the customer and the completion of the transaction. A well-implemented shopping cart and a minimal-step checkout are the critical requirements.

- Shoppers are purchase-motivated but require more information before committing. They benefit from detailed product descriptions, user reviews, comparison tools, and clear returns policies.
- Simplifiers value speed and convenience above all. They are attracted to sites that make routine transactions faster and easier than physical alternatives.
- Surfers explore the web for information, entertainment, and discovery. They engage with rich content and spend more time online than other types, but require more sustained persuasive effort to convert to purchase.
- Bargainers are motivated primarily by price. They represent a modest proportion of online users but a disproportionate share of traffic on price-comparison and auction platforms.
- Connectors use the internet primarily for social interaction. Email, messaging services, and social platforms are their primary destinations.
- Routiners return to a consistent set of trusted sites for news, financial information, and regular purchases. Brand consistency and reliability are their primary requirements.
- Sportsters are similar to routiners but orient their habitual usage toward sports and entertainment content.

Customer Relationship Intensity

Commercial relationships with customers progress through a series of stages of deepening engagement:

Awareness: The customer recognises the brand or product name but has not yet formed a transactional relationship with the organisation.

Exploration: The customer has completed initial transactions and is building familiarity with the organisation's offerings, policies, and service standards.

Commitment: Through repeated positive experiences, the customer has developed a strong preference for the brand and is willing to actively recommend it to others.

Separation: Changes in the customer's circumstances, needs, or the organisation's service quality may cause the relationship to deteriorate and the customer to seek alternatives.

Advertising on the Web

Web advertising encompasses a range of formats designed to deliver commercial messages to digital audiences. Unlike traditional advertising — which places messages in shared media environments and measures success by reach and frequency — digital advertising can be targeted precisely to individual user characteristics and behaviours, and its effectiveness can be measured by direct response rather than inferred from exposure data alone.

Banner Advertisements: These are graphical units of defined dimensions embedded within web page layouts. They may display static images, animated sequences, or rich interactive content, and incorporate a hyperlink that takes the user to the advertiser's website. Banners can serve both awareness and direct-response objectives.

Text Advertisements: Short promotional messages without graphic elements, typically placed adjacent to relevant search results or editorial content. Their unobtrusiveness makes them less likely to be blocked or ignored than graphical formats, and their close alignment

with user intent — as demonstrated by the search query that triggered their display — makes them highly effective at driving direct response. Google's AdWords platform popularised this format.

Pop-up Advertisements: Advertisements that load in a separate browser window overlying the page the user is viewing. The format is intrusive by design and has attracted significant user hostility, contributing to the widespread adoption of pop-up blocking software.

Pop-behind Advertisements: A variant of the pop-up that opens behind the current browser window, revealing itself only when the user closes their active session. This technique reduces immediate disruption but is equally unwelcome.

Interstitial Advertisements: Full-page advertisements that load between two content pages, intercepting the user's navigational journey to deliver a high-impact message. They are effective at generating awareness but create a poor user experience when overused.

Rich Media and Active Advertisements: Graphical units that animate or interact within the web page itself rather than opening a separate window. They may incorporate video, audio, and interactive elements, and can generate high engagement levels relative to static formats.

E-Mail Marketing

E-mail marketing is the use of electronic mail as a channel for delivering commercial messages to audiences of current or prospective customers. It is one of the oldest and most persistently effective tools in the digital marketing portfolio, consistently

achieving high returns on investment relative to other digital channels when executed well. Its principal advantages include measurable delivery and response rates, the ability to personalise messages at scale, relatively low cost per contact, and the capacity to automate sequences of messages triggered by specific customer behaviours.

The strategic foundation of effective e-mail marketing is permission: the explicit consent of the recipient to receive marketing communications. The practice of sending marketing emails only to individuals who have requested them is known as permission marketing or opt-in marketing, and is both legally required in many jurisdictions and empirically more effective than unsolicited campaigns, since consenting recipients are more engaged and conversion rates are correspondingly higher. Opt-in email programmes may evolve to employ handshake authentication protocols that further verify the sender-recipient relationship, deepening trust and filtering out fraudulent traffic.

A classic application of permission marketing is the email newsletter: a regular publication sent to subscribers who have actively requested it, providing news, analysis, product information, and curated external content relevant to their interests. Newsletters build the ongoing engagement and brand familiarity that convert occasional visitors into committed customers. More advanced programmes use drip marketing automation, delivering pre-designed message sequences to subscribers at defined intervals or in response to specific behaviours such as a purchase, a product page visit, or an abandoned cart.

Advantages of E-Mail Marketing

- E-mail investment can be tracked through the entire customer journey from delivery to revenue, providing clear attribution data for budget allocation decisions.

- Campaigns reach large audiences of pre-consented subscribers who have self-selected based on genuine interest.
- More than half of internet users engage with their email on a typical day, ensuring high reach within the opted-in audience.
- Compared to display advertising, email delivers a low cost per contact to a receptive audience.

Disadvantages of E-Mail Marketing

Deliverability remains the most significant operational challenge: a meaningful proportion of legitimate marketing emails are classified as spam by filtering algorithms, diverted to junk folders, or rejected outright by receiving servers. Even well-managed programmes typically achieve delivery rates below 100 per cent, and inbox placement rates below that. Maintaining list hygiene — promptly removing invalid addresses, honouring unsubscribe requests, and monitoring sender reputation metrics — is essential to sustaining deliverability over time.

Combining Content with Advertising

One of the most effective techniques for improving email acceptance rates is to deliver genuine informational value alongside commercial messaging. Subscribers who find the editorial content of an email — articles, research summaries, tips, or curated news — genuinely useful are far more likely to engage with the promotional elements than those who receive communications that are purely transactional or sales-oriented. This content-plus-advertising approach mirrors the editorial model of magazine publishing, where editorial quality is the vehicle that delivers audiences to advertisers.

Technology-Enabled Customer Relationship Management

Technology-enabled customer relationship management (CRM) describes the practice of using detailed, data-rich profiles of

individual customers to tailor every dimension of the commercial relationship — pricing, product recommendations, promotional offers, communication frequency, and service provision — to the specific characteristics and preferences of each individual. The foundational insight is that customers differ in their value to the business and in what they need from it, and that serving them as though they were identical wastes resources on unprofitable relationships and under-invests in profitable ones.

Technology-enabled CRM differs from conventional seller-customer interaction across seven dimensions: reach (global rather than local), richness (deep, personalised data exchange rather than generic communication), affiliation (customer-centric rather than company-centric), customisation (tailored to individual preferences rather than mass-market averages), interactivity (real-time, two-way engagement rather than one-way broadcast), pricing (dynamic and personalised rather than fixed), and loyalty mechanics (data-driven reward programmes rather than purely habitual or convenience-based retention).

Creating and Maintaining Brands on the Web

A brand is more than a name or a visual mark; it is the totality of associations, expectations, and emotional responses that an organisation's offerings evoke in the minds of its customers. Strong brands reduce customer acquisition costs by generating preference among undecided buyers, support premium pricing by justifying value perceptions above commodity levels, and create loyalty that insulates relationships against competitive incursion.

Three interdependent elements drive brand equity:

Differentiation: The brand must communicate clearly how its offerings are distinct from those of every other competitor in the

market. Differentiation that is meaningful — grounded in genuine product or service advantages rather than mere messaging — commands sustainable competitive advantage.

Relevance: Differentiation must be relevant to the specific needs and motivations of the target customer. A distinction that customers do not value creates no commercial advantage, regardless of how genuine or large it may be.

Perceived Value: The customer's perception of what they receive relative to what they pay must be at least equal to, and ideally greater than, the equivalent ratio offered by alternatives. Perceived value is ultimately a subjective assessment, shaped by brand communication, product experience, and social proof.

Brand Leveraging

Brand leveraging is the strategic extension of an established brand's equity into adjacent product categories or service domains. A company that has built a trusted, well-recognised brand in one domain can transfer a meaningful proportion of that trust to new offerings bearing the same brand identity. This reduces the marketing investment needed to establish the new offering and gives it an initial credibility advantage over unknown competitors entering the same space. Successful examples of brand leveraging in e-commerce include the extension of search and directory brands into financial services, email, and cloud computing.

Viral Marketing

Viral marketing is a strategy that relies on existing customers to spread awareness of a product or service to others in their social networks, replicating the exponential growth dynamic of a biological

virus. Content, campaigns, or experiences designed to be inherently shareable — because they are funny, useful, emotionally resonant, or simply surprising — can achieve massive reach at low cost if they genuinely motivate recipients to pass them along. The channel of transmission may be word of mouth, email forwarding, social media sharing, or any other form of peer-to-peer recommendation. Viral marketing's principal challenge is that the conditions necessary for genuine virality cannot be engineered with certainty; they require content quality and cultural timing that resists formula.

Search Engine Positioning

A search engine is a web service that enables users to locate relevant web pages by entering descriptive queries. Most search engines operate through three principal technical components: a spider or robot — an automated programme that systematically follows hyperlinks across the web to discover new and updated pages; a crawler — the component responsible for retrieving and indexing the content of discovered pages; and an index database — the repository against which user queries are matched to retrieve relevant results.

Marketers seek to ensure that their websites appear prominently in search results for queries relevant to their products and services, because users rarely look beyond the first page of results. The process of optimising a website to achieve high rankings for target queries is called search engine optimisation (SEO) or search engine positioning. It involves technical improvements to the site's structure and speed, the creation of authoritative and relevant content, and the acquisition of inbound links from other credible sites. The algorithms that search engines use to rank results are complex, continuously evolving, and proprietary, making SEO as much an art of interpretation as a technical discipline.

Electronic Data Interchange (EDI)

Electronic Data Interchange (EDI) is the structured, computer-to-computer exchange of business documents in a standardised electronic format between trading partners. It replaces paper-based documents — purchase orders, invoices, shipping notices, payment instructions — with machine-readable electronic equivalents that can be processed automatically without human intervention at either end of the transaction. EDI is therefore fundamentally different from informal electronic communication such as email: it is a formal, structured protocol for automating business-to-business document flows.

The National Institute of Standards and Technology (NIST) defined EDI as the computer-to-computer exchange of strictly formatted messages representing business documents, transmitted via telecommunications links or physical electronic media, with the expectation that processing will be performed by computer rather than by human review. Where human intervention is required — to handle exceptions, quality issues, or non-standard cases — it represents a departure from the normal EDI workflow rather than its standard mode of operation.

EDI Standards

For two organisations' systems to exchange EDI messages meaningfully, they must use a common document format. Several major EDI standards define these formats:

- UN/EDIFACT: The United Nations-sponsored standard that is the only internationally recognised EDI format and is predominant in inter-company trade outside North America.
- ANSI ASC X12: The standard developed by the American National Standards Institute, which is the dominant framework

in North American business transactions. Purchase orders are denoted as document type 850; invoices as 810.

- TRADACOMS: A standard developed by the Article Numbering Association (ANA), widely used in the UK retail sector.
- ODETTE: The standard used within the European automotive manufacturing industry for supply chain documentation.

All of these standards emerged in the early to mid-1980s. Each prescribes the character sets, data field formats, and structural rules for defined business documents, in the same way that building codes define structural requirements without prescribing aesthetic choices. Two firms can both comply with the same EDI standard while including different sets of optional data fields in their transactions: a food manufacturer might include expiry date data fields that a clothing retailer would replace with colour and size information.

As internet connectivity has become faster and more widely available than the private value-added networks (VANs) over which EDI was originally transmitted, many organisations have migrated their EDI traffic to internet-based channels, reducing both cost and latency.

Financial and Information Services Online

The internet has enabled broad categories of financial and information services to be delivered more efficiently, conveniently, and richly than through conventional channels.

Online Banking: Consumers and businesses can manage their financial affairs — checking account balances, paying bills, transferring funds, and trading investment products — through internet banking platforms at any time and from any location. The

reduction in the operational cost of transaction processing achieved through digital self-service allows banks to offer more competitive pricing while simultaneously improving customer convenience.

Online Billing: Businesses that issue large volumes of invoices and statements can reduce their distribution costs substantially by delivering them electronically rather than by post. Electronic billing also accelerates the payment cycle, since bills are received and accessible immediately rather than after postal transit.

Secure Information Distribution: For organisations whose primary commercial asset is proprietary knowledge or data, the internet provides a powerful distribution channel, but one that requires careful protection. Digital Rights Management (DRM) technologies provide mechanisms for controlling how digitally distributed intellectual property is used, copied, and shared after it has been received by the customer.

Supply Chain Management

Supply chain management (SCM) is the discipline of coordinating the complete network of organisations, processes, and activities through which raw materials are converted into finished products and delivered to end customers. It encompasses supplier relationships, inbound logistics, production scheduling, inventory management, outbound distribution, and after-sales service. The strategic goal of SCM is to maximise the value delivered to customers while minimising the total cost of operating the supply chain.

Contemporary supply chains are expected to combine speed, flexibility, and cost efficiency in equal measure. They must be capable of responding rapidly to changes in both supply-side availability and

demand-side requirements, maintaining visibility across every stage of the chain from raw material sourcing to final delivery. The most sophisticated supply chains employ real-time data sharing and analytical tools that allow all participants to anticipate and respond to disruptions before they cascade into customer-facing failures. The relational architecture of modern supply chains is typically tiered. A manufacturing or retail organisation develops long-term, trust-based relationships with a small group of high-capability primary suppliers (Tier 1). These in turn maintain relationships with a broader group of component and material suppliers (Tier 2), who source from yet another level of raw material providers (Tier 3). The stability and mutual investment of these relationships — referred to as supply alliances — enable the sustained quality improvement, cost reduction, and innovation sharing that individual transactional relationships cannot achieve.

Electronic Marketplaces and Portals

Electronic Marketplace: An electronic marketplace is a digital environment in which buyers and sellers exchange goods, services, and information using internet-based platforms. It replicates the matching and price-discovery functions of a physical market but extends them to participants anywhere in the world, operating continuously, with far lower transaction costs.

E-market: An online market, typically oriented toward B2B transactions, in which multiple buyers and sellers conduct commerce through a shared digital platform.

Types of E-Marketplaces

- Private sell-side marketplaces: Operated by a single selling organisation to manage transactions with its approved customer base. The seller controls the catalogue, pricing, and access.

- Private buy-side marketplaces: Operated by a single buying organisation to manage its procurement from an approved supplier panel. The buyer defines the specifications and the suppliers compete for business.
- Public e-marketplaces (exchanges): Operated by independent third-party intermediaries and open to many buyers and many sellers simultaneously. They perform price discovery through auctions or posted prices and may specialise in particular product categories or industries.

E-Marketplace Components

- Customers: The buyers whose demand the marketplace serves.
- Sellers: The suppliers who list and fulfil orders through the platform.
- Products and services: Physical goods, digital products deliverable over the internet, and services accessible through the platform.
- Front-end infrastructure: The seller-facing portal, electronic catalogue, shopping cart, search tools, and payment gateway through which customers interact with the marketplace.
- Back-end infrastructure: The systems supporting order processing, inventory management, supplier purchasing, payment settlement, packaging, and delivery.
- Intermediaries: Third-party agents and service providers operating between buyers and sellers within the marketplace ecosystem.
- Support services: Authentication, dispute resolution, logistics, financing, and analytics services that underpin marketplace operations.

Web Portal Types

A web portal aggregates and presents information from multiple sources through a unified, personalised interface. Portals have evolved to serve many specific contexts:

- Commercial (public) portals serve general consumer audiences, aggregating news, search, email, finance, and entertainment.
- Corporate portals provide employees with a single integrated access point to internal systems, knowledge bases, and collaboration tools.
- Publishing portals aggregate and present content from a specific domain — medical literature, legal databases, academic research — to professional audiences.
- Personal portals are customised by individual users to deliver a personalised information environment aligned with their specific interests and workflows.
- Mobile portals are optimised for access through smartphones and tablets, adapting content presentation and navigation for small screens and touch interfaces.
- Voice portals provide content and services through spoken interaction rather than visual interfaces, enabling access through telephone or voice-activated devices.
- Knowledge portals are purpose-built to support knowledge management within organisations, consolidating internal expertise, documentation, and collaboration history.

Review Questions

1. What is web marketing, and what strategic frameworks guide its application?
2. Explain e-mail marketing in detail, including the concept of permission marketing.

3. How are brands created and maintained on the web?
4. What is EDI and what are the principal EDI standards in use today?
5. What is supply chain management and how is it supported by electronic commerce?
6. What are electronic marketplaces and portals, and what types exist?

UNIT – 4

Online Auctions, Virtual Communities and Web Server Technologies

Objectives

Upon completing this unit, students will be able to:

- Explain online auctions, their types, and how they differ from traditional auctions
- Define virtual communities and describe their types and social impacts
- Explain the architecture and operation of web servers
- Describe electronic mail, its benefits, spam, and security concerns

Online Auctions

An auction is a structured competitive mechanism in which the price of a traded item is determined dynamically through successive bids rather than being set in advance by the seller. In a forward auction, a seller invites bids from multiple potential buyers, and the item is awarded to the party offering the highest price. In a reverse auction, a buyer specifies a requirement and invites competing sellers to bid for the contract, with the business going to the party offering the most favourable terms — typically the lowest price. Digital platforms have adapted both of these structures to the online environment, dramatically extending their reach and accelerating their execution.

Traditional Versus Electronic Auctions

Traditional offline auctions operate under significant practical constraints: participants must typically be physically present at a defined location and time, the pace of bidding leaves little time for careful deliberation, and the pool of potential bidders is limited to those who can attend. Electronic auctions overcome each of these constraints. Bidders can participate from anywhere in the world at any time during the auction period, can research items thoroughly before bidding, and are drawn from a global rather than a local population. Sellers correspondingly gain access to a far larger competitive pool of buyers, typically resulting in higher final prices. Dynamic pricing — prices that adjust continuously in response to the competitive behaviour of participants — is the defining mechanism of both traditional and electronic auctions.

Types of Electronic Auction

One seller, many buyers – Forward auction: The standard auction model in which a seller offers an item and competing buyers place escalating bids. The item is awarded to the highest bidder at the close of the auction. eBay's consumer marketplace operates predominantly on this model.

One buyer, many sellers – Reverse auction: A procurement mechanism in which a purchasing organisation specifies what it needs and invites suppliers to submit competing bids. Suppliers reduce their prices iteratively, and the contract is typically awarded to the lowest qualifying bid. This model is widely used in B2B and government procurement.

Name-your-own-price model: A buyer-driven variant in which the prospective customer specifies the price they are willing to pay and

the terms they require, and the platform matches them with willing sellers. Priceline.com pioneered this approach in the travel sector. It is classified as a C2B (consumer-to-business) model.

Double auction: A market structure in which multiple buyers and multiple sellers participate simultaneously, with the platform matching buyers' bids to sellers' asking prices according to price-quantity equilibria. This model is characteristic of stock exchanges and commodity trading platforms.

Auction Software

The operational complexity of managing multiple concurrent auctions — listing items, managing images, handling bidder enquiries, tracking feedback, and processing payments — has generated a market for specialist auction management software aimed at high-volume sellers. These tools automate repetitive tasks such as bulk listing creation, template-based page design, and post-auction email communications, allowing sellers to scale their operations without proportional increases in administrative effort.

On the buy side, auction sniping software monitors selected auctions and places a bid in the final seconds before closing, at a price just sufficient to win. This strategy exploits the structure of timed auctions by preventing competing bidders from responding with counter-bids. While technically within the rules of most auction platforms, sniping is viewed with mixed attitudes by participants: sellers and competing bidders generally prefer environments in which final prices are driven higher by extended competitive bidding.

Virtual Communities

A virtual community is a group of individuals who interact with one another through digital communication media — forming social bonds, sharing information, and pursuing common goals — without necessarily occupying the same physical space or even the same geographic region. The defining characteristic of a virtual community is the social relationship among its members, not the technology through which those relationships are mediated. Technologies including forums, email lists, chat platforms, multi-user games, social networks, and virtual world environments have all served as substrates for virtual community formation.

Three enabling conditions support the development of effective virtual communities: reliable mobile and networked communication technology that allows members to connect at will; software platforms that facilitate the specific forms of interaction the community requires; and, in commercially oriented communities, appropriate marketplace infrastructure through which members can transact.

For organisations, virtual communities offer substantial commercial and operational benefits. They create environments in which customers, suppliers, and internal teams can coordinate, share knowledge, and transact in ways that reduce friction and build mutual commitment. For consumers, community membership provides information, social connection, and a sense of belonging that creates switching costs and loyalty that advertising alone cannot generate.

Internet-Based Virtual Communities

The rapid expansion of internet access from the mid-1990s onward enabled virtual communities to grow from specialist enthusiast enclaves into mass social phenomena. The emergence of Web 2.0

platforms — characterised by user-generated content, persistent profiles, and social graph features — transformed community participation from a technical endeavour into an everyday social activity accessible to the general population. Today, hundreds of millions of people participate simultaneously in multiple overlapping virtual communities organised around shared interests, professional affiliations, geographic identities, and social relationships.

The social dynamics of online communities exhibit a pattern of reciprocity that mirrors those of offline communities: members contribute to the common resource of shared knowledge and social support with the implicit expectation of receiving equivalent contributions in return. This norm of reciprocal exchange is the social contract that sustains community cohesion over time, even in the absence of physical co-presence.

Health-Related Virtual Communities

A significant and growing subset of virtual communities forms around shared health experiences. Individuals managing chronic or serious illnesses, caregivers supporting affected family members, and patients navigating complex treatment decisions have found online communities to be valuable sources of experiential knowledge, emotional support, and practical advice that their clinical providers cannot fully supply. Patients dealing with cancer, HIV, rare diseases, and other life-limiting conditions may face physical constraints that make conventional social participation difficult or impossible, and online communities give them access to peer relationships they would otherwise be unable to sustain.

Research examining the impact of health-focused virtual communities has found broadly positive effects on patient engagement, adherence

to treatment, emotional wellbeing, and willingness to participate in care. A study by Battles and Wiener examining the effects of online communities on children with serious illnesses found improvements in mood and behaviour, and increased willingness to attend treatment appointments. Healthcare providers are increasingly establishing managed online communities for their patient populations, recognising that peer interaction and shared experience complement rather than compete with clinical care.

Types of Virtual Communities

Internet Message Boards

An internet message board (also called a forum or discussion board) is a platform on which members post text messages organised by topic into threads, which others can read and respond to at any subsequent time. The asynchronous nature of forum communication — in which participants do not need to be simultaneously present — makes it suitable for substantive, considered exchanges that real-time chat does not support. Forums can accommodate large numbers of concurrent users and persistent archives of discussion history, making them valuable repositories of community knowledge.

A distinctive characteristic of online forum participation is the reduced social inhibition that digital anonymity or pseudonymity can produce. Users who would hesitate to speak in person to a stranger may readily post detailed questions, opinions, or personal disclosures on a public forum. This reduced inhibition can be socially beneficial — enabling people to seek help or share experiences they would find embarrassing to disclose in person — but also carries risks of disinhibited antisocial behaviour.

Online Chat Rooms

Chat rooms provide synchronous, text-based communication among users who are simultaneously online. Unlike message boards, whose conversations unfold over days or weeks, chat room exchanges happen in real time, more closely approximating the rhythm of spoken conversation. CompuServe's CB Simulator, launched in 1980, was among the earliest platforms to offer this capability, providing forty parallel channels in which users could converse simultaneously. The development of channel or room structures allowed community self-organisation around specific interests, so that users could find conversations relevant to their concerns without filtering through unrelated discussions.

Chat room user interfaces typically provide three components: a text input field through which the user composes and sends messages; a scrolling message window that displays the conversation history with time stamps; and a participant list showing which users are currently present. This simple structure is sufficient to support a sense of shared social space that facilitates community formation. Internet Relay Chat (IRC) established the technical standards for multi-channel chat communication and remains in use in developer and enthusiast communities.

Virtual Worlds

Virtual worlds are the most spatially and socially immersive form of virtual community. Participants are represented by graphical avatars — customisable digital characters — that inhabit and navigate a persistent three-dimensional environment rendered on screen. Users interact with each other not only through text but through the actions and movements of their avatars within the shared space, approximating the richness of physical co-presence more closely than any other digital medium. Social activities in virtual worlds include

conversation, collaborative building, commercial transactions, entertainment, and the formation of long-term social relationships.

Unlike conventional online games, virtual worlds typically have no defined objectives or winning conditions; the environment is an open-ended social platform rather than a competitive challenge. Second Life is the most widely known example, providing a platform in which users design their own content, own virtual property, conduct commerce using a platform currency, and form social groups and organisations. The creative and economic ecosystems that emerge from large virtual worlds exhibit genuine social complexity.

Social Network Services

Social network services are the dominant form of virtual community in the contemporary internet. They provide persistent personal profiles, bidirectional social connections (friends, followers), activity feeds, and tools for creating and sharing a wide range of content. Facebook, Instagram, LinkedIn, and X (formerly Twitter) are representative platforms, each with distinct orientations toward personal social connection, professional networking, visual content, or public discourse respectively. Social networks enable passive social monitoring — maintaining ambient awareness of friends' and contacts' activities without requiring active engagement — as well as active communication and collaborative content creation.

Advantages and Disadvantages of Internet Communities

Advantages

Online communities offer a range of benefits that their physical counterparts cannot fully replicate. Information exchange is immediate and operates without geographic or temporal constraints, allowing participants anywhere in the world to contribute and access

knowledge at any time. Specialist communities on topics that could not support a geographically concentrated physical community — rare hobbies, uncommon medical conditions, niche professional interests — can achieve critical mass online through aggregation across a global population. The communal experience of shared interest and mutual support generates feelings of belonging that have genuine psychological value. Commercially, virtual communities can generate revenue through subscription fees, usage charges, and advertising, and create a form of customer engagement and loyalty that is difficult to replicate through conventional marketing. Disintermediation in community-supported commerce — the removal of intermediary layers between buyers and sellers — allows more favourable pricing and more direct relationships between producers and consumers.

Disadvantages

The same characteristics that make online communities valuable — open participation, low barriers to contribution, and the speed of information propagation — also create risks. In the absence of editorial curation, misinformation and inaccurate content circulate freely alongside reliable information, and users must apply their own critical judgement to distinguish them. The pseudonymity available in many online contexts enables individuals to present false identities, potentially deceiving other community members. Personal information disclosed in online communities is archived persistently and may be discovered by unintended audiences, creating privacy risks that participants may not fully appreciate at the time of disclosure.

Critical Issues for Virtual Communities

The effective management of virtual communities involves three categories of interrelated challenges. At the individual level, members

must be sufficiently comfortable with the communication technologies involved to use them effectively, and must develop the social skills — including conflict management and trust calibration — specific to digitally mediated interaction. Researchers have examined the roles of trust, communication anxiety, and identity management in shaping member engagement and community cohesion.

At the organisational level, managing virtual teams and communities within enterprise contexts raises human resource challenges including performance assessment, conflict resolution, and the design of participation incentives. The primary managerial challenge is creating conditions that motivate employees and other members to contribute actively; a virtual community that fails to engage its intended membership cannot achieve its purpose, however sophisticated its technology.

At the technological level, the capabilities of communication platforms continue to evolve rapidly, and community operators must continuously evaluate emerging tools to determine whether they offer capabilities that would enhance the community experience. Voice interfaces, augmented reality, wearable computing, and artificial intelligence-assisted moderation are among the technologies that may reshape virtual community interaction in the coming decade. Communities that successfully adapt to technological change will sustain and grow their membership; those that do not risk obsolescence.

Web Logs (Blogs)

A blog (web log) is a website in which an individual author or a small editorial team publishes periodic commentary, analysis, or narrative

on a specific subject. Blog posts are typically displayed in reverse chronological order, giving the most recent contribution the highest visibility. Most blogs enable reader comments, creating a discussion thread beneath each post that constitutes a form of community dialogue. Because blogs centre on a specific topic and their audiences self-select based on shared interest, they exhibit many of the characteristics of more formally structured virtual communities.

Web Portals and Advertising-Supported Models

A web portal is a website that aggregates and presents content, tools, and services from multiple sources through a unified, personalised interface. Portals typically combine a search function with a curated selection of news, financial data, email access, and specialist content, providing users with a single starting point for a broad range of information needs. The commercial significance of portals lies in their ability to attract and retain high volumes of repeat visitors — a characteristic described as stickiness — which in turn generates the advertising revenue or subscription income that sustains the service.

Two broad categories of portal architecture are recognised. Horizontal portals address a wide range of topics and user interests, aiming for the broadest possible audience. Vertical portals (vortals) focus tightly on a specific industry, profession, or topic area, serving a smaller but more engaged audience with more precisely tailored content. A news portal operated by a broadcast or print media organisation is a specialised variant, providing the organisation with a digital distribution channel that reaches audiences with a speed and immediacy that print or scheduled broadcast cannot match.

Web Server Basics

A server is any computer whose primary function is to provide files, applications, or services to other computers connected to it through a network. The software that manages this provision is called server software, and in many cases it is bundled with the operating system. When a server computer is connected to the internet and is running web server software, it is specifically designated a web server: its function is to respond to requests from web browsers by serving the appropriate web pages and associated resources.

Client-Server Architecture

The World Wide Web operates on the client-server architectural model. The client is the software — typically a web browser — running on the user's device, which formulates and sends requests for web resources. The server is the remote system that receives these requests, processes them, and returns the appropriate responses. Communication between client and server follows formally defined protocols that specify exactly how requests are structured, how servers acknowledge and process them, and how responses are formatted and transmitted.

Because the web is a connectionless system — each request-response exchange is an independent transaction, with no persistent channel maintained between them — every interaction between browser and server is initiated fresh, without inheriting state from previous exchanges. This stateless characteristic greatly simplifies server design but requires applications to implement their own mechanisms for maintaining continuity across multiple interactions.

The principal protocols governing web communication are:

- HTTP (Hypertext Transfer Protocol): The protocol used for requesting and delivering web pages and their embedded resources — images, scripts, and stylesheets — across the World Wide Web.
- FTP (File Transfer Protocol): A protocol for transferring files between computers on a network, widely used for uploading web content to servers.
- SMTP (Simple Mail Transfer Protocol): The protocol that governs the transmission of email messages between mail servers.
- Telnet: A protocol that enables a user to establish an interactive command-line session on a remote computer, used primarily for server administration.

Model 1: Static HTML Pages

In the simplest web architecture, the server stores pre-authored HTML files and delivers them unchanged to every browser that requests them. The server's role is purely that of a file store and delivery mechanism; no processing of the content takes place at the time of delivery. Static pages are fast to deliver and simple to manage for small sites, but become impractical for sites with large numbers of pages or content that changes frequently, since each update requires the manual editing and re-uploading of individual files.

Model 2: CGI Scripts

Common Gateway Interface (CGI) scripts extend the server's capability beyond static file delivery by allowing browser requests to trigger the execution of a programme on the server. When a user submits a search query or a form, the server passes the submitted data to the appropriate CGI programme, which processes it and generates a customised HTML response that is returned to the browser. This

enables dynamic content — search results, database-driven product listings, personalised pages — to be generated on demand. The limitation of CGI is performance: each request spawns a separate process on the server, creating significant overhead at high request volumes.

Model 3: Server-Side Scripting

Server-side scripting technologies address the performance limitations of CGI by embedding programme code directly within HTML templates, which are then interpreted by a server-side engine at the time of each request. The major server-side scripting platforms are:

- Active Server Pages (ASP): A Microsoft technology in which scripting code embedded in .asp files is processed by the IIS web server.
- PHP (Hypertext Preprocessor): An open-source server-side language widely used for web development, with files typically carrying .php extensions.
- Java Server Pages (JSP): A Java-based technology in which Java code is embedded in .jsp pages and processed by a Java application server.
- Server Side Includes (SSI): A simpler mechanism that allows fragments of common content — headers, footers, navigation menus — to be included in multiple pages from a single source file, reducing maintenance overhead.

A key security advantage of server-side scripting is that the source code is never transmitted to the browser: only the resulting HTML output is sent. Users viewing the page source see finished markup rather than the application logic that generated it.

Three-Tier and N-Tier Architecture

Modern commercial web applications are typically structured as three-tier or n-tier systems that separate the user interface, business logic, and data management functions into independent layers, each of which can be developed, deployed, and scaled independently.

- Presentation tier: The user interface layer, comprising the web pages, forms, and interactive elements that the user sees and interacts with through their browser. Its sole responsibility is presenting information and collecting input.
- Logic tier (Application tier): The layer that implements the business rules governing how the application processes information and responds to user actions. It coordinates the flow of data between the presentation and data tiers, applying validation, calculation, and decision logic.
- Data tier: The layer responsible for persistent storage and retrieval of data, typically implemented through a relational database management system. It maintains the integrity and consistency of stored data and provides query and update services to the logic tier.

N-tier architectures extend this pattern by introducing additional specialised layers — such as integration layers for connecting to external systems, caching layers for performance, or messaging layers for asynchronous processing — where the complexity of the application warrants it. The three-tier model's primary commercial virtue is its ability to support complex transaction processing, personalisation, and inventory management capabilities that static or two-tier architectures cannot achieve at scale.

Web Server Software and Hardware

The most widely deployed web server software programmes are Apache HTTP Server, a free and open-source platform that powers a large proportion of the world's web traffic; Microsoft Internet Information Services (IIS), the server platform integrated into the Windows Server operating system; and the Sun Java System Web Server. Each supports the core web serving function — receiving HTTP requests and returning responses — as well as security features, logging, and integration with application servers and databases.

The hardware supporting web servers has evolved to meet growing capacity requirements:

- High-specification server computers: Web servers are equipped with substantially greater memory, faster processors, and larger storage capacity than desktop systems, enabling them to handle large numbers of concurrent connections without performance degradation.
- Blade servers: Compact server modules mounted in shared rack enclosures that share power and cooling infrastructure, allowing high processing density in limited physical space.
- Virtual servers: Software-defined servers that simulate the behaviour of independent hardware systems within a shared physical host, enabling efficient resource utilisation and rapid provisioning.
- Load balancing systems: Infrastructure that distributes incoming requests across multiple server instances, preventing any single server from becoming a bottleneck and providing resilience against individual hardware failures.

Electronic Mail

Electronic mail (email) is a digital messaging system that allows individuals and organisations to compose, send, receive, and store text-based communications — along with attached files of any type — across the internet or private networks. Modern email systems use a store-and-forward model: messages are submitted to an email server, which stores them and forwards them through the network toward the recipient's server, where they are held until the recipient retrieves them. Neither sender nor recipient needs to be online simultaneously; the server infrastructure handles delivery asynchronously. An email message comprises three structural elements: the envelope (routing information used by servers), the header (visible metadata including sender, recipient, subject, and timestamp), and the body (the message content and any attachments).

Benefits and Advantages of Email

Email combines the informality and conversational accessibility of spoken communication with the permanence and searchability of written records. Its principal advantages include:

- Simplicity of operation: Composing, sending, receiving, and organising email requires no specialist knowledge.
- Speed: Messages are delivered and available for reading within seconds of being sent, regardless of the geographic distance between sender and recipient.
- Ease of prioritisation: Subject lines allow recipients to assess the importance and urgency of each message before opening it.
- Security and reliability: Contemporary email infrastructure incorporates encryption, authentication, and redundancy mechanisms that make it among the more secure and reliable of digital communication channels.

- Conversational record: Reply chains automatically accumulate the history of an exchange, providing context for each new message without the recipient needing to consult external records.
- Automation capability: Autoresponders, triggered sequences, and integration with business systems allow email to be used as a fully automated communication channel for notifications, confirmations, and campaigns.
- Environmental efficiency: Electronic communication eliminates the paper consumption and transport emissions associated with postal correspondence.
- Multimedia capability: Images, formatted layouts, attachments, and links can all be incorporated, enriching the communicative range of the medium.
- Commercial versatility: Email serves effectively as a direct marketing channel, a customer service medium, and an internal communications infrastructure.

Disadvantages of Email

- Malware propagation: Email attachments and embedded links are among the most common vectors through which malicious software reaches end-user devices.
- Spam: The near-zero cost of sending email has produced an enormous volume of unsolicited commercial messages that consume recipient attention and infrastructure bandwidth.
- Phishing and spoofing: The ease with which email headers can be manipulated allows fraudsters to impersonate trusted organisations to deceive recipients into divulging sensitive information.

- Susceptibility to interception: Email messages traverse multiple network nodes between sender and recipient and may be intercepted at any point unless end-to-end encryption is applied.
- Misinterpretation risk: Written communication lacks the tonal and gestural cues of face-to-face interaction, increasing the risk that messages are read in unintended ways.
- Inbox management burden: High email volumes require active management effort to ensure that important messages are not overlooked.
- Formality limitations: Email's conversational informality makes it poorly suited to formal business correspondence requiring signatures, witnessed execution, or legal documentation.

Email Spam

Email spam — also described as unsolicited bulk email (UBE) or junk mail — is the mass distribution of substantially identical commercial or fraudulent messages to large numbers of recipients who have not requested them. Spam originated as a nuisance in the early years of the commercial internet and has grown into a major operational challenge: estimates place spam at roughly 78 to 90 per cent of total global email volume, the majority of it generated automatically by networks of compromised computers (botnets) controlled by criminal operators.

The economics of spam are fundamentally asymmetric: the cost of sending each message is negligible to the sender, while the cumulative cost of receiving, filtering, and discarding spam — in terms of storage, processing, and human attention — is borne by recipients and network operators. This externality makes spam commercially rational for senders even at extremely low response rates, and has made its

elimination technically infeasible. The legal landscape is equally variable: the United States' CAN-SPAM Act of 2003 permits commercial email subject to compliance with disclosure and opt-out requirements; other jurisdictions impose stricter opt-in requirements or outright prohibitions on unsolicited commercial email.

Phishing

Phishing is a form of social engineering attack conducted through email in which the attacker impersonates a trusted organisation — a bank, a payment platform, a government agency — to deceive the recipient into disclosing credentials, financial details, or other sensitive information. Phishing emails are designed to appear visually identical to legitimate communications from the impersonated organisation, and typically direct recipients to fraudulent websites that replicate the appearance of the genuine site. Spear-phishing is a targeted variant that uses personal information about the specific recipient to make the deceptive communication more convincing.

Spam Techniques

Address harvesting: Spammers compile recipient lists by extracting email addresses from publicly accessible sources including websites, online directories, and social media profiles. Automated harvesting tools can collect millions of addresses rapidly. The practice violates the explicit preferences of many address holders and the law of many jurisdictions.

Image spam: To evade text-based filters that scan message content for known spam signatures, some operators encode their message text as an embedded image rather than as readable characters. This technique prevents content-based filters from detecting the spam, though image-analysing technologies have been developed in

response. Animated GIF images and distorted text (similar to CAPTCHA techniques) are further variants.

Blank spam: Messages that carry no substantive payload and appear entirely empty. These may be generated intentionally as directory harvest attacks — sent to millions of addresses to identify which ones are valid by observing which generate delivery failures — or may result from technical errors in spamming infrastructure.

Backscatter: When spam is sent with a forged sender address, any bounce messages generated by undeliverable addresses are directed to the forged address rather than to the actual sender. The innocent holder of the forged address may receive large volumes of misdirected bounce messages as a secondary effect of spam campaigns in which they had no involvement.

Content obfuscation: Filter evasion techniques include deliberate misspellings of commonly blocked terms, insertion of invisible characters between letters, HTML comment injection within words, and the presentation of text at a font size too small to be read or in a colour identical to the background. Bayesian poisoning — filling messages with excerpts from legitimate text sources to dilute the statistical signature of the spam content — is used to defeat probabilistic spam classifiers.

Growth of Email Spam

The volume of spam has grown from a single incident in 1978 (an advertisement sent to approximately 600 ARPANET users) to an estimated 200 billion messages per day by 2010. Key milestones include: approximately 2.4 billion daily messages in 2002; 11 billion in 2004; 30 billion by mid-2005; 55 billion by mid-2006; 90 billion

by early 2007; and 100 billion by mid-2007. This growth trajectory reflects both the expansion of internet user populations and the increasing industrialisation of spam operations through botnets and automated distribution infrastructure. Despite the scale of the problem, a 2010 survey found that 46 per cent of US and European email users had opened spam messages despite being aware of the associated risks.

Website and Internet Utility Software

A utility programme is a software application designed to perform a specific, well-defined task that extends or supports the capabilities of the underlying operating system or platform. Utilities are typically narrow in scope — focused on a single function such as file compression, search-and-replace operations, or system diagnostics — and are designed for efficiency and ease of use rather than the comprehensive functionality of a full application suite.

In the web context, utilities encompass tools for server configuration, performance monitoring, log analysis, link checking, and content optimisation. Data analysis software — used to inspect, clean, transform, and model information — supports decision-making by revealing patterns and trends in datasets that would be imperceptible through direct examination. Its applications range from web traffic analysis and A/B testing to business intelligence and scientific research.

Review Questions

1. Explain the types of online auctions and how they differ from traditional auctions.

2. What are virtual communities? Describe their principal types and their impacts.
3. Explain the architecture of web servers, including the three-tier model.
4. What is electronic mail? Describe its benefits and the challenges posed by spam.
5. Explain the three-tier and n-tier client-server architecture in detail.

UNIT – 5

E-Commerce Software, Security, Payment Systems and Implementation

Objectives

Upon completing this unit, students will be able to:

- Evaluate web hosting alternatives for e-commerce sites
- Identify and compare e-commerce software packages for different business scales
- Explain the key security threats facing e-commerce operations
- Describe the principal electronic payment systems
- Explain electronic cash, electronic wallets, and stored-value cards
- Outline strategies for planning and developing e-commerce web sites

Web Hosting Alternatives

Web hosting is the provision of server space, network connectivity, and associated services that make a website accessible on the internet. A hosting provider operates or leases server infrastructure in a data centre environment, offering this capacity to clients who publish their websites on it. The selection of an appropriate hosting arrangement is an early and consequential decision in establishing an e-commerce presence, as it affects the site's reliability, performance, security, and cost.

The most basic hosting tier is shared hosting, in which a single physical server accommodates multiple client websites

simultaneously, keeping per-site costs low but constraining performance and customisation options. Dedicated hosting assigns an entire physical server to a single client, providing maximum performance and configuration control at higher cost. Virtual private server (VPS) hosting occupies an intermediate position, using virtualisation to partition a physical server into several isolated virtual environments, each behaving as an independent dedicated server. Cloud hosting distributes a site across a pool of networked resources, providing on-demand scaling and high resilience at variable cost. Many hosting providers offer domain registration, email services, SSL certificate management, and e-commerce-specific tools such as shopping cart software as part of their service packages.

Personal websites can typically be hosted at low or no cost. Business and e-commerce sites require more robust hosting environments with guaranteed uptime, faster server hardware, dedicated IP addresses, and security-hardened configurations, reflecting the greater impact of downtime or breaches on commercial operations.

Basic Functions of E-Commerce Software

Regardless of the scale of the operation, any functional e-commerce platform must provide three core capabilities: a product catalogue for presenting the range of available offerings; shopping cart functionality for accumulating selected items across a browsing session; and transaction processing for managing the checkout, payment capture, and order fulfilment workflow.

A static product catalogue is a fixed set of HTML pages describing available items, updated manually by editing the underlying files. A dynamic catalogue retrieves product data from a database at the time of each request, allowing the range and presentation of products to be

managed centrally and updated immediately without modifying page code. A site-integrated search engine that allows customers to locate items by keyword or attribute greatly improves the utility of large catalogues. The commercial priority at the product display stage is to remove every obstacle between a motivated customer and their purchase; unnecessary complexity, unclear navigation, or absent product information are all conversion killers.

Shopping Cart Technology

The web is inherently stateless: each request from a browser to a server is an independent transaction, carrying no memory of previous interactions. An e-commerce site must therefore implement explicit mechanisms for maintaining continuity across the series of requests that constitute a shopping session — tracking which items a customer has selected, remembering preferences and delivery information, and managing the progress of the checkout process. Shopping cart software addresses this need by creating a session-linked data store that accumulates and persists the user's selections across multiple page requests. This session identity is typically maintained through a cookie stored in the user's browser, a session token appended to page URLs, or server-side session management keyed to a unique identifier.

Transaction Processing

Transaction processing is the most operationally complex phase of online selling, involving the real-time coordination of multiple systems and services. It must accurately compute the total cost of the purchase including any applicable volume discounts, sales tax rates — which may vary by jurisdiction, product category, and the customer's location — and delivery charges based on the weight, dimensions, and destination of the order. It must then present this

summary to the customer, capture payment securely, and trigger the order fulfilment workflow. Error handling, fraud detection, and the management of payment failures or declines add further complexity to the process.

Advanced E-Commerce Software Functions

Beyond the core transaction cycle, sophisticated e-commerce operations require deeper integration between their customer-facing web presence and their internal operational systems.

Enterprise Resource Planning (ERP) systems manage core business functions including finance, procurement, inventory, and human resources through an integrated data model. Middleware software — provided by companies such as BEA Systems, Broadvision, IBM Tivoli Systems, and Digital River — bridges the architectural gap between the e-commerce platform and ERP systems, enabling web sales to flow automatically into accounting and inventory records without manual re-entry. This integration eliminates a major source of operational errors and delays.

Enterprise application integration (EAI) extends this connectivity further, connecting the web platform not only to ERP but to the full range of an organisation's systems — CRM, logistics, supplier portals, and analytics platforms — creating a unified information flow that gives managers a comprehensive, real-time view of the business.

Application Servers and Web Services

Application servers are software platforms that execute the business logic of a web application — the rules and processes that determine how the system responds to user requests — separately from both the web server that handles HTTP communication and the database that

stores persistent data. They retrieve the information they need from structured databases managed by database management systems (DBMS), construct the appropriate response, and return it to the web server for delivery to the browser.

Web services are modular, self-contained software components that expose specific business functions to other applications over the internet using standard protocols. They enable organisations to compose complex digital services from independently maintained components, and to integrate systems across organisational boundaries. The principal standards governing web services are SOAP (Simple Object Access Protocol), which defines the message format, and WSDL (Web Services Description Language), which describes what operations a service offers and how to invoke them.

E-Commerce Software Packages

Basic Packages

Entry-level e-commerce software packages are typically provided by hosting companies as part of their web hosting service, at low or no additional cost. They offer sufficient functionality — catalogue management, shopping cart, basic payment processing — to launch a simple online store quickly. They are appropriate for small businesses testing the e-commerce channel or operating low-volume stores, but offer limited control over design, functionality, and integration.

Mid-Range Packages

Mid-range e-commerce platforms are designed for businesses with more complex requirements: greater control over site design and layout, database-driven product catalogues with advanced search and filtering, integration with payment gateways and logistics providers, and reporting and analytics tools. Representative platforms at this tier

include Intershop Enfinity, which provides catalogue management, shopping cart functionality, online credit card processing, and connectivity to back-office databases such as DB2 and Oracle; IBM WebSphere; and Microsoft Commerce Server. These platforms are typically deployed and managed on the client's own infrastructure or on dedicated hosting.

Enterprise Solutions

Enterprise-class e-commerce software is designed for large organisations operating high-volume, high-complexity digital commerce at global scale. It integrates tightly with back-office ERP and CRM systems, supports highly configurable products and pricing, provides sophisticated personalisation and merchandising tools, and can be deployed across multiple brands, markets, and languages from a single platform. Examples include IBM WebSphere Commerce Business Edition, Oracle E-Business Suite, and Broadvision One-To-One Commerce. An enterprise-scale e-commerce architecture typically encompasses:

- Domain Name System (DNS) management
- SMTP servers for transactional and marketing email
- Web server infrastructure
- Application server layer
- Database server layer
- Comprehensive security mechanisms including firewalls, intrusion detection, and encryption

Online Security

Computer security is the systematic protection of digital assets — hardware, software, data, and communication channels — against unauthorised access, use, modification, or destruction. It encompasses two complementary dimensions: physical security, which protects

assets through tangible measures such as access controls, surveillance, and fire suppression; and logical security, which protects information and systems through technical controls including access credentials, encryption, and network monitoring.

A security countermeasure is any procedure, control, or technology that recognises, reduces, or eliminates a defined threat. Risk management in security requires comparing the cost of implementing a countermeasure against the potential cost of the threat it addresses: when the countermeasure costs more than the asset it protects, or when the probability of the threat materialising is negligible, it may be rational to accept the residual risk rather than incur the protection cost. This risk-acceptance judgment should be made explicitly rather than by default.

Elements of Computer Security

Availability: Systems and data must be accessible to authorised users whenever they are needed. Disruptions to availability — through hardware failure, software faults, network outages, or malicious attacks — have direct operational and commercial consequences. The CIH virus of the late 1990s demonstrated the extreme end of this risk by corrupting BIOS firmware on affected machines, rendering them inoperable. Even less dramatic availability failures — system crashes, extended maintenance windows, or degraded performance under load — impose real costs on businesses and their customers.

Integrity: Data must remain accurate, complete, and unmodified except through authorised processes. Integrity failures — whether caused by malicious tampering, software defects, or storage corruption — can be deeply damaging, particularly when affected data underpins financial records, operational decisions, or legal

obligations. In some cases, corrupted data can be recovered from backups; in others, the original information may be irretrievably lost or irrecoverably altered.

Confidentiality: Sensitive information must be accessible only to the individuals and systems that are authorised to see it. Breaches of confidentiality — through hacking, insider disclosure, or inadequate access controls — can cause competitive harm, reputational damage, regulatory penalties, and in extreme cases the commercial destruction of the affected organisation. Personal data breaches additionally expose individuals whose data is disclosed to identity theft, financial fraud, and privacy violations.

A comprehensive security programme addresses all three of these dimensions simultaneously. Improving one at the expense of another creates exploitable weaknesses: a system that is highly available but poorly protected against unauthorised access, or tightly locked down but unavailable when needed, fails in its security objectives.

Malware Categories

Viruses: A computer virus is a malicious programme that attaches its code to a legitimate executable file or document and replicates itself into further files when the infected host is opened or executed. The payload of a virus may range from the display of a nuisance message to the deletion of files, the corruption of system components, or the installation of additional malicious software.

Macro viruses: A subtype of virus that embeds itself in the macro scripting capabilities of application documents — word processor files or spreadsheets — activating when the document is opened and

potentially spreading to other documents opened subsequently in the same application.

Worms: A worm is a self-replicating programme that propagates across networks under its own power, without needing to attach itself to a host file. Worms can spread at extraordinary speed, consuming network bandwidth and system resources as they replicate. Some worms carry destructive payloads; others create backdoors that allow remote attackers to control infected machines. The Sasser and Blaster worms are illustrative examples of the operational disruption that fast-spreading network worms can cause.

Trojan horses: A Trojan horse is a programme that presents itself as legitimate or useful software while secretly performing malicious functions. Unlike viruses and worms, Trojans do not self-replicate; they rely on users voluntarily installing them, typically through social engineering techniques such as deceptive email attachments or false software update notices.

Digital Certificates and Communication Security

A digital certificate is an electronically signed credential, issued by a trusted Certification Authority (CA), that binds a public encryption key to the identity of its holder. When a web server presents a digital certificate to a browser, the browser can verify the server's identity and establish an encrypted communication channel through which data is protected against interception. This mechanism underpins HTTPS — the secure version of HTTP — and is the foundation of trust in e-commerce transactions.

Secrecy and privacy are related but distinct concepts in security: secrecy prevents specific information from reaching unauthorised

parties, while privacy protects individuals' rights to control information about themselves. Sniffer programmes — software that captures and logs network traffic passing through a router or network interface — represent a passive threat to both by enabling the silent collection of transmitted data.

Integrity and Denial-of-Service Threats

Integrity threats arise when an attacker is able to intercept and modify data in transit between two communicating parties. Masquerading or spoofing attacks involve an attacker impersonating a legitimate party — by forging an IP address, falsifying DNS records, or cloning the appearance of a trusted website — to deceive communicating parties about with whom they are actually exchanging data.

Denial of Service (DoS) attacks aim to render systems unavailable to legitimate users by overwhelming them with spurious traffic or exploiting vulnerabilities that cause them to fail. In a distributed denial of service (DDoS) attack, traffic originates from a large number of compromised machines simultaneously, making the attacking traffic difficult to distinguish from legitimate requests and preventing simple countermeasures from being effective.

Wireless Network Threats

Wireless networks introduce security vulnerabilities that are not present in wired infrastructure, primarily because radio signals propagate beyond physical boundaries and can be received by any device within range. Key wireless security threats include:

- MAC address spoofing: An attacker alters their device's hardware identifier to impersonate an authorised device, bypassing access controls that use MAC address filtering.

- Rogue access points: An unauthorised wireless access point is introduced into the network environment, either by an attacker seeking to intercept traffic or by a well-intentioned employee extending coverage without authorisation. Rogue points operating within a firewalled network create an uncontrolled entry path through the perimeter defences.
- Man-in-the-middle attacks: An attacker inserts themselves between two communicating parties by sending forged disassociation messages that cause devices to disconnect from their legitimate access point and reconnect to a fraudulent one under the attacker's control.
- Active network scanning: Tools such as NetStumbler and Dstumbler transmit probe requests to discover available access points. The response frames reveal the network identifier (SSID) and hardware addresses of responding access points, providing an attacker with the information needed to target the network. Networks using open authentication are directly vulnerable; even shared-key authentication can be attacked through cryptographic analysis of challenge-response exchanges.

Security Measures for Web Servers

Web servers present a particularly attractive target for attackers because they are exposed to the public internet and receive requests from arbitrary sources. A range of defensive measures should be applied:

- Authentication: Implement strong authentication for all access to server administration interfaces and application resources. Consider mutual authentication — where both the client and the server verify each other's identity — for sensitive operations such as banking transactions.

- Encryption: Deploy SSL/TLS to encrypt all data in transit between browser and server. Use message authentication codes to detect tampering with transmitted data.
- Access control: Apply least-privilege principles through access control lists, granting each user or process only the permissions strictly required for their legitimate function.
- CryptoAPI and digital signatures: For applications requiring strong data integrity guarantees, implement digital signature schemes that allow the recipient to verify that content has not been altered since it was signed.
- Process isolation and exception handling: Design server applications to handle errors gracefully, preventing malformed requests from causing crashes or exposing system information. Implement limits on message sizes and request rates to mitigate flood-based denial-of-service attacks.
- Network firewalls: Deploy firewalls to separate the public-facing server from internal systems, preventing lateral movement in the event of a server compromise and limiting the exposure of internal network segments to internet-originated traffic.

Payment Systems for E-Commerce

An electronic payment system is the infrastructure through which financial value is transferred between parties to a digital transaction. Electronic payment systems mirror the functions of their physical counterparts — cash, cheques, and credit cards — but deliver them through digital protocols and automated processing rather than physical exchange. The development of these systems has been central to the commercial success of e-commerce, as digital transactions are only viable when parties can exchange value securely and efficiently without meeting in person.

In a conventional payment, cash or payment instructions (cheques, card authorisations) pass directly between buyer and seller, with final settlement occurring through the banking network that adjusts the respective account balances. Electronic payment systems replicate this process digitally, potentially introducing additional intermediaries — payment processors, digital currency issuers, or escrow services — that manage the mechanics of transfer on behalf of the principals. The choice of payment system involves trade-offs between cost, convenience, security, anonymity, and the degree of intermediation required.

Online Credit Card Payments

Credit card payment is the dominant mechanism for online retail transactions, accepted by merchants globally and offering consumers a familiar, low-friction checkout experience. The process involves the following sequence:

1. The cardholder holds a card issued by a financial institution affiliated with a card network (Visa, Mastercard, or similar). The card was physically issued to the cardholder following an approved application.
2. When making a purchase, the cardholder enters their card details into the merchant's payment form or payment gateway interface.
3. The merchant's system transmits the transaction details to the card network for authorisation. The network verifies the card's validity and the cardholder's available credit.
4. The authorised transaction amount is credited to the merchant's acquiring bank account, less a processing fee. The merchant retains a record of the transaction.

5. The acquiring bank settles the transaction with the card network.
6. The card network recovers the funds from the issuing bank and the transaction amount is debited from the cardholder's account.

The key advantages of online credit card payment include its universal acceptance, consumer familiarity, and the fraud protection frameworks that card networks provide. Limitations include the processing fees charged to merchants, the risk of card-not-present fraud (since the physical card cannot be verified online), and the requirement for consumers to transmit sensitive financial details over the internet.

Electronic Cheque System

An electronic cheque replicates the structure and function of a paper cheque in digital form. It carries the payer's account details, the payee's name, and the transaction amount, and is authenticated by a digital signature derived from the payer's private cryptographic key rather than a handwritten signature. The digital signature verifies that the instruction originated from the authorised account holder and that its content has not been altered in transit.

Electronic cheques offer several advantages over both paper cheques and credit cards: they do not require the transmission of a credit card number to the merchant; they do not expose the payer's full account details in each transaction; and they carry lower per-transaction processing costs than credit cards. Their principal limitations are relatively high fixed infrastructure costs, limited acceptance beyond the digital environment, and the complexity of managing user anonymity and authentication simultaneously.

Electronic Cash (E-Cash)

Electronic cash is a digital instrument that stores monetary value and can be transferred directly between parties to complete transactions, analogously to physical notes and coins but without requiring a bank account or card infrastructure to intermediate each exchange. Like physical cash, e-cash is designed to provide anonymity — the identity of neither party need be known to the other to complete a transfer — and to be transferable without the involvement of a third party at the moment of exchange.

E-cash exhibits several desirable properties: it carries a defined monetary value; it can be stored on a device or account and retrieved later; it is interoperable across the merchants and platforms that accept it; and it incorporates cryptographic security features that prevent forgery and double-spending. Its commercial advantages include low transaction costs, strong privacy protection, and wide theoretical acceptability. Its practical limitations include the risk of permanent loss if the storage medium is damaged or stolen (since e-cash, like physical cash, is not recoverable through a central registry), and the challenge of achieving widespread merchant acceptance comparable to that of established card networks.

The cryptographic architecture of e-cash typically represents each unit as a string of bits incorporating a unique reference number and a digital signature. Enhanced implementations add a digital watermark that allows the issuing authority to verify authenticity and provides forensic traceability in the event of suspected fraud, without compromising the privacy of routine transactions.

Smart Card-Based Payment

A smart card is a payment instrument embedded with an integrated circuit that provides both data storage and, in more sophisticated variants, processing capability. Smart cards can store significantly greater amounts of data than magnetic-stripe cards and can perform cryptographic computations on-card, enabling more robust authentication and transaction security. Some smart cards require the entry of a PIN code to authorise transactions, providing a two-factor authentication requirement that reduces the risk of fraudulent use of lost or stolen cards.

Smart cards have been used in commercial payment applications for over two decades, most extensively in Europe and Asia. They are deployed across a range of use cases including transit fare payment, prepaid telephone services, stored-value retail payment, and identification. Their flexibility derives from the programmability of their embedded processors, which can support multiple applications on a single card.

Electronic Wallets

An electronic wallet (e-wallet) is a software application that securely stores payment credentials, billing information, and shipping details, enabling the user to complete online transactions without re-entering this information at each checkout. At minimum, an e-wallet must provide secure payment and identity verification in support of digital transactions. More sophisticated implementations extend this core function with features such as loyalty reward tracking, digital receipts, budget management, and integration with loyalty programmes.

The vision for the electronic wallet is that it will become the user's comprehensive digital identity and payment agent on the internet —

accessible from any connected device, authorised to act on the user's behalf in e-commerce transactions, and capable of aggregating the full range of the user's payment, identity, and loyalty relationships into a single managed interface.

Stored-Value Cards

A stored-value card is a payment instrument on which monetary value is encoded directly in the card's physical medium — typically in an embedded chip or magnetic stripe — rather than being held in an account at a financial institution that the card merely accesses. This distinguishes stored-value cards from debit cards, which carry no value themselves but provide access to a linked bank account, and from prepaid cards, where the monetary balance is maintained in a computer system at the card issuer rather than physically on the card.

Stored-value cards are typically anonymous: unlike debit or credit cards, they are not issued in an individual's name and carry no record of the holder's identity. The value on the card can be accessed by swiping the magnetic stripe, tapping the card over an RFID reader, or entering a numeric code printed on the card. Common applications include gift cards, transit fare cards, prepaid mobile phone top-up cards, and single-use payment instruments for online transactions where the user does not wish to expose their primary card details.

Internet Technologies and the Banking Industry

Internet technologies have profoundly altered the structure and economics of banking and financial services. The following research variables have been used to study the relationship between technology investment and banking performance:

- Software: Net investment in banking software during the study period.

- Hardware: Net investment in computing hardware and related equipment.
- Internet banking (InBank): Whether the institution offers internet banking services (binary variable).
- Phone banking (PhBank): Whether the institution offers telephone banking services (binary variable).
- ATM: The number of automated teller machines operated by the institution.
- Cyber branches (CyBranch): Whether the institution offers digital branch services (binary variable).
- SMS banking: Whether the institution offers mobile SMS-based banking services (binary variable).
- Size: Total assets of the institution (control variable).
- Deposits: Ratio of deposits to total assets (control variable).
- Credit: Ratio of credit facilities to total assets (control variable).

Planning E-Commerce Initiatives

A successful e-commerce initiative requires more than technology selection and website development. It demands a disciplined planning process that begins with the identification of clear, specific objectives and proceeds through strategy formation, resource allocation, execution, and evaluation in a structured sequence.

Common strategic objectives for e-commerce include: expanding sales within existing markets; entering new geographic or demographic markets that physical distribution cannot efficiently reach; enhancing the quality and responsiveness of customer service; identifying and qualifying new suppliers; improving the efficiency of coordination with existing supply partners; and attracting higher-quality candidates through improved digital employer branding.

Regardless of their specific content, well-formed objectives should satisfy the SMART criteria:

- Specific: Precisely defined rather than vague or aspirational.
- Measurable: Associated with quantitative or verifiable indicators of achievement.
- Achievable: Realistic given the organisation's resources and capabilities.
- Results-based: Focused on outcomes rather than activities.
- Time-bound: Associated with a defined completion date or milestone.

Linking Objectives to Strategy

Once objectives have been defined, the organisation must identify the strategic approaches through which they will be pursued. Downstream strategies focus on adding value for customers — improving the purchase experience, deepening relationships, expanding the product range, or enhancing post-sale support. Upstream strategies focus on reducing cost and improving supply-side efficiency through better supplier relationships, procurement processes, and logistics management.

E-commerce enables a wide range of strategic activities including brand building, digital advertising, direct product sales, content marketing, customer service improvement, supply chain coordination, auction-based procurement, and virtual community development. Each activity carries costs and produces benefits that may be tangible (measurable in revenue or cost terms) or intangible (customer satisfaction, brand equity, employee engagement). Effective planning assigns explicit accountability and measurement criteria to each activity rather than pursuing them in an ad hoc manner.

Strategies for Developing E-Commerce Web Sites

The evolution of e-commerce web site development can be understood in terms of increasing functional and relational sophistication over time:

First generation (1996–1999): Early e-commerce sites were primarily electronic brochures supplemented with basic transactional capabilities. Their distinguishing features were complete product catalogues, shopping cart functionality, secure payment processing, basic information queries, and order shipment tracking.

Second generation (1999 onward): More advanced implementations added personalisation based on browsing and purchase history; interactive features that engaged customers beyond the transaction; dynamically updated content that maintained freshness and relevance; and integrated customer relationship management tools that supported post-sale engagement and loyalty programmes.

Managing E-Commerce Implementations

As e-commerce systems grow in complexity, informal management approaches become inadequate. Formal project management disciplines — scope definition, work breakdown, timeline and budget management, risk tracking, and change control — are required to deliver complex digital initiatives reliably. Project portfolio management extends this to the organisational level, treating the portfolio of digital initiatives as a managed investment portfolio in which each project is assessed for its strategic value and risk profile, and resources are allocated in proportion to expected return.

Post-implementation audits are an essential but often neglected component of the development lifecycle. A thorough post-implementation review compares actual outcomes against the planned

objectives, timeline, cost, and quality specifications defined at project initiation. Its purpose is not to assign blame for shortfalls but to extract learning that can improve future initiatives: identifying planning assumptions that proved incorrect, process failures that caused delays, communication breakdowns between teams, and estimation errors that can be corrected in subsequent projects.

Review Questions

1. What e-commerce software options are available, and how do they differ by scale of operation?
2. Explain the key online security threats and the countermeasures available to address them.
3. What security measures should an organisation apply when operating a web server?
4. Describe the major electronic payment systems and compare their characteristics.
5. What is electronic cash, and what are its advantages and limitations?
6. What is an electronic wallet and how does it support digital commerce?
7. Explain the concept of a stored-value card and how it differs from a prepaid debit card.

E-COMMERCE IN PROJECT MANAGEMENT SYSTEM

Model Question Paper – I

PART – A (5 × 5 = 25 Marks)

(Answer any 5 questions only)

1. Define e-commerce and explain its significance in modern business.
2. Explain the categories of e-commerce with suitable examples for each.
3. Describe any three revenue models used by e-commerce businesses.
4. What are the legal issues associated with e-commerce?
5. What is customer relationship management and why is it important in e-commerce?
6. What is Electronic Data Interchange and how is it used in business?
7. What is a virtual community? Describe the types of virtual communities.
8. Explain shopping cart technology and its role in e-commerce.

PART – B (5 × 15 = 75 Marks)

(Answer any 5 questions only)

9. With the help of a neat diagram, explain the technology infrastructure required for e-commerce applications.
10. Trace the evolution of the Internet from its origins to its commercialisation, explaining the key milestones.
11. Explain the ethical issues of e-commerce in detail, including privacy, defamation, and cyber crime.
12. Describe the historical development of markup languages from GenCode through SGML and HTML.
13. What are the principal web marketing strategies available to an online business? Explain each.
14. With the help of a neat diagram, explain the role and architecture of a web server.
15. Explain the growth of e-mail spam in detail, including the techniques used by spammers and countermeasures.
16. Explain the major online security issues facing e-commerce operations and the measures used to address them.

E-COMMERCE IN PROJECT MANAGEMENT SYSTEM

Model Question Paper – II

PART – A (5 × 5 = 25 Marks)

(Answer any 5 questions only)

1. What are the advantages and disadvantages of e-commerce?
2. Explain the principal internet protocols and the services each supports.
3. What is a Uniform Resource Locator (URL)? Explain its structure and purpose.
4. Explain trade mark and domain name conflicts with examples of each type.
5. What is supply chain management? Explain its objectives and structure.
6. How are brands created and maintained on the web?
7. What are online auctions? Explain the disadvantages of traditional auctions compared to e-auctions.
8. Differentiate between conventional and electronic payment systems.

PART – B (5 × 15 = 75 Marks)

(Answer any 5 questions)

9. With the help of a neat diagram, explain e-commerce and its principal categories.
10. Explain the following networking technologies:
    a) Packet-switched networks
    b) Circuit-switched networks
    c) Intranets
    d) Extranets
11. What are the revenue models available to e-commerce businesses? Explain each with examples.
12. Explain the web and internet marketing strategies available to an online business in detail.
13. What is meant by marketing segmentation? Explain the bases of segmentation and the role of consumer behaviour.
14. What is customer relationship management? How does technology-enabled CRM differ from traditional approaches?
15. With the help of a neat diagram, explain the client-server architecture of the web.
16. With the help of a neat diagram, explain the online credit card payment process from card application to transaction settlement.