Kenyatta University

SCO 311: ELECTRONIC COMMERCE

BSc Computer Science Year 3 Semester 2

Lecturer: Emma Cheserem Longei Email: cheserem.emma@ku.ac.ke

Lecture 2b: The Infrastructure of e-commerce (Part II)

2.5 The Internet

The Internet and its underlying technology is not a static phenomenon in history, but instead continues to change over time. Computers have merged with cell phone services; broadband access in the home and broadband wireless access to the Internet via smartphones, tablet computers, and laptops are expanding rapidly; self-publishing on the Web via blogging, social networking, and podcasting now engages millions of Internet users; and software technologies such as Web services, cloud computing, and smartphone apps are revolutionizing the way businesses are using the Internet.

2.5.1. Trends in E-Commerce Infrastructure

I. BUSINESS

- Mobile devices become the primary access point to social network services and a rapidly expanding social marketing and advertising platform.
- Explosion of Internet content services and mobile access devices strains the business models of Internet backbone providers (the large telecommunication carriers).
- The growth in cloud computing and bandwidth capacity enables new business models for distributing music, movies, and television.
- Search becomes more social and local, enabling social and local commerce business models.
- "Big data" produced by the Internet creates new business opportunities for firms with the analytic capability to understand it.

II. TECHNOLOGY

- Mobile devices such as smartphones and tablet computers become the dominant mode of access to the Internet. The new client is mobile.
- The explosion of mobile apps threatens the dominance of the Web as the main source of online software applications
- HTML5 grows in popularity among publishers and developers and makes possible Web applications that are just are visually rich and lively.
- Cloud computing reshapes computing and storage, and becomes an important force in the delivery of software applications and online content.
- The Internet runs out of IPv4 addresses; transition to IPv6 begins.
- The shipment of tablet computers exceeds the shipment of PCs.
- The decreased cost of storage and advances in database software leads to explosion in online data collection known as "big data," and creates new business opportunities for firms with the analytic capability to understand it. Big data firms operating in Kenya? Safaricom, IBM, Universities (CUEA, JKUAT)
- The Internet of Things, with millions of sensor-equipped devices connecting to the Internet, starts to become a reality

III. SOCIETY

- Internet Corporation for Assigned Names and Numbers (ICANN), which manages the Internet's domain name system, okays vast expansion of top-level domain names.
- Governance of the Internet becomes more involved with conflicts between nations.
- Government control over, and surveillance of, the Internet is expanded in most advanced nations, and in many nations the Internet is nearly completely controlled by government agencies.
- The growing Web-based infrastructure for tracking online and mobile consumer behaviour conflicts with individual claims to privacy and control over personal information

.

2.5.2. The Evolution of the Internet

The Internet has developed in three stages over approximately a 50-year period from 1961 to the present.

In the Innovation stage (60s - 70s), basic ideas and technologies were developed; in the Institutionalization stage (70s - 90s), these ideas were brought to life; in the Commercialization stage (1995 to present), once the ideas and technologies had been proven, private companies brought the Internet to millions of people worldwide. (Laudon and Travers, 2014:112)

2.6. The infrastructure of the Internet

In 1995, the Federal Networking Council (FNC) passed a resolution formally defining the term *Internet* as a network that uses the IP addressing scheme, supports the Transmission Control Protocol (TCP), and makes services available to users much like a telephone system makes voice and data services available to the public.

Although the Internet has evolved and changed dramatically in the last 30 years, three concepts -> packet switching, the TCP/IP communications protocol, and client/server computing, are at the core of the way the Internet functions today and are the foundation for the Internet of the future.

2.6.1. Packet Switching

Packet switching is a method of slicing digital messages into discrete units called **packets**, sending the packets along different communication paths as they become available, and then reassembling the packets once they arrive at their destination (ibid:117).

In packet-switched networks, messages are first broken down into packets. Appended to each packet are digital codes that indicate a source address (the origination point) and a destination address, as well as sequencing information and error-control information for the packet. Rather than being sent directly to the destination address, in a packet network, the packets travel from computer to computer until they reach their destination. These computers are called routers.

A **router** is a special c. To ensure that packets take the best available path toward their destination, routers use a computer program called a **routing algorithm**.

Packet switching does not require a dedicated circuit, but can make use of any spare capacity that is available on any of several hundred circuits. Packet switching makes nearly full use of almost all available communication lines and capacity. Moreover, if some lines are disabled or too busy, the packets can be sent on any available line that eventually leads to the destination point.

2.6.2. TCP/IP

Transmission Control Protocol/Internet Protocol (TCP/IP) is one of the core communications protocol for the Internet.

TCP establishes the connections among sending and receiving Web computers, and makes sure that packets sent by one computer are received in the same sequence by the other, without any packets missing.

IP protocol that provides the Internet's addressing scheme and is responsible for the actual delivery of the packets.

TCP/IP is divided into four separate layers, with each layer handling a different aspect of the communication problem.

i. The **Network Interface Layer** is responsible for placing packets on and receiving them from the network medium, which could be a LAN (Ethernet) or Token Ring network, or other network technology. TCP/IP is independent from any local network technology and can adapt to changes at the local level.
ii. The **Internet Layer** is responsible for addressing, packaging, and routing messages on the Internet.
iii. The **Transport Layer** is responsible for providing communication with the application by acknowledging and sequencing the packets to and from the application.
iv. The **Application Layer** provides a wide variety of applications with the ability to access the services of the lower layers.

2.6.3. HTTP

HyperText Transfer Protocol (HTTP) is the Internet protocol used to transfer Web pages. HTTP was developed by the World Wide Web Consortium (W3C) and the Internet Engineering Task Force (IETF).

HTTP runs in the Application Layer of the TCP/IP model.

An HTTP session begins when a client's browser requests a resource, such as a Web page, from a remote Internet server. When the server responds by sending the page requested, the HTTP session for that object ends. Because Web pages may have many objects on them—graphics, sound or video files, frames, and so forth—each object must be requested by a separate HTTP message.

2.6.4. SMTP

E-mail is one of the oldest, most important, and frequently used Internet services. Like HTTP, the various Internet protocols used to handle e-mail all run in the Application Layer of TCP/IP. **Simple Mail Transfer Protocol (SMTP)** is the Internet protocol used to send e-mail to a server. SMTP is a relatively simple, text-based protocol. SMTP handles only the sending of e-mail.

To retrieve e-mail from a server, the client computer uses either **Post Office Protocol 3 (POP3)** or **Internet Message Access Protocol (IMAP)**. POP3 can be set to retrieve e-mail messages from the server and then delete the messages on the server, or retain them on the server. IMAP is a more current e-mail protocol supported by all browsers and most servers and ISPs. IMAP allows users to search, organize, and filter their mail prior to downloading it from the server.

2.6.5. FTP

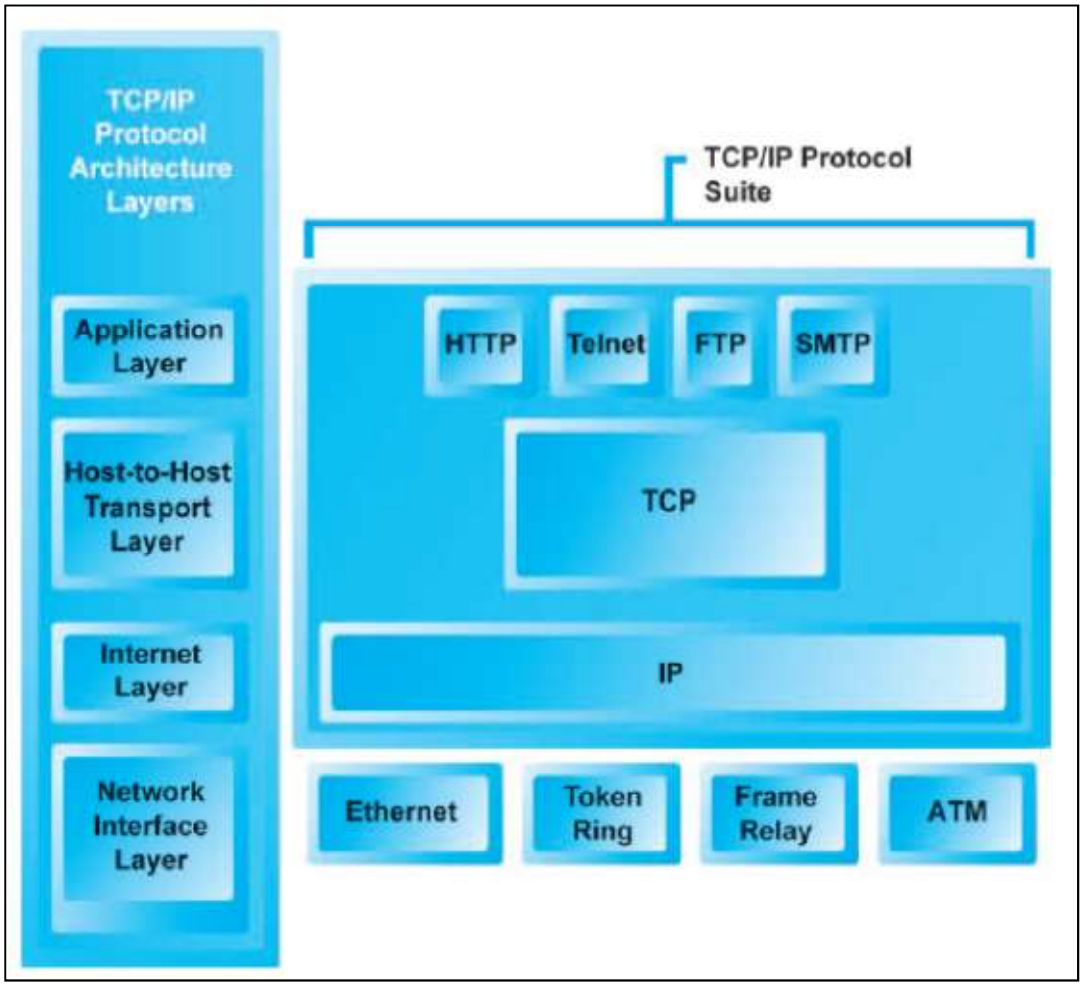
File Transfer Protocol (FTP) is one of the original Internet services. FTP runs in TCP/IP's Application Layer and permits users to transfer files from a server to their client computer, and vice versa. The

files can be documents, programs, or large database files. FTP is the fastest and most convenient way to transfer files larger than 1 megabyte, which some e-mail servers will not accept.

2.6.6. SSL

Secure Sockets Layer (SSL)/Transport Layer Security (TLS) are protocols that operate between the Transport and Application Layers of TCP/IP and secure communications between the client and the server. SSL/TLS helps secure e-commerce communications and payments through a variety of techniques, such as message encryption and digital signatures.

THE TCP/IP ARCHITECTURE AND PROTOCOL SUITE



2.6.7. IP Addresses

Every computer connected to the Internet must be assigned an address—otherwise it cannot send or receive TCP packets. Most corporate and university computers attached to a local area network have a permanent IP address.

There are two versions of IP currently in use: IPv4 and IPv6. An IPv4 Internet address is a 32-bit number that appears as a series of four separate numbers marked off by periods, such as 64.49.254.91. Each of the four numbers can range from 0–255. Because many large corporate and government domains have been given millions of IP addresses each (to accommodate their current and future work forces), and with all the new networks and new Internet-enabled devices requiring

unique IP addresses being attached to the Internet IPv6 was created, to increase the address space. An **IPv6 Internet address** is 128 bits, so it can support up to 2^{128} (3.4×10^{38}) addresses, many more than IPv4.

2.6.8. Domain Names and URLs

An IP address can be represented by a natural language convention called a **domain name**. The **Domain Name System (DNS)** allows expressions such as Cnet.com to stand for a numeric IP address (cnet.com's numeric IP is 216.239.113.101).

A **Uniform Resource Locator (URL)**, which is the address used by a Web browser to identify the location of content on the Web, also uses a domain name as part of the URL. A typical URL contains the protocol to be used when accessing the address, followed by its location.

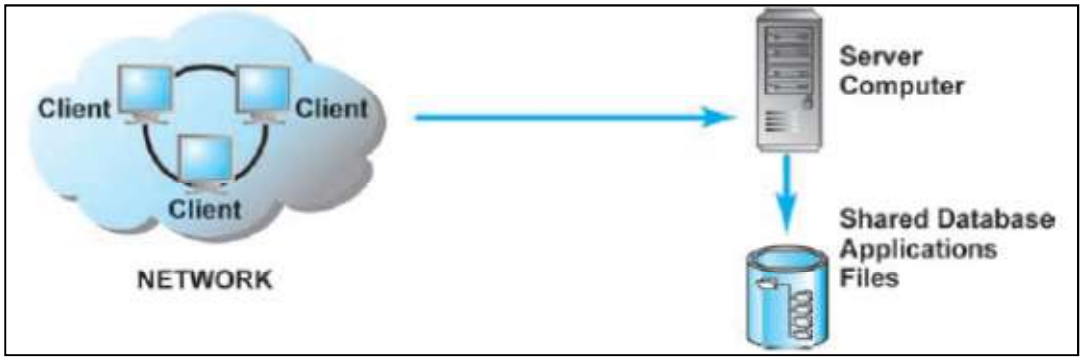
The **Domain Name System** is a hierarchical namespace with a root server at the top. Top-level domains appear next and identify the organization type (such as .com, .gov, .org, etc.) or geographic location (such as .uk [Great Britain] or .ca [Canada]). Second-level servers for each top-level domain assign and register second-level domain names for organizations and individuals such as IBM.com, Microsoft. com, and Stanford.edu. Finally, third-level domains identify a particular computer or group of computers within an organization, e.g., www.finance.nyu.edu.

2.6.9. Client/Server computing

While packet switching exploded the available communications capacity and TCP/ IP provided the communications rules and regulations, it took a revolution in computing to bring about today's Internet and the Web. That revolution is called client/server computing and without it, the Web—in all its richness—would not exist. **Client/server computing** is a model of computing in which powerful personal computers and other Internet devices called **clients** are connected in a network to one or more server computers. These clients are sufficiently powerful to accomplish complex tasks such as displaying rich graphics, storing large files, and processing graphics and sound files, all on a local desktop or handheld device. **Servers** are networked computers dedicated to common functions that the client computers on the network need, such as file storage, software applications, utility programs that provide Web connections, and printers.

The Internet is a giant example of client/server computing in which millions of Web servers located around the world can be easily accessed by millions of client computers, also located throughout the world.

THE CLIENT/SERVER COMPUTING MODEL (Laudon and Traver, 2014:122)



2.6.10. The Mobile Platform

Currently, the primary means of accessing the Internet both and worldwide is through highly portable smartphones and tablet computers, and not traditional desktop or laptop PCs. This means that the primary platform for e-commerce products and services has to change to a mobile platform. The tablet PCs are supplementing PCs for use in mobile situations.

Smartphones are a disruptive technology that radically alters the personal computing and e-commerce landscape. The mobile platform has profound implications for e-commerce because it influences how, where, and when consumers shop and buy.

2.6.11. Cloud Computing

The growing bandwidth power of the Internet has pushed the client/server model one step further, towards what is called the "cloud computing model".

Cloud computing refers to a model of computing in which firms and individuals obtain computing power and software applications over the Internet, rather than purchasing the hardware and software and installing it on their own computers. Currently, cloud computing is the fastest growing form of computing,

Hardware firms such as IBM, HP, and Dell have built very large, scalable cloud computing centers that provide computing power, data storage, and high-speed Internet connections to firms that rely on the Internet for business software applications. Amazon, the Internet's largest retailer, is also one of the largest providers of cloud infrastructure and software services.

Software firms such as Google, Microsoft, SAP, Oracle, and Salesforce.com sell software applications that are Internet-based. Instead of software as a product, in the cloud computing model, software is a service provided over the Internet (referred to as SaaS—software as a service). For instance, Google claims there are around 40 million active users and 4 million businesses that use Google Apps, its suite of office software applications such as word processing, spreadsheets, and calendars, that users access over the Internet. More than 100,000 firms and organizations use Salesforce.com's customer relationship management software.

Microsoft, which in the past has depended on selling boxed software to firms and individuals, is adapting to this new marketplace with its own "cloud services" Azure.

Cloud computing has many significant implications for e-commerce. For e-commerce firms, cloud computing radically reduces the cost of building and operating Web sites because the necessary hardware infrastructure and software can be licensed as a service from Internet providers at a fraction of the cost of purchasing these services as products. This means firms can adopt "pay-as-you-go" and "pay-as-you-grow" strategies when building out their Web sites.

For individuals, cloud computing means you no longer need a powerful laptop or desktop computer to engage in e-commerce or other activities. Instead, you can use much less-expensive tablet computers or smartphones that cost a few hundred dollars.

For corporations, cloud computing means that a significant part of hardware and software costs (infrastructure costs) can be reduced because firms can obtain these services online for a fraction of the cost of owning, and they do not have to hire an IT staff to support the infrastructure. These benefits come with some risks: firms become totally dependent on their cloud service providers.

2.7. The Internet Backbone

Originally, the Internet had a single backbone, but today's Internet has several backbones that are physically connected with each other and that transfer information from one private network to another. These private networks are referred to as **Network Service Providers (NSPs)**, which own and control the major backbone Networks. For the sake of clarity we will refer to these networks of backbones as a single "backbone." The **backbone** has been likened to a giant pipeline that transports data around the world in milliseconds.

Bandwidth measures how much data can be transferred over a communications medium within a fixed period of time and is usually expressed in bits per second (bps), kilobits (thousands of bits) per second (Kbps), megabits (millions of bits) per second (Mbps), or gigabits (billions of bits) per second (Gbps).

Connections between continents are made via a combination of undersea fiber-optic cable and satellite links. The backbones in foreign countries typically are operated by a mixture of private and public owners. The backbone has built-in redundancy so that if one part breaks down, data can be rerouted to another part of the backbone. **Redundancy** refers to multiple duplicate devices and paths in a network.

2.7.1. Internet Exchange Points

In Kenya, there is a hub where the backbone intersects with regional and local networks, and where the backbone owners connect with one another. Such hubs are referred to as **Internet Exchange Points (IXPs)**. IXPs use high-speed switching computers to connect the backbone to regional and local networks, and exchange messages with one another. The regional and local networks are owned by private telecommunications firms; they generally are fiber-optic networks operating at more than 100 Mbps. The regional networks lease access to ISPs, private companies, and government institutions. Kenya's IXP is called Kenya Internet Exchange Point (KIXP), (read more at https://www.tespok.co.ke/?page_id=11648)

2.7.2. Internet Service Providers

The firms that provide the lowest level of service in the multi-tiered Internet architecture by leasing Internet access to home owners, small businesses, and some large institutions are called **Internet Service Providers (ISPs)**. ISPs are retail providers. They deal with "the last mile of service" to the curb—homes and business offices. ISPs typically connect to IXPs with fiber or wireless connections (45 Mbps and higher).
Major ISPs in Kenya are Safaricom, Wananchi (Zuku), Jamii Telecom (JTL or Faiba), Access Kenya and iWay.

There are two types of ISP service: narrowband and broadband. **Narrowband** service is the traditional telephone modem connection now operating at 56.6Kbps (although the actual throughput hovers around 30 Kbps due to line noise that causes extensive resending of packets). This used to be the most common form of connection worldwide but is quickly being replaced by broadband connections. **Broadband**, in the context of Internet service, refers to any communication technology that permits clients to play streaming audio and video files at acceptable speeds—generally anything above 100 Kbps.

2.7.3. Who Governs the Internet?

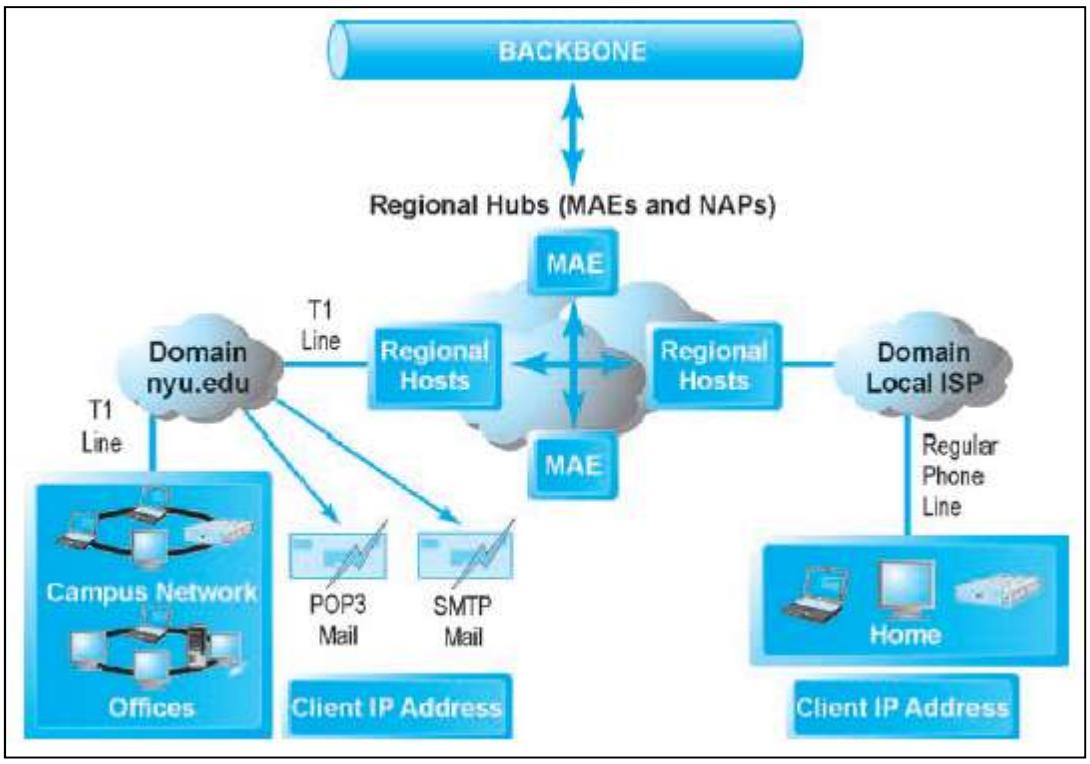
The Internet runs over private and public telecommunications facilities that are themselves governed by laws, and subject to the same pressures as all telecommunications carriers. In fact, the Internet is tied into a complex web of governing bodies, national governments, and international professional societies. There is no one single governing organization that controls activity on the Internet. Instead, there are a number of organizations that influence the system and monitor its operations. Among the governing bodies of the Internet are:

- The *Internet Corporation for Assigned Names and Numbers (ICANN)*, which coordinates the Internet's systems of unique identifiers: IP addresses, protocol parameter registries, and the top-level domain systems. ICANN was created in 1998 by the U.S. Department of Commerce.
- The *Internet Assigned Numbers Authority (IANA)*, which is based at ICANN and in charge of IP addresses.
- The *Internet Engineering Task Force (IETF)*, which is an open international community of network operators, vendors, and researchers concerned with the evolution of the Internet architecture and operation of the Internet. The IETF has a number of working groups, organized into several different areas, that develop and promote Internet standards, which influence the way people use and manage the Internet.
- The *Internet Research Task Force (IRTF)*, which focuses on the evolution of the Internet. The IRTF has a number of long-term research groups working on various topics such as Internet protocols, applications, applications, and technology.
- The *Internet Engineering Steering Group (IESG)*, which is responsible for technical management of IETF activities and the Internet standards process.
- The *Internet Architecture Board (IAB)*, which helps define the overall architecture of the Internet and oversees the IETF and IRTF.
- The *Internet Society (ISOC)*, which is a consortium of corporations, government agencies, and nonprofit organizations that monitors Internet policies and practices.
- The *Internet Governance Forum (IGF)*, which is a multi-stakeholder open forum for debate on issues related to Internet governance.
- The *World Wide Web Consortium (W3C)*, which is a largely academic group that sets HTML and other programming standards for the Web.
- The *Internet Network Operators Groups (NOGs),* which are informal groups that are made up of ISPs, IXPs, and others that discuss and attempt to influence matters related to Internet operations and regulation.

While none of these organizations has actual control over the Internet and how it functions, they can and do influence government agencies, major network owners, ISPs, corporations, and software developers with the goal of keeping the Internet operating as efficiently as possible. ICANN comes closest to being a manager of the Internet and reflects the powerful role that the U.S. Department of Commerce has played historically in Internet governance.

In addition to these professional bodies, the Internet must also conform to the laws of the sovereign nation-states in which it operates, as well as the technical infrastructures that exist within each nation-state. Although in the early years of the Internet there was very little legislative or executive interference, this situation is changing as the Internet plays a growing role in the distribution of information and knowledge, including content that some find objectionable.

INTERNET NETWORK ARCHITECTURE



(Laudon and Travers, 2014:129)

2.7.4. Fiber Optics and the Bandwidth Explosion in the First Mile

Fiber-optic cable consists of up to hundreds of strands of glass that use light to transmit data. It often replaces existing coaxial and twisted pair cabling because it can transmit much more data at faster speeds, with less interference and better data security. Fiber-optic cable is also thinner and lighter, taking up less space during installation.

Telecommunication firms have made substantial investments in fiber optic crosscountry and regional cable systems in the last decade. This installed base of fiber optic cable represents a vast digital highway that is currently being exploited by YouTube (Google), Facebook, and other high-bandwidth applications. Telecommunications companies are recapitalizing and building new business models based on market prices for digital traffic. The net result is that society ultimately benefited from extraordinarily lowcost, long-haul, very high-bandwidth communication facilities that are already paid for.

2.7.5. The Last Mile: Mobile Internet Access

Fiber-optic networks carry the long-haul bulk traffic of the Internet to the household and small business. But along with fiber optics, arguably the most significant development for the Internet and Web in the last five years has been the emergence of mobile Internet access. Wireless Internet is concerned with the last mile of Internet access to the user's home, office, car, smartphone, or tablet computer, anywhere they are located.

2.7.6. Telephone-based versus Computer Network-based Wireless Internet Access

There are two different basic types of wireless Internet connectivity: telephone-based and computer network-based systems.

Telephone-based wireless Internet access connects the user to a global telephone system (land, satellite, and microwave) that has a long history of dealing with thousands of users simultaneously and already has in place a large-scale transaction billing system and related infrastructure. Cellular telephones and the telephone industry are currently the largest providers of wireless access to the Internet today. In 2017, 1.54 billion smartphones were sold worldwide.

Worldwide Smartphone Sales to End Users by Vendor in 2017 (Thousands of Units)

Vendor	2017 Units	2017 Market Share (%)	2016 Units	2016 Market Share (%)
Samsung	321,263.3	20.9	306,446.6	20.5
Apple	214,924.4	14.0	216,064.0	14.4
Huawei	150,534.3	9.8	132,824.9	8.9
OPPO	112,124.0	7.3	85,299.5	5.7
Vivo	99,684.8	6.5	72,408.6	4.8
Others	638,004.7	41.5	682,915.3	45.7
Total	**1,536,535.5**	**100.0**	**1,495,959.0**	**100.0**

Source: Gartner (February 2018)

https://www.gartner.com/newsroom/id/3859963

Wireless local area network (WLAN)-based Internet access derives from a completely different background from telephone-based wireless Internet access. Popularly known as **Wi-Fi**, WLANs are based on computer local area networks where the task is to connect client computers (generally stationary) to server computers within local areas of, say, a few hundred meters. WLANs function by sending radio signals that are broadcast over the airwaves using certain radio frequency ranges (2.4 GHz to 5.875 GHz, depending on the type of standard involved). The major technologies here are the various versions of the Wi-Fi standard, WiMax, and Bluetooth.

In a Wi-Fi network, a *wireless access point* (also known as a "hot spot") connects to the Internet directly via a broadband connection (fiber or copper cable) and then transmits a radio signal to a transmitter/receiver installed in a laptop computer built-in at manufacture.

Will WLAN compete directly against far more expensive telephone 4G services? The answer is "eventually, but not right now." Wi-Fi was originally a local area network technology of limited range, for stationary client computers, but with high capacity suitable for most Web surfing and some corporate uses with modest bandwidth demands. Cellular phone systems are wide area networks of nearly unlimited range, for mobile client computers and handhelds, and with modest but rapidly increasing capacity suitable for e-mail, photos, and Web browsing.

2.8. The Internet of Things

No discussion of the future Internet would be complete without mentioning the **Internet of Things (IoT)**. Internet technology is spreading beyond the desktop, laptop, and tablet computer, and beyond the smartphone, to consumer electronics, electrical appliances, cars, medical devices, utility systems, machines of all types, even clothing—just about anything that can be equipped with sensors that collect data and connect to the Internet, enabling the data to be analyzed with data analytics software. The Internet of Things builds on a foundation of existing technologies, such as RFID, and is being enabled by the availability of low-cost sensors, the drop in price of data storage, the development of "Big Data" analytics software that can work with trillions of pieces of data, as well as implementation of IPV6, which will allow Internet addresses to be assigned to all of these new devices.

3.0. The Web

Without the Web, there would be no e-commerce. The invention of the Web brought an extraordinary expansion of digital services to millions of amateur computer users, including color text and pages, formatted text, pictures, animations, video, and sound. In short, the Web makes nearly all the rich elements of human expression needed to establish a commercial marketplace available to nontechnical computer users worldwide. While the Internet was born in the 1960s, the Web was not invented until 1989– 1991 by Dr. Tim Berners-Lee of the European Particle Physics Laboratory, better known as CERN (Berners-Lee et al., 1994). Several earlier authors—such as Vannevar Bush (in 1945) and Ted Nelson (in the 1960s)—had suggested the possibility of organizing knowledge as a set of interconnected pages that users could freely browse (Bush, 1945; Ziff Davis Publishing, 1998). Berners-Lee and his associates at CERN built on these ideas and developed the initial versions of HTML, HTTP, a Web server, and a browser, the four essential components of the Web.

First, Berners-Lee wrote a computer program that allowed formatted pages within his own computer to be linked using keywords (hyperlinks). Clicking on a keyword in a document would immediately move him to another document. Berners-Lee created the pages using a modified version of a powerful text markup language called Standard Generalized Markup Language (SGML). Berners-Lee called this language HyperText Markup Language, or HTML. He then came up with the idea of storing his HTML pages on the Internet. Remote client computers could access these pages by using HTTP.

Information being shared on the Web remained text-based until 1993, when Marc Andreessen and others at the National Center for Supercomputing Applications (NCSA) at the University of Illinois created a Web browser with a graphical user interface (GUI) called **Mosaic** that made it possible to view documents on the Web graphically—using colored backgrounds, images, and even primitive animations. Mosaic was a software program that could run on any graphically based interface such as Macintosh, Windows, or Unix. The Mosaic browser software read the HTML text on a Web page and displayed it as a graphical interface document within a GUI operating system such as Windows or Macintosh. Liberated from simple black and white text pages, HTML pages could now be viewed by anyone in the world who could operate a mouse and use a Macintosh or PC.

In 1994, Andreessen and Jim Clark founded Netscape, which created the first commercial browser, **Netscape Navigator**. Although Mosaic had been distributed free of charge, Netscape initially charged for its software. In August 1995, Microsoft Corporation released its own free version of a browser, called **Internet Explorer**. In the ensuing years, Netscape fell from a 100% market share to less than .5% in 2009. The fate of Netscape illustrates an important e-commerce business lesson. Innovators usually are not long-term winners, whereas smart followers often have the assets needed for long-term survival. Much of the Netscape browser code survives today in the Firefox browser produced by Mozilla, a nonprofit heavily funded by Google.

3.1. Hypertext

Web pages can be accessed through the Internet because the Web browser software on your PC can request Web pages stored on an Internet host server using the HTTP protocol. **Hypertext** is a way of formatting pages with embedded links that connect documents to one another and that also link pages to other objects such as sound, video, or animation files. When you click on a graphic and a video clip plays, you have clicked on a hyperlink. For example, when you type a Web address in your browser such as http://www.sec.gov, your browser sends an HTTP request to the sec.gov server requesting the home page of sec.gov.

HTTP is the first set of letters at the start of every Web address, followed by the domain name. The domain name specifies the organization's server computer that is housing the document. Most companies have a domain name that is the same as or closely related to their official corporate name. The directory path and document name are two more pieces of information within the Web address that help the browser track down the requested page. Together, the address is called a Uniform Resource Locator, or URL. When typed into a browser, a URL tells it exactly where to look for the information. For example, in the following URL: http://www.megacorp.com/content/features/082602.html http = the protocol used to display Web pages www.megacorp.com = domain name content/features = the directory path that identifies where on the domain Web server the page is stored 082602.html = the document name and its format (an HTML page)

3.2. Markup Languages

Although the most common Web page formatting language is HTML, the concept behind document formatting actually had its roots in the 1960s with the development of Generalized Markup Language (GML).

3.2.1. HyperText Markup Language (HTML)

HyperText Markup Language (HTML) is a GML that is relatively easy to use. HTML provides Web page designers with a fixed set of markup "tags" that are used to format a Web page. When these tags are inserted into a Web page, they are read by the browser and interpreted into a page display. You can see the source HTML code for any Web page by simply clicking on the "Page Source" command found in all browsers.

HTML defines the structure and style of a document, including the headings, graphic positioning, tables, and text formatting. Since its introduction, the major browsers have continuously added features to HTML to enable programmers to further refine their page layouts. Unfortunately, some browser enhancements may work only in one company's browser. Whenever you build an e-commerce site, you should take care that the pages can be viewed by the major browsers, even

outdated versions of browsers. HTML Web pages can be created with any text editor, such as Notepad or WordPad, using Microsoft Word (simply save the Word document as a Web page), or any one of several Web page development tools such as Microsoft Expression Web or Adobe Dreamweaver.

The most recent version of HTML is HTML5. HTML5 introduces features like video playback and drag-and-drop that in the past were provided by plug-ins like Adobe Flash. HTML5 applications have many of the rich interactive features found in smartphone apps.

3.2.2. eXtensible Markup Language (XML)

eXtensible Markup Language (XML) takes Web document formatting a giant leap forward. XML is a markup language specification developed by the W3C that is similar to HTML, but has a very different purpose. Whereas the purpose of HTML is to control the "look and feel" and display of data on the Web page, XML is designed to describe data and information.

3.3. Web Servers and Clients

We have already described client/server computing and the revolution in computing architecture brought about by client/server computing. You already know that a server is a computer attached to a network that stores files, controls peripheral devices, interfaces with the outside world—including the Internet—and does some processing for other computers on the network.

But what is a Web server? **Web server software** refers to the software that enables a computer to deliver Web pages written in HTML to client computers on a network that request this service by sending an HTTP request. The two leading brands of Web server software are Apache, which is free Web server shareware that accounts for about 52% of the market, and Microsoft's Internet Information Services (IIS), which accounts for about 20% of the market (Netcraft, 2013).

Aside from responding to requests for Web pages, all Web servers provide some additional basic capabilities such as the following:

- *Security services*—These consist mainly of authentication services that verify that the person trying to access the site is authorized to do so. For Web sites that process payment transactions, the Web server also supports SSL and TLS, the protocols for transmitting and receiving information securely over the Internet. When private information such as names, phone numbers, addresses, and credit card data needs to be provided to a Web site, the Web server uses SSL to ensure that the data passing back and forth from the browser to the server is not compromised.
- *FTP*—This protocol allows users to transfer files to and from the server. Some sites limit file uploads to the Web server, while others restrict downloads, depending on the user's identity.
- *Search engine*—Just as search engine sites enable users to search the entire Web for particular documents, search engine modules within the basic Web server software package enable indexing of the site's Web pages and content and permit easy keyword searching of the site's content. When conducting a search, a search engine makes use of an index, which is a list of all the documents on the server. The search term is compared to the index to identify likely matches.
- *Data capture*—Web servers are also helpful at monitoring site traffic, capturing information on who has visited a site, how long the user stayed there, the date and time of each visit, and which specific pages on the server were accessed. This information is compiled and saved in a log file, which can then be analyzed. By analyzing a log file, a site manager can find out the total number of visitors, the average length of each visit, and the most popular destinations, or Web pages.

The term *Web server* is also used to refer to the physical computer that runs Web server software. Leading manufacturers of Web server computers include IBM, Dell, and Hewlett-Packard. Although any personal computer can run Web server software, it is best to use a computer that has been optimized for this purpose. To be a Web server, a computer must have the Web server software installed and be connected to the Internet. Every public Web server computer has an IP address.

Aside from the generic Web server software packages, there are actually many types of specialized servers on the Web, from **database servers** that access specific information within a database, to **ad servers** that deliver targeted banner ads, to **mail servers** that provide e-mail messages, and **video servers** that provide video clips. At a small e-commerce site, all of these software packages might be running on a single computer, with a single processor. At a large corporate site, there may be hundreds or thousands of discrete server computers, many with multiple processors, running specialized Web server functions.

A **Web client**, on the other hand, is any computing device attached to the Internet that is capable of making HTTP requests and displaying HTML pages. The most common client is a Windows or Macintosh computer, with various flavors of Unix/ Linux computers a distant third. However, the fastest growing category of Web clients are not computers at all, but smartphones, tablets, and netbooks outfitted with wireless Web access software. In general, Web clients can be any device—including a printer, refrigerator, stove, home lighting system, or automobile instrument panel—capable of sending and receiving information from Web servers.

3.4. Web Browsers

A Web browser is a software program whose primary purpose is to display Web pages. Browsers also have added features, such as e-mail and newsgroups (an online discussion group or forum). Common Web browsers include Mozilla Firefox, Microsoft Internet Explorer, Apple Safari and Google Chrome.

3.4.1. Leading Web Features and Services

1. Email.
2. Instant Messaging (Skype)
3. Search Engines
4. Online forums and chat
5. Streaming media
6. Cookies: a tool used by a Web site to store information about a user. Cookies are useful to consumers because the Web site will recognize returning patrons and not ask them to register again. Cookies are also used by advertisers to ensure visitors do not receive the same advertisements repeatedly. Cookies can also help personalize a Web site by allowing the site to recognize returning customers and make special offers to them based on their past behaviour at the site. Cookies allow Web marketers to customize products and segment markets—the ability to change the product or the price based on prior consumer information.

3.4.2. Web 2.0 Features and Services

Today's broadband Internet infrastructure has greatly expanded the services available to users. These new capabilities have formed the basis for new business models. Digital content and

digital communications are the two areas where innovation is most rapid. Web 2.0 applications and services are "social" in nature because they support communication among individuals within groups or social networks.

1. Online Social Networks: Facebook, LinkedIn, Twitter, and others
2. Blogs
3. Really Simple Syndication (RSS)
4. Podcasting
5. Wiki: a Web application that allows a user to easily add and edit content on a Web page.
6. Music and video services
7. Internet telephony
8. Video Conferencing, Video Chatting, and Telepresence
9. Online Software and Web Services: Web Apps, Widgets, and Gadgets
10. Intelligent Personal Assistants: a software agent that can perform tasks or services for an individual. Examples: Google now, Siri,

3.5. Mobile Apps

Mobile capabilities include making sure Web sites are compatible with mobile browsers, are optimized for use on various devices (discussed further in Chapter 4), and provide downloadable mobile apps. Although both are important, right now, mobile apps appear to be attracting most of the attention. According to Nielsen, in March 2013, smartphone users spent 87% of their time using mobile apps, and only 13% of their time using the mobile Web. iPad users showed a similar pattern: 76% of their time was spent using mobile apps and only 24% of their time was spent using the mobile Web (Nielsen, 2013).

The app phenomenon, popular on all mobile operating system platforms, has spawned a new digital ecosystem: tens of thousands of developers, a wildly popular hardware platform, and millions of consumers looking for a computer in their pocket that can replace their now clunky desktop/laptop.

The implications of the app ecosystem for e-commerce are significant. The smartphone in your pocket becomes not only a general-purpose computer, but also an always-present shopping tool for consumers, as well as an entirely new marketing and advertising platform for vendors.

3.5.1. Platforms for Mobile Application Development

Unlike mobile Web sites, which can be accessed by any Web-enabled mobile device, apps are platform-specific. Applications for the iPhone, iPad, and other iOS devices are written in the Objective-C programming language using the iOS SDK (software developer kit).

Applications for Android operating system–based phones typically are written using Java, although portions of the code may be in the C or C++ programming language. Applications for Windows mobile devices are written in C or C++.

3.5.2. App Marketplaces

Once written, applications are distributed through various marketplaces. Android apps for Android-based phones are distributed through Google Play, which is controlled by Google. iPhone applications are distributed through Apple's App Store. Microsoft operates the Windows Phone Marketplace for Windows mobile devices. Apps can also be purchased from third-party vendors such as Amazon's Appstore. It is important to distinguish "native" mobile apps, which run directly on a

mobile device and rely on the device's internal operating system, from Web apps, which install into your browser, although these can operate in a mobile environment as well.

WORLD INTERNET USAGE AND POPULATION STATISTICS
DEC 31, 2017 - Update

World Regions	Population (2018 Est.)	Population % of World	Internet Users 31 Dec 2017	Penetration Rate (% Pop.)	Growth 2000-2018	Internet Users %
Africa	1,287,914,329	16.9 %	453,329,534	35.2 %	9,941 %	10.9 %
Asia	4,207,588,157	55.1 %	2,023,630,194	48.1 %	1,670 %	48.7 %
Europe	827,650,849	10.8 %	704,833,752	85.2 %	570 %	17.0 %
Latin America / Caribbean	652,047,996	8.5 %	437,001,277	67.0 %	2,318 %	10.5 %
Middle East	254,438,981	3.3 %	164,037,259	64.5 %	4,893 %	3.9 %
North America	363,844,662	4.8 %	345,660,847	95.0 %	219 %	8.3 %
Oceania / Australia	41,273,454	0.6 %	28,439,277	68.9 %	273 %	0.7 %
WORLD TOTAL	7,634,758,428	100.0 %	4,156,932,140	54.4 %	1,052 %	100.0 %

NOTES: (1) Internet Usage and World Population Statistics estimates in Dec 31, 2017. (2) CLICK on each world region name for detailed regional usage information. (3) Demographic (Population) numbers are based on data from the United Nations Population Division. (4) Internet usage information comes from data published by Nielsen Online, by the International Telecommunications Union, by GfK, by local ICT Regulators and other reliable sources. (5) For definitions, navigation help and disclaimers, please refer to the Website Surfing Guide. (6) The information from this website may be cited, giving the due credit and placing a link back towww.internetworldstats.com.

https://www.internetworldstats.com/stats.htm

Compiled from:

1. Laudon, K.C. and Traver, C.G. (2014). E-commerce 2014 - Business, Technology, Society. 10th edition. Pearson. Chapter 3. Retrieved from: https://files.pearsoned.de/ps/toc/9781292009131