Module 3

Infrastructure for Electronic Commerce - E-Service Implementation and Support

Introduction

As you saw in earlier modules, the Internet is the foundation of e-commerce. As an e-business manager, therefore, you need to have a basic understanding of its infrastructure and operations. While it is unlikely that you will be programming your organisation's site, you will — as a manager, decision maker, or owner of your own business — need to talk with professionals and get advice from technical staff. For this reason you need to know the vocabulary of their trade and to understand the basic makeup of the Internet. Only in this way will you know what can be done and what cannot be done. It will also help to keep you from expensive mistakes — we all have a tendency to buy toys that look good, but when we are talking about Internet technologies and strategies, these can be expensive playthings and only to be bought if we can get our money's worth from them.

In order to make informed decisions about e-commerce issues, you need to be familiar with Internet and telecommunications terminology and technology. You will have the opportunity to study the technical issues in other courses, if your talents lie in that direction. This module aims to show you the key elements of the Internet that are essential to the management of e-business, and to provide you with enough background knowledge to get the best out of your e-commerce operation and deal with its limitations.

We start Module 3 by looking at the Internet's physical infrastructure, and then moving on to consider the World Wide Web. We will also include a discussion of the domain names that identify every website. You then move to the application level in which the Internet is perceived in a client/server model. Finally, you are introduced to the technologies that enable the interactive functions of the Internet, which essentially make e-commerce transactions happen. Module 4 will take an in-depth look at business-to-business and business-to consumer models of e-commerce respectively. This is not because they use different elements of the Internet, but because their emphasis on the tools available, as well as the scale on which they deploy them, is so different.

Upon completion of this module you will be able to:

Outcomes

- *describe* the structure of the Internet and indicate the speed of its development.

- *discuss* the World Wide Web.

- *explain* domain names and their registration.

- *describe* client/server applications and their application on the Internet.

- *explain* how your business can use email to effect positive results.

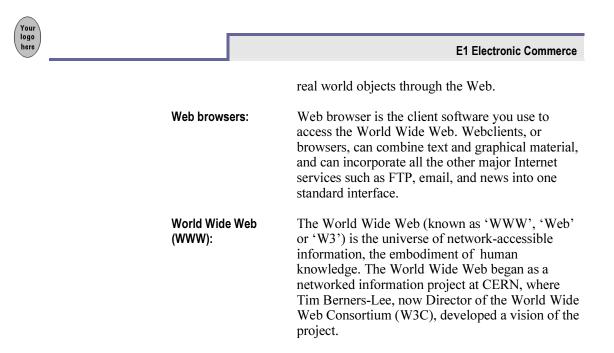- *describe* the use of various www development languages.

Terminology

Terminology

Hypertext Mark-up Language (HTML):	The language used to create Web pages. Documents are stored on Web servers as pages (or frames) of text containing HTML tags. Tags are used in order to define a document's structure.
IP address:	An address that uniquely identifies each computer connected to a network or the Internet. IP address is a unique 32-bit binary number representing just one resource on the Internet, at any given time. These global addresses are assigned by one of three Regional Internet Registries (RIRs) worldwide that collectively provide IP registration services to all regions around the globe.
Uniform Resource Locator (URL):	The addressing scheme used to locate documents on the Web. A URL may represent the site of a Web page or of a file stored in that site. It has the following format:<protocol>://<domain name>/<path>/<file name> You often find 'http' as the name of the protocol at the beginning of a URL. It stands for 'Hypertext Transfer Protocol', which is the most popular protocol on the Internet, and the one used when you visit Web pages.
Virtual reality (VR):	Virtual reality (VR) is primarily a real-time graphics and animation technology that creates environments that seem as real as the world of nature. Through the combination of sensing and interface devices and software, VR systems provide direct interaction with computer generated models, allowing users to experience simulated

real world objects through the Web.

Web browsers: Web browser is the client software you use to access the World Wide Web. Webclients, or browsers, can combine text and graphical material, and can incorporate all the other major Internet services such as FTP, email, and news into one standard interface.

World Wide Web (WWW): The World Wide Web (known as 'WWW', 'Web' or 'W3') is the universe of network-accessible information, the embodiment of human knowledge. The World Wide Web began as a networked information project at CERN, where Tim Berners-Lee, now Director of the World Wide Web Consortium (W3C), developed a vision of the project.

The Internet as a network

As a start up activity for this module, visit one of the most famous online shopping sites — the Amazon bookshop, at **www.amazon.com** if you have not already done so. **Figure 3.1** gives you an idea of what is happening when a customer arrives on the scene to buy a book.

Figure 3.1: Online purchasing process (www.amazon.com)

Once a customer has accessed the site, they can browse through the online shopping catalogue and decide what to buy. Having loaded (added items to) their shopping basket, they click on the payment button. A payment Web page pops up requesting credit card information and the amount to be paid. After confirmation, the payment information is sent to the purchaser's bank through the bank's payment gateway. Payment information is processed when the bookstore's bank account is credited and the credit card account is debited. At the same time, the order information is sent to the bookstore's logistics centre, after which time the items that have been ordered are delivered. All the transactions in this process are automatic, and the majority of the transaction messages are

transmitted through the Internet, which, as you probably know, is 'a network of networks'. Let's review what that means.

The physical infrastructure of the Internet

The Amazon website is physically located on a computer called a server. Well, strictly speaking, since thousands of people are using the online bookstore (the 'system') at any one time, the system is spread over many servers. (You may have heard a technical person say, 'One of the servers is down' – but we will explain servers in more detail later). As you know, your computer does not connect with the Internet directly. It will link either into your telephone circuit, via a cable (optical link) or even through a satellite dish to get to the local supplier who links you (and hundreds of others) into an Internet connection. The company which links you to the Internet – either directly or by passing your message traffic on to a bigger company which collects from many like your supplier — is called an Internet Service Provider(ISP). (**Note**: Each Internet user will have an ISP, which reveals their geographical location within the world).

We are starting to use a number of technical terms now, so as you work through this module you may find it useful to note any terminology that you are not familiar with or could not give a definition for. You can then use Google to search for the definition and so build your own glossary of terms.

Connecting to the Internet

The core, or essential wholesale movement of information on the Internet, happens along major high-speed highways known as backbones. These are paid for by the U.S. government, some large Internet Service Providers (ISPs), and telecommunication companies. These backbones are connected to private and government-sponsored Network Information Centres (NICs), which obtain assistance from an international organisation, the InterNIC (Internet Network Information Centre). Start adding these terms to your glossary. ISPs maintain permanent connections to Internet backbones. They sell temporary connections to corporate and individual users, who access them through telephone lines. If you have a PC, a modem, and a phone line, you can subscribe to an ISP, which will give you access to the Internet. You will note that there are many ways of displaying the data and many maps to play with. Within the U.S. experimental networks are testing the way for even more powerful and faster backbones for the next generation of network services. The Internet is growing so fast that it is impossible to keep visual presentations of it up to date. Connection speeds are also increasing all the time, as is the number of Internet users.

Table 3.1

World Internet Usage And Population Statistics						
World Regions	**Population (2009 Est.)**	**Internet Users (Dec. 31, 2000)**	**Internet Users Latest Data (2009)**	**Penetration (Population %)**	**(Growth %)**	**Users % percentage**
Africa	991,002,342	4,514,400	86,217,900	8.7	1,809.8	4.8
Asia	3,808,070,503	114,304,000	764,435,900	20.1	568.8	42.4
Europe	803,850,858	105,096,093	425,773,571	53.0	305.1	23.6
Middle East	202,687,005	3,284,800	58,309,546	28.8	1,675.1	3.2
North America	340,831,831	108,096,800	259,561,000	76.2	140.1	14.4
Latin America / Caribbean	586,662,468	18,068,919	186,922,050	31.9	934.5	10.4
Oceania / Australia	34,700,201	7,620,480	21,110,490	60.8	177.0	1.2
TOTAL WORLD	**6,767,805,208**	**360,985,492**	**1,802,330,457**	**26.6**	**399.3**	**100.0**

Source: Internet World Stats, 2009

Table 3.2 shows Pakistan Internet usage and population statistics.

Table 3.2

YEAR	Users	Population	% Pen.	GDP p.c.*
2000	133,900	163,985,373	0.1 %	N/A
2006	12,000,000	167,806,831	7.2 %	US$ 821
2009	18,500,000	174,578,558	10.6 %	US$ 1,017
2010	18,500,000	177,276,594	10.4 %	US$ 1,068

Note: Per Capita GDP in U.S. dollars

Source: International Monetary Fund.

NOTES:

1) Internet Usage and World Population Statistics are for December 31, 2009 from http://www.internetworldstats.com/stats.htm

2) Demographic (Population) numbers are based on data from the US Census Bureau .

3) Internet usage information comes from data published by Nielsen Online, by the International Telecommunications Union, by GfK, local Regulators and other reliable sources.

4) For definitions, disclaimer, and navigation help, please refer to the Site Surfing Guide.

5) Information in this site is cited, giving the due credit to www.internetworldstats.com.

The Web

People tend to use terms 'Internet' and 'Web' interchangeably, but as you know, they are not the same. Putting it simply, the Internet is the network of networks. The Web consists of all the pages of information that can be transmitted through that network. The World Wide Web Consortium (W3C) describes the Web and its origins as follows.

> The World Wide Web (known as 'WWW', 'Web' or 'W3') is the universe of network-accessible information, the embodiment of human knowledge. The World Wide Web began as a networked information project at CERN, where Tim Berners-Lee, now Director of the World Wide Web Consortium (W3C), developed a vision of the project. The Web has a body of software, and a set of protocols and conventions. Through the use of hypertext and multimedia techniques, the Web is easy for anyone to roam, browse, and contribute to.

The Internet supports several other services, such as email, newsgroups and File Transfer Protocol (FTP). Apart from email, the Web has become the most used of these services. It is now difficult not to be aware of the increasingly widespread usage and awareness of the World Wide Web (WWW, the Web) in all aspects of information, storage, and retrieval. Increasingly, it is being used to conduct business with consumers, or electronic commerce as it has become known. For example, you will have noticed that press advertisements, and the packaging for nearly every food item, now contain the address of the advertiser's website. Anyone can use the Web provided they have access, and its increasing popularity and the realisation that the Web is a place to make money has contributed to its explosive growth in the last few years.

Activity 3.1

Activity

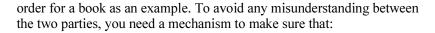**Internet transmission**

Visit

http://www.cuhk.edu.hk/hkix

and find how it facilitates local Hong Kong Internet traffic.

Also visit the website of Digital Internet Exchange in Palo Alto at
http://www.bgp4.as/internet-exchanges

for further information on how this technology works.

You know that the Internet is a network, and that your computer connects to it via an ISP, which provides a gateway to one of the backbones. But how is the data actually transferred from your computer to Amazon, and how does it come back again (when your order is confirmed)? How do all computers on all networks communicate with each other? Let's take your

order for a book as an example. To avoid any misunderstanding between the two parties, you need a mechanism to make sure that:

- The language and computer characters that symbolise the words are sent and received by the other computer in their exact form;

- Both parties know the timing and sequencing of the message; and

- There is a way to detect and correct errors, if they arise.

You also want your message to be moved as quickly as possible. This may mean that it has to be broken up into several 'packets', each of which may go a different route. At the other end, our mechanism has to ensure that the 'packets' are reassembled in the right order. Such a mechanism is known as a protocol — a set of conventions agreed on by all networks so they can communicate. The International Standard Organisation (ISO) has formulated a model for most communication protocols. There are many protocols, but the only one we will mention for now is TCP/IP (Transmission Control Protocol/Internet Protocol), which carries out all the functions we have just discussed.

Website location

IP addresses

Millions of computers are connected to the Internet. For users to find each other they each need to have an individual address, just as you need a home address to locate the home of a person you want to visit. As you learned in the last section, the protocol ensuring that messages arrive in one piece and in the right order is known as TCP/IP. Internet addresses are known as IP addresses and look like this:

123.152.91.59.

This is known as dotted quad addressing — four numbers separated by full stops or dots. Each of the four numbers represents eight bits and may range from 0 to 255. The IP address is actually in two parts. One relates to the network of which the computer is a part. This is the Internet network number, which is allocated to an organisation by the Network Information Centre (NIC) when it first joins the Internet. The other part of the address is unique to the machine that is sending or receiving the message.

A global, static IP address is a unique 32-bit binary number representing just one resource on the Internet, at any given time. These global addresses are assigned by one of three Regional Internet Registries (RIRs) worldwide that collectively provide IP registration services to all regions around the globe. The American Registry for Internet Numbers (ARIN) covers IP addresses in the geographic areas of North America, South America, the Caribbean, and sub-Saharan Africa. APNIC (Asia Pacific Network Information Centre) and RIPE (Roseau IP Europeans) cover their own specific regions.

An IP address' 32-bit binary number is actually made up of four bytes of information, and each byte can be represented by an eight-bit binary number or octet. Since we find it easier to read and write numbers using digits from 0 to 9 instead of giant binary numbers consisting of just ones and zeroes, IP addresses are expressed as four decimal numbers, each separated by a dot. This format is called dotted-decimal notation. The IP address is also called a dot address, because periods are used to separate four sets of decimal numbers, each between 0 and 255,representing all 256 possible combinations of eight bits (00000000 through 11111111). Each of the decimal numbers is called a —quad because four of them make up the IP address. Thus, an IP address is also sometimes called a dotted quad.
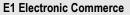
When you type in or click on a link such as www.microsoft.com, that domain name(www.microsoft.com) has no meaning for your computer, but its associated IP address is a different matter it is what's used to connect your browser with the Microsoft site. Thus, when you input www.microsoft.com, your computer sends a message to a DNS server on the Internet for the Microsoft website's IP address, and that 32-bit binary number is used to connect your browser with the Microsoft site.

There are millions of computers, millions of websites, and millions of IP addresses. It's easy to see how the DNS simplifies using the Internet through the exchange of a familiar string of letters (the domain name) for an arcane IP address. So instead of typing 216.239.51.99, you can type, www.google.com, to reach the popular search engine website. In the final analysis, the Domain Name System was established to provide a mnemonic device that makes it easier for people to remember Internet addresses.

Figure 3.2: Screenshot of website

As you can imagine, having to record or remember all the IP addresses you have to use would be a huge chore. Words are easier to remember than numbers, so every IP address has a text-based domain name. You're already familiar with domain names. The domain name of the Common

Wealth of Learning Web server, for example, is: **http://www.col.org**. You can see that in structure this is similar to the IP address, in that it has segments separated by dots. However, domain names are much more meaningful. For example, in **figure 3.2** you can see 'www' and this tells you it's a website; 'COL' tells you the name of the organisation; 'org' tells you it is an organisation, rather than a business (usually indicated as .com or .biz).

Furthermore, the suffix 'edu' tells you that it's an educational institution and there is no country code afterward which would identify a country, which implies that it was registered in the U.S. When the system of domain names began, the only Internet users were in the U.S. as it was purely a domestic product — so there was no need for a country code. As the system spread, nobody faced up to the enormous task of persuading all registrations without a country code to adopt one. All email addresses at the COL end in @COL.org, so you can often guess the domain name of a website by the information in the last part of an email address (it's usually the same).Now let's go on to see how you locate the specific Web pages that you want.

Activity 3.2

Activity

IP address

Visit Lawrence Goetz's site **www.lawrencegoetz.com/programs/ipinfo/** to find your own IP address.

Scroll down to read Goetz's explanation of IP addresses. If you are connected to the Internet through an organisation's LAN (Local Area Network) such as the one in your workplace, you will be assigned a fixed IP address (in fact it is the PC you are using that has been assigned a fixed IP address).

If you are connected through a modem dial-up, such as when you are at home, your ISP will assign you with a dynamic IP address. It will be different every time you sign on. You don't need to know much more about IP addresses.

The main point to realise is that when a message is sent, each packet contains the IP addresses of both the sender and recipient. This is how the complete message arrives at its destination (most of the time). In theory, the maximum number of computers that can be connected to the Internet is 256, which is approximately four billion. However, in reality, a much smaller number of valid IP addresses are available, because many organisations already control a large number of IP addresses that they don't use.

Note it!

Most of today's Internet still uses IPv4 (Internet Protocol version4), which is now nearly 20 years old. IPv4 has been remarkably resilient in spite of its age, but it is beginning to have problems. Most importantly, there is a growing shortage of IPv4addresses, which are needed by all new machines added to the Internet. IPv6 fixes a number of problems in IPv4, such as the limited number of available IPv4 addresses. It also adds many improvements to IPv4 in areas such as routing and network auto configuration.

IPv6 is expected to gradually replace IPv4, with plans for the two to coexist for a number of years during a transition period. Many common Internet applications already work with IPv6, and more are being ported (Ported is a techie word for being moved over transferred or carried). Some introductory information about the protocol can be found at:

http://arstechnica.com/gadgets/2007/03/ipv6/

Domain names

Let's first look at choosing a Web address also known as domain name. A domain name is your Web business's cyber address — it's also known as your site's URL (Uniform Resource Locator).You've no doubt seen the many dot-com advertisements — www.[name].com (or .org or .net).That is a domain name or Web address. It's how the public will find your Web-business unless you have opted for the cyber mall concept. While you can choose just about any combination of words or numbers for your domain name, we recommend a catchy, easy-to-remember name that can serve to quickly evoke your business and/or the products and services it offers. Come up with several options. In your quest for the perfect domain name remember: Your online business depends on the customer correctly typing your URL so the shorter the better. And please, don't put your entire name or your company's name in the address. No one wants to input www.the-one-and-only-genuine-original-widget-company.com. Find something simple. If your brick-and-mortar business has a well-known name that is already branded, re-enforce that brand online, don't create an entirely new Web name. Remember that brands are expensive to promote, particularly new ones.

Think twice before you use Web or.com in your name. Yes, we know .com is probably part of your URL but it is not necessarily part of your name, which will, by necessity, be branded. Why? Because technology and the growth of the Internet are moving at breakneck speed and these will, in the future, appear stale and dated. In the new world of fast moving technology your business should always present the image of being on the cutting edge. Competition for rights to domain names has exploded. Many people and companies have registered not only the domain names they use, but names they think may be valuable in the future. Check the Network Solutions' whois directory (**www.networksolutions.com/cgi-bin/whois/whois**) to see if your chosen domain name is available. If your ideal domain name isn't available, you might consider contacting the owner of that particular domain name to try to purchase the rights.

Once you have chosen your domain name / web address / URL, the next step is to register it so you can have an exclusive home for your online business. Registering your chosen domain name with a domain registration site ensures that you own that specific Web address; at least as long as you continue to renew your ownership by paying the required annual fee. The process itself is easy, but there is much you need to know to begin this process.

- First, understand the Internet's system, known as the Domain Name System, which keeps track of the millions of computers that are connected to its byways. The Domain Name System (DNS) allows data packets to find their way to their destination.

- Every computer on the Internet has a unique address called an IP address (IP stands for Internet Protocol). But that address is a rather complicated string of numbers, which is hard for the average person to remember.

Uniform Resource Locator (URL)

A browser locates a Web page by using its Uniform Resource Locator (URL). A URL may represent the site of a Web page or of a file stored in that site. It has the following format:

<protocol>://<domain name>/<path>/<file name>

You often find 'http' as the name of the protocol at the beginning of a URL. It stands for 'Hypertext Transfer Protocol', which is the most popular protocol on the Internet, and the one used when you visit Web pages. (Examples of other protocols are: when you do a file transfer, the protocol is 'ftp'; when you want to perform a remote logon, it's telnet.) The rest of the URL is made up of strings of characters separated by full stops and slashes.

The URL also represents a path by which the browser can find the file specified at the end of the URL. These systems organise their files in a hierarchical structure like a directory, and they use a slash '/' to separate directories.

Sometimes the file name at the end of the URL is omitted, if the URL is used to refer to the default page, called the home page of the website. The home page is the first page a visitor will see and is usually named as either 'welcome.htm' or 'index.htm' (or '. html'). Moreover, the path length varies. If the browser goes to an organisation's home page, then the URL will just be the domain name.

DNS

As you saw in the analysis of the COL domain, the word groups in a domain name represent the portion of the Internet, the name of the organisation, its business type and geographical location. The latter two are usually called the generic Top-Level Domain (gTLD) and (country

code) Top-Level Domain (ccTLD) respectively. They are assigned by the TLD naming authority to various regions around the world.

Top Level Domain System (TLD)

To understand the Top Level Domain (TLD) system, you must grasp the role that the Internet Corporation for Assigned Names and Numbers (ICANN) plays as the technical coordination body for the Internet. As such, ICANN provides a global forum for developing policies for the coordination of some of the Internet's core technical elements, including the Domain Name System (DNS). This non-profit organisation operates on the basis of consensus, with affected stakeholders coming together to formulate coordination policies for the Internet's core technical elements in the public interest. The policies are then implemented by the agreement of the operators of the core elements, including generic Top Level Domains (gTLDs) registry operators and sponsors, country-code Top Level Domains (ccTLDs) managers, regional Internet (IP address) registries, and root-name server operators.

Originally, the agreement to implement coordinated policies for the Internet was informal. But, as the Internet grew in commercial importance, operators and users of the Internet concluded that a more formal set of written agreements must be established. One of ICANN's activities is to work with the other organisations involved in the Internet's technical coordination to document their participatory role within the ICANN process and their commitments to implement the policies that result. These have included agreements with Network Solutions (now VeriSign),which operates the .com and .net gTLDs; the companies responsible for operating the unsponsored TLDs (.biz, .info, and .name); the organisations sponsoring the sponsored TLDs (.aero, .coop, and .museum); Public Interest Registry, which operates the .org gTLDs; more than 150 ICANN-accredited registrars; the regional Internet registries; and the Internet Engineering Task Force.

Let's look more closely at the Top Level Domain system. There are several types of Top Level Domains (TLDs) within the Domain Name System.

Table 3.3: gTLD and ccTLD

gTLD	Business type	ccTLD	Country
.com	Commercial	.au	Australia
.edu	Educational	.ca	Canada
.gov	Government	.cn	China
.int	International treaty organisation	.de	Germany
		.hk	Hong Kong SAR
.mil	Military	.jp	Japan
.net	Network service	.tw	Taiwan
.org	Non-profit organisation	.uk	United Kingdom
		.us	United States

The TCP/IP protocol can convert a domain name into an IP address (or vice versa) in a process called 'resolution'. This is mainly the responsibility of the Domain Name Service (DNS) program within the TCP/IP suite. The master table of domain names and IP addresses is stored in special host computers on the Internet called root servers (or domain name servers). There are other secondary servers on some LANs or WANs. They store the lookup tables as a backup or a means to relieve traffic to the root servers. When activated, a DNS will search for the proper IP address and domain name across the network of root and secondary servers. For example, if a host computer on the other side of the world wants to contact 'www.AIOU.edu.pk', it starts asking DNS servers for help, starting at the right end and working left. First, it asks the local DNS server to look up the address. The local DNS server can resolve the address in three possible ways:

1. The local server can find it directly because the computer is inside the same local network the server belongs to.

2. The local server knows the address because someone else has asked for the same address recently. The DNS server keeps addresses that have been asked for during a period of time in case they are asked for again.

3. The local server doesn't know the address. It will contact a root server — the server that knows the addresses of name servers for the highest level (rightmost) zone, in this case 'pk'. It asks the root server for the name server that takes care of the 'pk' zone. It then contacts the name server that takes care of the 'edu' zone for the address of the name servers of the 'aiou' zone, and finally gets the address for 'www.AIOU.edu.pk'.

Registration issues

Good domain names are crucial to e-businesses. The best are those that are easily remembered or guessed, as then the business has higher visibility on the Internet. (If you know how domain names are structured you can often guess what the domain name of a particular organisation will be.) The small amount of money it costs to register a domain name is certainly worth it — it can buy you a 'property' in cyberspace.

The registration fee for a domain name differs among naming authorities. Before 1998, InterNIC offered a domain-name registration service. It charged somewhere between USD 40 and USD 150 for the initial fee, plus an annual subscription fee. Once registered, these domain names are stored in a special computer called a domain name server. This is where the respective IP address is looked up when a domain name is called upon.

Nowadays this responsibility has been passed down to individual countries. The practice of a third party registering a domain name that is the trademark of another person or company, hoping that the company will pay them for it, has become known as 'cyber squatting'.

This system is not without its problems, however. It was designed by Europeans and Americans and so was concerned about applications in their field. The Internet was not seen as a worldwide system from the beginning — and this means that the problems associated with many languages were not thought of when the system was devised. Arabic, Japanese and other languages using non-alphabetic scripts present difficulties to the Internet as it stands. For example: Until December 1999 domain names had to be registered in ASCII text standard. A new system offered by i-DNS.net International in California gives Chinese businesses the chance to register their domain names in Chinese (or other languages that have characters that must be coded differently). To avoid disputes, the 3rd Generation Network Information Centre (3gnic) in Hong Kong announced that domain names of all companies listed on the Stock Exchange of Hong Kong would only be sold to the legal representatives of these companies. However, 3gnic's claim is not widely accepted by other practitioners in the business.

Can you think of a language group near you that has problems with the Internet?

When you register a domain name, you are inserting an entry into a directory of all the domain names and their corresponding computers on the Internet. To register your new domain name you must use the services of an accredited registrar. Domain names ending with .biz, .com, .info, .name, .net or .org can be registered through many different registrars that compete with one another.

The registrar you choose will ask that you provide various contact and technical information as part of the registration process. The registrar is then charged with keeping records of the contact information and submitting the technical information to a central directory known as the registry. This registry can be accessed by any computer on the Internet any time information is needed to send an email message or to find a specific website. The registrar also will require that you enter into a registration contract. That document sets forth the terms under which your registration is accepted and maintained by the registrar.

Client/server applications

We have been looking at the Internet from a structural point of view. You now know about the physical layout of the Internet, what protocols computers use to communicate on the Internet, and the way computers identify themselves on the Internet by using IP addresses and domain names. In the coming section, you are going to look at the Internet in terms of the applications that enable it to exist. You will be introduced to the client/server model of operation on the Internet, especially the most widely used application on the Internet: the World Wide Web.

You met the term 'server' in the last section. Different kinds of servers are connected to the Internet for different purposes. Your email, for example, is stored on a 'mail server' at your ISP before you download it to your own computer. The 'news server' distributes news to Internet newsgroups. The most widely used kind of server on the Internet is the

Web server. Formally, a Web server is the program that serves data (HTML pages or other data) to clients using the Internet.

However, people often use the term to refer to the host computer on which the Web pages are stored. (This computer is, of course, connected to the Internet so that users can access the pages.)

The client/server-programming model

Client/server computing emerged in the early 1990s. While most people now take it for granted, it has transformed corporate computing. Before the age of client/server computing, corporate computing relied heavily on the host-based model in which a centralised computer (a mainframe) performed all of an organisation's data-processing tasks and stored all the corporate data. Staff accessed this mainframe through dumb terminals (called dumb terminals because they contained no processing capacity of their own; they were dumb in the sense of not being intelligent, not in the sense of being quiet) connected directly to the mainframe.

This meant that everyone was using the mainframe as the computer that performed all operations – handled screen display, processed requests for files or operations, and organised how the results were presented on the screen in front of the user Client/server computing is different. There is a software program on the user's machine, a client, which handles screen display and the input of messages, and also the sending of requests to the server. The server receives the requests from the client – either to send a file across the network, or to process a calculation and send the answers back. In this case, the client software needs to be on a machine that is not dumb, that means it needs a machine with processing ability of its own, in short.

Now, as you may know from your own computing environment, organisations use local area networks (LAN). These are client/server based. The clients and servers are both computing machines connected to the network (it can be a departmental LAN or a WAN — a wide area network). Each machine is assigned certain computing functions, but ideally, the user won't be aware of the way these functions are divided. He/she will experience the network as a single system with all functions, both client and server, integrated and accessible. The client is the user's desktop computer, workstation, notebook, or even mobile phone (for the wireless computing environment).

For example, suppose you want to perform a budget analysis of your company using a spreadsheet program. You click on the spreadsheet program button on the Window running in your PC and the program starts. In most cases, the spreadsheet program itself is not in your PC, since buying a spreadsheet software licence for everyone in a company would be very expensive. The program comes from the company's file server (we call the process 'downloading'), which is connected, to your PC through the company's LAN. However, most of the company's employees are completely unaware of this, as it makes no difference to them whether the spreadsheet program is running locally in their PC or is downloaded from the file server.

Why the change from host-based models to client/servers? One of the obvious answers is simply that the technology became available. Advances in hardware and software design, computer networking technologies, distributed database technology, and the development of GUIs (graphical user interfaces) made it possible. There were also other influences, both economic (the globalisation of markets demands maximum efficiency in information sharing within and between organisations) and organisational (the trend of downsizing led to a need for computing resources to be accessible at a more affordable price). Computing resources shifted from the host-based platform to PC-based LANs and workstation-based platforms.

This sharing of computer functions between the client and the server was, at first, used within organisations in LANs. However, once the wider network of the Internet became available, there was no reason why it should not work the same way between remote clients and servers, who might well be on opposite sides of the world. Obviously, this development was crucial for e-commerce.

Types of client/server computing services

There are different ways of categorising client/server computing. The first is to classify it according to the type of computing services provided to users. The world's most widely deployed client/server application is, of course, the WWW, the most important application on the Internet, with hundreds of millions of 'universal' clients (mostly Web browsers running on PCs) that talk to millions of Web servers, that connect to the Internet. The next section deals with WWW servers and clients; below we briefly describe some of the other kinds of client/server services.

File server

With a file server, the client (usually a PC) passes requests for the file records over a network to the file server. This service is useful for sharing files across a network. They are indispensable for creating shared repositories of documents, images, and even utility software. The example I gave earlier demonstrates how an organisational file server is used for sharing software inside an organisation. As you continue with more advanced applications of the Internet and Internet computing, you will come across a recent development in e-commerce, which is the emergence of the Application Service Provider (ASP). This ASP provides business application software through the Internet. This is, in fact, an extension of the concept of software sharing within an organisation to the sharing of software among organisations. Organisations can rent the use of the software from the ASP. This is not widespread yet in any country, and many professionals are doubtful as to whether it will succeed- but this is not stopping large companies (like Oracle) from trying it out. If it works, reasons Oracle, they want to be on top of it.

Database server

With a database server, the client sends requests to the database server Using SQL (structured query language). The data and the program that

processes the request reside on the same machine. The server uses its own processing power to find the requested data. Database servers provide the foundation for decision-support systems that facilitates ad hoc queries and flexible reports. They also play a key role in data warehousing. The first time you registered as a user on an e-commerce website, you may be asked a series of questions about yourself, such as your occupation, age, family income, and so on. All this information will be stored in the database server and retrieved when it is needed, such as to send you promotion news for things that you are interested in and can afford to buy (i.e., suitable for your income group).

Transaction server

With a transaction server, the client invokes remote procedures (or services) that reside in the server. A transaction server means you can create the client/server application by writing the programs for both the client and server components. The client component usually includes a Graphical User Interface (GUI) while the server component usually consists of complicated computing logic. These applications are called Online Transaction Processing (OLTP). A typical example is the cash machine or Automated Teller Machine found outside many banks to provide banking services. Customers use the ATM terminals (the 'client') to send requests for banking transactions to the bank's main machine (the 'server') for processing.

Fat servers or fat clients

Another way of categorising client/server models is to distinguish the ways in which the components of an application are divided between the client and server. A client/server application has three components.

1. The presentation component is the application interface, i.e. how the application appears visually to the user

2. The application logic component consists of the processing logic

3. The data management component consists of the storage and management of the data used by the application.

However, the application program must be written as two or more separate software components that run on different machines but appear to operate as a single application. The exact division of tasks depends on the requirements of each application including its processing needs, the number of users and the available resources. There are five different ways in which the components of an application can be partitioned between the client and the server. In the fat server, the server has more of the functions, and vice versa in the fat client model. Transaction and Web servers are examples of fat servers; database and file servers are examples of fat clients.

Whether it is better to have a fat client and to be more independent of the network, or to use a thin client and depend on the network for processing, is a debate that has been going on for years now. Not surprisingly, companies like Microsoft, who make their money by providing the things

that support fat clients, prefer fat client computing. On the other hand, companies which make their money and see the future of computing as being network-based (like Oracle), advocate the thin client model.

A more complete description follows, for those interested.

In a thin client network environment, clients act as terminals, providing access to applications and data held on servers. Rather than being hosted individually on each client device, applications are instead held centrally with clients accessing them across the network. Thus, the majority of application processing is carried out by the server rather than by the individual client.

A thin client device may handle only keyboard input and screen output, leaving all application processing to the server. This dedicated main server provides applications and other resources to a large number of terminals. The terminals often have just enough intelligence to operate the mouse, keyboard, and monitor. A thin client terminal generally does not even have a hard drive to save data, data is stored on servers e.g. fileserver.

Thin client servers vs. other networks

How is a thin client network different from other networks?

An example of a fat client, by way of contrast, is the typical network-ready desktop PC, which does most of the application processing as well as storing applications software and data on its own hard disk. This can also be networked to provide access to shared files and resources. A fat client can be defined as a computer that runs applications locally, normally including an operating system, RAM, ROM, a processor, and installed applications that run on the desktop.

Another way to differentiate between thin and fat clients is that a fat client can also be used away from the network as a stand-alone device, whereas a thin client terminal may well be unusable if it is disconnected from the network. However, it is important to remember that thin client networking cannot be considered solely in terms fat or thin clients. This is too simplistic an approach. For example, it is possible to implement a thin client network using conventional PCs.

In such an instance, traditionally fat clients (PCs) would be configured to operate as thin clients but this would negate many of the advantages offered by the thin client model. The designations 'thin' and 'fat' are in many cases misleading or too simple, as client devices and network implementations can combine elements of both to fall somewhere in between. Similarly, a network might comprise both thin and fat clients, depending on different user requirements.

The thin client approach to networking involves much, much more than replacing PCs with terminals; it represents a server-based approach to networking, software architectures and application deployment. As with any network environment, maintaining a thin client network requires careful planning and a high level of technical expertise.
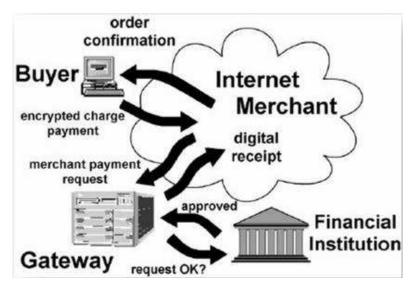
Figure 3.3: Thin client system

Two-tiered versus three-tiered

Client/server models can also be classified according to their physical architecture. The term *tier* refers to the relationship between the logical division of the application components(presentation, application logic and data management) and the physical architecture in which these components are divided.

Two-tiered client/server architecture delivers the presentation component on the client and the database management on the server. The application logic maybe delivered on either — if it's on the client, it's a 'fat client model'; if it's on the server it's a 'fat server model'.

Three-tiered client/server architecture (sometimes referred to as n-tiered client/server architecture) delivers the presentation component on the client, the application logic on one or more dedicated servers, and the data management on one or more super servers (or mainframes). Specialised middleware servers are often located on the second tier.

Activity 3.3

Activity

Client/Server models

Pick an organisation known to you that needs and uses a networked system. When you have thought about the above and read the information given on the websites, answer the following questions:

1. What are the benefits for organisations in shifting to client/server computing models?

2. What problems must organisations address when adopting the client/server computing model?

It may be useful to draw up tables for this purpose. For each type, thin and fat, draw up a table with two columns. Label the left column Advantages and the right column Disadvantages and fill in as much as you can think of. Remember to keep these specific to the organisation you are thinking about. Now repeat the procedure for fat clients, and see what you come up with.

World Wide Web (WWW) servers and clients

The technologies that have evolved over the last few years — including cheaper and faster computing platforms, higher network bandwidth, more reliable data communications, and improved software — have made the World Wide Web possible by creating a mesh of servers and clients. In late 1993, the Mosaic graphic Web browser introduced the first Web-style client/server. Mosaic itself was a bit of a handful to use, but its inventors moved on from this to generate the highly successful Netscape, which is still with us today, despite imitators' attempts to drive it from the market. This new model of client/server consisted of thin (as opposed to 'fat'), portable, 'universal' clients that talk to 'super fat' servers. The Web was built on open, cross-platform, global client/server standards.

The Web server

A Web server combines hardware and software components to offer Web services to its clients — Web browsers installed in the users' PC. The Web server will service requests from the client applications. These requests are usually sent from browsers to request a document (an HTML page). The server retrieves the document from the disk and sends it back to the browser using the HTTP protocol. Even with these fairly simple types of application, such as the static HTML page retrieval, the Web server needs to perform a number of important basic operations. These include:

1. Checking the user authorisation

2. Translating and logging the user address

3. Providing the requested service (usually returning an HTML page stored on the Webserver to the client)

4. Checking /determining the message return path

5. Checking for errors

6. Logging the transaction.

The code required to carry out these basic functions — often referred to as core server application functions — is included with the code provided with the Web server's operating system (OS) and forms part of the server's basic functionality. These built-in functions are generally shareable and efficient.

Hypertext Mark-up Language (HTML)

Documents are stored on Web servers as pages (or frames) of text containing HTML tags. Tags are used in order to define a document's structure. They are like control keywords and are used to surround portions of the text so the receiving browser can recognise the different elements of the document, which it receives as HTML pages from the server.

To see HTML in action, open any Web page in your browser. Now right click on the page and select 'View Page Source'. This opens a window showing all the html codes that your browser needs as a set of instructions to display the page as you see it. It looks confusing, but if you are interested, it doesn't take long to sort out what is happening with these instructions.

Figure 3.4: HTML page

Figure 3.5: HTML code used to produce HTML

The 'tags' are enclosed in angle brackets and mostly appear in twos. (There are certain exceptions but we need not deal with them here.) Each element of the document is composed of a string of text enclosed by two tags that define the nature of the element. The angle brackets enable the browser to recognise them as being different from the normal flow of document text.

Elements fall into three main classes:

1. **Structural**: titles, paragraphs, lists, section headings, figures and tables. These are also called 'block-oriented' elements because they contain blocks of text.

2. **Descriptive**: also called 'content-oriented', that describe the reason certain words are significant, e.g. an index entry, a citation, or a hypertext link.

3. **Visual**: a part of the document's external appearance (as opposed to its content) such as centring or a new typeface.

In HTML, most elements are structural or descriptive. There are very few visual ones, because the objective of HTTP is to concentrate on content and meaning, rather than on the way it will look on any particular client machine. The finer details of exactly how it is displayed on a particular client machine are left up to the client's browser. Dynamic HTML is a newer set of technologies that provides the user with pages that are richer, faster and more interactive. These technologies also give page authors more precise control over the styles, positions and actions of the HTML objects that make up a page. You will read a little more about Dynamic HTML in the next section.

Web browsers

As you know, a Web browser is the client software you use to access the World Wide Web. Web clients, or browsers, can combine text and graphical material, and can incorporate all the other major Internet services such as FTP, email, and news into one standard interface. The Web also incorporates a hypertext system that allows individual Web pages to provide direct links to other Web pages, files, and other types of information.

Although many different browsers are available, Mozilla Firefox and Google Chrome are the two most popular. Most browsers today are multifunctional – they handle a lot more than just Web browsing.

For the most up-to-date information about the current versions of these browsers, you should check the online handbook under the Help menu (if you have already installed the browser) or go to the websites of the respective software companies.

Figure 3.6: Google Chrome shows website google.com

Figure 3.7: Microsoft Internet Explorer shows website Microsoft.com

This service provides the latest browser information and contains reviews and downloaded information on browsers, cookie utilities, filtering software, bookmark organisers, etc. All of the browsers provide bookmarking, tabbed browsing facilities, and integrate audio, video and animation through the use of plug-ins.

The competition between browsers has led to continuous improvements in the technology. However, there are sometimes compatibility problems. If your Web page coding or Web applications won't run on the most popular browser platforms, you risk losing a substantial portion of your market.

A typical example is Dynamic HTML (DHTML). DHTML can be used to create stunning interactive websites full of animation and special effects. You can also use DHTML to develop complex Web-based applications, multimedia presentations, and wonderfully detailed games. Unfortunately DHTML hasn't really caught on. Of the millions of websites, only a relative handful use DHTML, and much of what's being done with the technology is fairly basic. What's keeping DHTML from taking off? The answer is simple: Microsoft Internet Explorer and Netscape Navigator support different versions of the technology, and developers simply don't want to code everything twice.

Now let's move on to the real reasons why you are studying this course. You don't really care about all the technology or you would be doing programming! You want to know how to get things done using these technologies, and that is what we are about to explore. We move now to look at some of the interactive Web applications that have made e-commerce possible.

E-Mail: The killer application

E-mail is widely regarded as the killer application of the Internet. By this we mean that it is the application that immediately and powerfully justifies the introduction and use of Internet technologies. While we are all familiar with the basics of sending and receiving an email, for

business use we must look more closely at it to understand the power and benefit for business use. These are all too diverse for summary into a single chapter, so follow the links provided. Remember that this is general advice so take care when applying what you read to your particular case.

Electronic mail, better known as email, is the most important tool used on the Internet. It's much faster than writing letters, less expensive, environmentally friendly, and enables you to instantly communicate with your visitors and customers. Although most Internet Service Providers include email accounts for their customers, these accounts are not really adequate for an Internet business — especially if you expect to get a large amount of email. Not only do the email addresses contain your ISP's name, but they are also very limited on features and options. It is better for a business, even a small business, to begin by gaining its own domain, and using its own email addresses associated with that name.

In the same way, it is far better to use a proper dedicated e-mail client than to rely on the features built into the modern browser suites such as Internet Explorer and Netscape. There are many email programs available on the Internet.

Figure 3.8: Shows a web interface of www.gmail.com

Figure 3.9: Interface of dedicated e-mail client

Activity 3.4

Activity

Website links

Go to **http://www.microsoft.com/athome/** and try the links within to find out more about the Internet. As you work through, remember that this site is hosted by Microsoft, a large organisation whose interests often lie in a completely different direction to those of the Internet. A word of caution: do not rely on this site as the only means of information.

Interactive technologies

With first generation Web technologies, the only way you could interact with Web servers was by clicking on hyperlinks to surf between documents. As you know, e-commerce needs more than that. For example, if you want to buy a book from Amazon.com, you have to input your personal data and the items you require. Amazon also needs some way of processing your data. It will want to keep some of your personal details on a database so they can be retrieved. It has to process your order and ensure that you receive the correct items. Also, as prices and stock items change, this information has to be transferred to the site. In other words, Amazon needs applications that can access the dynamic data (data that is being updated in real time) stored on resources external to the Web server. Technology able to do this was developed in the mid-1990s, and the Web began to subtly transform from a passive browsing medium into

a more interactive client/server medium. Once this happened, e-commerce was born.

A variety of software mechanisms and standards have been developed to permit applications to access data on external databases and applications. When you want to develop active sites for yourself, there are other learning tools, which will prepare you to do this effectively. At this stage, we shall restrict ourselves to gaining an overview appropriate to a management level briefing, leaving the technical implementation to others.

In this module we have selected three examples of the technologies in use for you to explore further. We do not expect you to master these in detail, simply to appreciate the sort of technical backup and programming that a Web page designer must call upon for a successful site. We shall look at what they do (rather than how they do it) and their application to the e-commerce environment. These are:

1. Forms

2. Common Gateway Interfaces (CGIs)

3. Java

Forms

Let's go back to the registration process, say on Amazon.com. As explained, you need to supply Amazon with some personal information such as your name, address, phone number, occupation, family income, etc. Sometimes you need to key in the information such as name and address. Sometimes, the website provides other optional items, such as occupation and family income. This information capturing uses a Web technology called Forms.

Note it!

When adding this to your glossary, please check with several online dictionaries and sources to get a feeling for how the term is used, and then build your own definition that you could use to explain to others. Not everyone will be happy with the same explanation. Forms are HTML features (features for use in displaying Web pages) that let you embed within HTML documents features such as text-entry fields, radio boxes, selection lists, check boxes and buttons that gather information from the users for a server application. You can use forms for every imaginable Web transaction including surveys, data entry, placing and tracking orders, and database queries. You can have anything inside a form except another form. HTML defines tags for creating interface elements that you can place anywhere within a form to interact with a user. There are three types of interface elements: input fields, text areas, and selections. You can use input fields to enter and capture data. **Figure 3.10** shows the four stages of the Amazon form, which contains a number of the types of input fields.
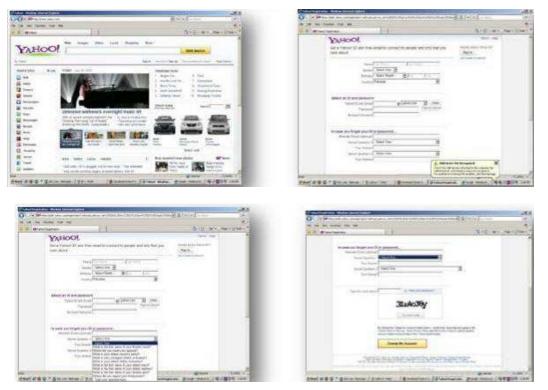
Figure 3.10: Four stages of Amazon form with number of input fields

Types of input

The 'select fields' option lets you create a dropdown list box, from which a user picks one or more items. Two other types of input field not shown in **Figure 3.10** are:

1. **Reset** — displays a push-button type of 'reset'. You click on the reset button to clear the contents of a form and restore its default values.

2. **Hidden** — is a field that does not appear on the form. It may contain a default value that you send to the server application.

Common Gateway Interface (CGI)

Therefore, the website has used a form to collect your input. Once you send the data back to the server, it has to be processed. The standard method for creating a program that processes the data in the Web server is called Common Gateway Interface (CGI). This sounds complicated, but all it means is that a CGI is a bit of software that translates what has happened in one piece of software, into something that a different piece of software can understand. In general, CGI is a method for creating programs that allow external applications to interface with web servers in a standard way.

Advantages of CGI

The main advantages of CGI are:

- **Simplicity** — it is easy to understand.

- **Language independence** — CGI applications can be written in almost any language.

- **Process isolation** — CGI applications run in separate processes, so bug-ridden applications cannot crash the Web server or access the server's private internal state.

- **Open standard** — some form of CGI has been implemented on virtually every type of Web server.

- **Architecture independence** — CGI is not tied to any particular server architecture.

All these features make CGI a good choice when the Web server is used primarily to distribute HTML documents. However, if the CGI approach is used for applications that need to frequently access external resources, then it can have some disadvantages. The main disadvantages are:

- **CGI programmes cannot be shared.** CGI requires the server to create and execute a separate a program every time a client makes a request. The creation and execution of each copy of a CGI program uses server resources (e.g. memory and processor cycles). Because CGI programs cannot be shared, when several clients request the same type of service at the same time, several copies of the same CGI program must be created. This can put a heavy load on the server.

- **CGI programs are transient.** They are only active in the server while they are executing a single request from a single client. This means that:

  o If a client transaction requires accessing the application's database several times (which most interactive transactions do), a separate copy of the CGI program is created and terminated for each access. Because each program terminates after servicing a single access request, each has to make a separate database connection and disconnection (instead of maintaining a single connection for the duration of the transaction). This also adds to the resource load placed on the server.

  o It is difficult to ensure that one transaction does not change the state of the database while another transaction is being executed. There is a similar problem on the client side when used for interactive applications. This is because there is no efficient mechanism for the server to maintain information on the thread of connections made

o   to it by a single client browser during the execution of a transaction requiring multiple connections.

o   These problems can cause considerable performance degradation if a large number of users request access to interactive applications via the same Web server at the same time.

Problems arise from the non-shareability of CGI because it is a centralised computing model (from the Web application's perspective). Like a mainframe computer, a server running CGI takes all the workload; the client machine acts solely as an interface between the information stored, various Web servers and the user. In order to ease the situation, there must be some way of bringing intelligence to the client side. Some of the workload must be taken from the centralised CGI applications and moved to the client machines. This is the distributed model of the Web client/server applications.

Java: a distributed model client/server solution

The Java programming language is one of the key enabling technologies for distributed Web client/server applications. Java is a high-level programming language developed by Sun Microsystems. Originally called OAK, Java was code, designed to be embedded in the computer chips of household appliances to run them intelligently.
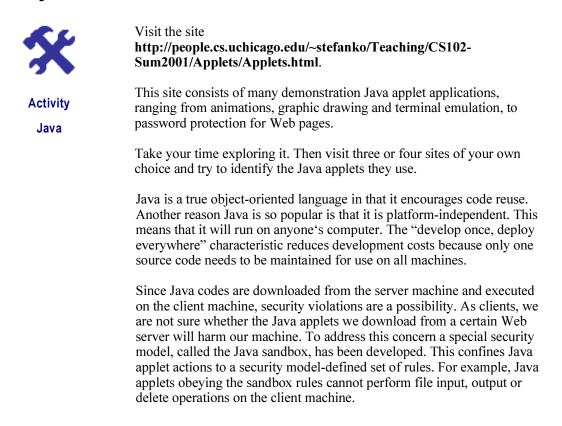
However, Java's most popular use to date is in Web applications, where thousands of 'applets' implement a wide variety of client/server applications. Applets are a 'just-in time' shippable code for clients. This means that the server downloads the client application when and where it is needed. That way, client machines can share part of the computing resources required by Web applications.

A brief note on JavaScript

You are likely to come across many references to Java, and you will also see references to JavaScript. You should be clear that they are not the same thing. JavaScript is a scripting language that controls high-level Web functionality such as objects, contents and interaction within browsers. Scripting languages were originally designed as a packaging for Operating Systems (OS) commands in a file, with a few control flow constructs added to allow repetition and decision points. A typical use of scripts is to automatically start some OS functions as the machine boots up. JavaScript was the first major Web scripting language. The basic idea is that all functionality of a browser is scriptable, and scripts can manipulate all content within a browser. JavaScript is a good glue language between Java applets, plugins and HTML content. How confusing!

Activity 3.5

Activity

Java

Visit the site
http://people.cs.uchicago.edu/~stefanko/Teaching/CS102-Sum2001/Applets/Applets.html.

This site consists of many demonstration Java applet applications, ranging from animations, graphic drawing and terminal emulation, to password protection for Web pages.

Take your time exploring it. Then visit three or four sites of your own choice and try to identify the Java applets they use.

Java is a true object-oriented language in that it encourages code reuse. Another reason Java is so popular is that it is platform-independent. This means that it will run on anyone's computer. The "develop once, deploy everywhere" characteristic reduces development costs because only one source code needs to be maintained for use on all machines.

Since Java codes are downloaded from the server machine and executed on the client machine, security violations are a possibility. As clients, we are not sure whether the Java applets we download from a certain Web server will harm our machine. To address this concern a special security model, called the Java sandbox, has been developed. This confines Java applet actions to a security model-defined set of rules. For example, Java applets obeying the sandbox rules cannot perform file input, output or delete operations on the client machine.

Multimedia delivery

Computer-based multimedia systems were developed in the early 1990s and became very popular in the mid-90s. By that time, most PCs could handle multimedia information. The best example is the Windows system developed by Microsoft. Multimedia technology is different from the old text-based information technology in that there are different forms of presenting information such as graphics, photos, animation, sound and even video. The Internet was originally developed for text-based computing (such as Gopher, which was a text-based file and document search service). It was not intended for commercial use, but was used for information interchange between government and academic communities. It was not until the early 1990s that the National Science Foundation in the U.S. lifted the restriction on commercial Internet use.

This fostered the development of Web-based Internet technology. The Web was originally designed to provide a convenient common platform for sharing information in the hypermedia format.

Hypermedia is an approach to information management in which data are stored in a network of documents connected by links. Hypermedia contains links to documents that are not restricted to text documents but

also other forms of media such as sound, graphics and video. In other words, the Web is a network of documents in multimedia format. The growth in the use of multimedia on the Web has had a significant impact on the growth of electronic commerce.

Commercial websites with rich multimedia content will certainly attract more visits than websites composed of mainly plain text. On the other hand, multimedia itself has become a trading commodity. There are commercial websites that deliver music soundtracks and video to customers.

There are several state-of-the-art Web-based multimedia delivery technologies including virtual reality (VR), webcasting, and Web-based telephony. This area is the fastest growing area in Web technology.

Virtual reality (VR)

Virtual reality (VR) is primarily a real-time graphics and animation technology that creates environments that seem as real as the world of nature. Through the combination of sensing and interface devices, and software, VR systems provide direct interaction with computer generated models, allowing users to experience simulated real world objects through the Web. For example, in a car dealer's website, instead of displaying 2-D car photos, a 3-D model of the car can be displayed, allowing users to view the car from different perspectives. Users can even view the interior of the car just as if it were physically present in a showroom.

The major technology for developing VR applications is Virtual Reality Modelling Language (VRML). VRML extends HTML to the 3-D world, describing how a 3-D environment can be explored and created. It encodes computer-generated graphics into a compact file format for transportation over the Internet, thus allowing for much richer interaction and perspective than HTML.

Activity 3.6

Activity

Virtual world

Visit this site and look at how the emerging Web technology can give you insights on how the technology works:

http://www.bized.co.uk/virtual/home.htm

Try the Virtual Developing Case study centred on Zambia, for example (at **http://www.bized.co.uk/virtual/dc/farming/theory/th2.htm**).

On the other hand, if you want to play with multimedia in action and have time to spare, try this site out and see how appealing it is to interact online:

http://www.activeworlds.com/

Push technology and webcasting

'Pull' and 'push' are originally terms used in marketing to describe interaction between a marketer and a buyer. In pull marketing, a person requests product information from the marketer. However, in many cases people don't actively request information because they may not be aware of their need for a product. This is where push marketing comes in: letting people know about products. Similarly, in the Internet world, most information is distributed to users through pull technology, where people actively search for information themselves by browsing through the Web. Commercial websites couldn't send Web pages to potential customers but instead had to wait until people came to the website.

The advent of push technology enabled Web servers to send asynchronous messages to specific clients without the client requesting the information. A typical example is Point-cast which is a screensaver that downloads and displays news and advertisements when your computer is idle. There are two popular push technology models. The first is the **publish and subscribe model**, where the clients register their intention to receive information from the server. When the information is created at the server, it is sent to whichever clients have subscribed to it. Point-cast belongs to this model. The second is the **broadcast model**, where the server indiscriminately sends out information to whoever wishes to receive it. Spam – email sent indiscriminately to everyone on a mailing list – is a broadcast model. Most of you have probably received commercial email, though sometimes it is annoying.

Webcasting is a push technology that delivers a constant stream of information via the Internet. In most cases, the stream of information delivered has audio or video content. Radio Television Hong Kong (RTHK) (**http://www.rthk.org.hk**) broadcasts live radio on the Internet. You will notice that in order to receive the radio streaming from the radio sites, your computer needs pop-up player software. (If you don't have player software, most of the webcasting sites will direct you to the streaming players' site to download player software for free.) At present, the most popular webcasting player software is offered by several companies including :

- Real Networks (**www.real.com**),

- Liquid Audio (**www.liquidaudio.com**),

- Xingtech (**www.xingtech.com**) and

- Microsoft's NetShow
  (**www.microsoft.com/windows/windowsmedia**).

The main problem when developing webcasting technology is bandwidth. As we have seen from the previous module, a number of Internet users are still in the age of narrowband connections. For true high quality multimedia webcasting to become possible, the majority of Internet users must have a broadband connection. The next reading describes recent developments in webcasting in the U.S. Internet telephony.
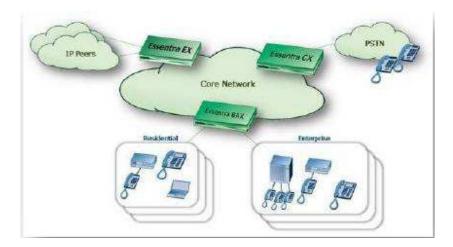
Figure 3.11: Public Switched Telephone Network

Internet telephony

Originally regarded as a novelty, Internet telephony is attracting more and more users because it offers tremendous cost savings relative to the PSTN (Public Switch Telephone Network). Users can bypass long-distance carriers and their per-minute usage rates and run their voice traffic over the Internet for a flat monthly Internet-access fee.

The essential point to bear in mind in order to understand what all the fuss about using the Internet for voice is all about, is this: the Internet and the telephone are, in fact, two different networks.

Traditional voice telephone is transmitted through the Public Switched Telephone Network (PSTN) while Internet data are transmitted through the Packet Switched Network (PSN). For ordinary voice calls, every time a phone call is made, a dedicated communication line is established and maintained between the caller and the receiver throughout the call. For the switched network, no direct communication connection is established between any two nodes on the Internet. The message (in this case voice) to be sent from one place to another is divided into packets, which are routed through the network, possibly through different paths. The major advantage of PSN over PSTN is that communication bandwidths are used much more efficiently.

Internet telephony is the technology of transmitting voice over the Internet, i.e. over the PSN instead of the traditional PSTN. This technology began in early 1995 when a U.S. technology company Vocaltec, Inc. (**www.vocaltec.com**) introduced its Internet Phone software.

Figure 3.12: www.vocaltec.com

The software allows so-called PC-to-PC voice communication over the Internet. This is a rather restricted mode of Internet telephony, where both parties are required to have a PC with the Internet Phone software installed (also with audio features such as sound card, speaker and microphone).

The main advantage of Voice Over IP (VoIP) technology is the significant reduction in price, especially for long-distance voice communication, since voice data are transmitted through the much more cost effective PSN. With this economic incentive, rapid technology advancement has led to the emergence of gateway servers, enabling VoIP users to communicate via standard telephones. These server gateways act as an interface between the PSN and PTSN, so that Internet telephony can operate in the PC-to-phone and phone-to-phone modes.

Various types of voice-over-broadband (VoBB) providers rely on broadband access solutions for connecting to subscribers and providing them with innovative telephony services. This needs to be done while ensuring voice quality and service consistency. Essentra BAX meets the needs of VoBB providers for the provision of residential and enterprise VoIP services. Coupled with additional Essentra elements, it is an ideal solution providing a cost effective entry into the world of VoIP over any broadband infrastructure, and allows operators to offer new IP-based services, attract new customers and expand into new markets.

Deploying residential/enterprise IP telephony:

- Offers subscribers cutting-edge technologies

- Enables innovative services

- Reduces operating costs

- Essentra BAX Offers:

o High-quality SIP-based services

o Scalability

o Carrier-grade reliability

o Maximum service flexibility

IMS-TISPAN Ready: Application Server

Service providers are looking for ways to leverage the burgeoning broadband access market in order to introduce new revenue generating IP communications services. Enabling the delivery of residential and hosted enterprise VoIP services over Mobile, WiMAX and fixed Line broadband infrastructures, VocalTec's Essentra BAX Application Server helps service providers take advantage of evolving IP opportunities.

Based on over a decade of leadership in VoIP solutions, Essentra BAX offers service providers an efficient solution for delivering broadband VoIP services, with the capability of scaling up to millions of subscribers. Featuring innovative in-memory data-grid technology, Essentra BAX provides continuous availability and predictable scalability supporting carriers' stringent requirements of service delivery and network planning.
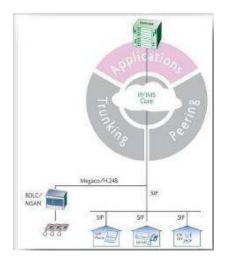

Figure 3.13 : Essentra™ BAX VoIP Application Server

Essentra BAX boasts an extensive set of subscriber calling features including cutting-edge IP features such as click-to-dial, attendant console, auto-attendant and others. For enterprise customers, Essentra BAX supports VoIP virtual private networks (VPNs) and an array of IP-Centrex features. Equipped with a Web-based subscriber self-provisioning interface, Essentra BAX enables subscribers to manage their own services, thereby enhancing user experience while reducing operating expenses (OPEX) for service providers.

Key features and benefits:

- Broad range of subscriber calling features creating new revenue-generating opportunities

- Hosted enterprise services, serving enterprise customers across distributed networks

- Innovative in-memory data grid technology scaling up to millions of subscribers while supporting the unique requirement inherent to mobile and fixed environments

- Linear and predictable scalability enabling gradual subscriber growth while maintaining entry-level cost efficiencies

- Carrier-grade availability and site redundancy, ensuring maximum network utilisation and service usage

- Fully customisable multi-tier web-based management facilitating configuration and provisioning, while lowering operating costs

- Proven interoperability with leading SIP devices and Megaco/H.248 access gateways

Module Summary

Summary

Module 3 has introduced the physical composition of the parts of the Internet that facilitate electronic commerce. Although these may not be actual hardware, logically they are almost physical in nature within the Web-based applications and once you grasp that this simulated universe is in fact real, you are able to "see" how it truly works and falls into place.

Unfortunately, technology is the main component that allows e-commerce to be and without introducing you to it, your knowledge will be quite handicapped. We have tried to touch on only the technical aspects which we deem necessary and the main issues that we wish to highlight would of course be the Web-related protocols and applications that exist. By now, you would have realised that from Module 1 where we brought you into the world of e-commerce and Module 2 where we showed you the framework, we have now gone into the inner workings and actual products or functions of electronic commerce. At this juncture, you should be able to conceive of your own e-commerce ideas and are encouraged to consider the feasibility of an e-commerce business.

Assessment 1

Answer each of the following questions, and submit your assessment by the due date.

1. Think of how the following types of businesses could possibly benefit from online collaboration, and identify who they should link-up with for the maximum advantage :

   a. flower shop
   b. airline
   c. bookshop
   d. private educational institution
   e. electronic home appliance manufacturer
   f. restaurant

2. Of all the categories of e-commerce (B2B, B2C, B2G, etc), identify which may never break away from the "bricks and mortar" aspects of transactions and explain why.

3. Explain how brick and mortar companies can add value to their business using marketing if they embark on online expansion. Use an illustration of a company that you are familiar with.

4. Discuss the ways in which websites can earn a revenue without selling products and/or services. Explain the necessity for ethics in business.

5. Identify social problems that may have arisen as a direct result of online social media, and explain how those social problems could influence the rise or fall of electronic commerce.

6. Confidence and trust are necessary for buyers and sellers to co-exist and transact. Whose responsibility do you think it should be to ensure that the electronic commerce is fraud-proof? Discuss with examples related to your country.

7. Discuss how advertising guidelines for bricks and mortar businesses may not be applicable for online e-commerce based businesses.

8. List and describe the hardware, software and other Information Technology requirements that you think are absolutely necessary for a small 100-pax capacity restaurant if they were to expand into online ordering and delivery.

9. Explain how a business owner would buy the domain name that they want for their website.

10. The statistics on Internet usage worldwide show a tremendous opportunity for electronic commerce since the medium that it is on has become so acceptable and the norm in communication. What are the implications of this for software creators and providers? Discuss.

References and further reading

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