1. Subject Name: E-Commerce (BBAA405SE2)
2. Semester / Year: Semester IV
3. Name of the Teacher: Pinaki Dey
4. Name of the topic: Technology in E-Commerce (Part II)

6.4 INTERNET PROTOCOL ADDRESS

When you have to send a letter to your friend, you always mention the residence address of your friend so that it can reach her. This residence address is unique. If you want to talk to your friend, you need to dial her telephone number, which is again unique. Similarly, if you have to send a message over the Internet, you need some addressing mechanism so that the message can reach the correct destination.

Internet protocol address or IP address is, therefore, a unique address allotted to computing devices such as computers, routers, printers, scanners, modems, smartphones, tablets, and so on that are connected with the Internet. This address facilitates unique identification of devices for communication to take place.

Features

The following are the features of IP address:

- An IP address is divided into four parts where each part is separated from the other using a dot.
- Each part of the address contains a number ranging from 0–255.
- For example, 79.121.10.190 is a valid IP address.
- Without IP addresses, sending and receiving data over the Internet would be impossible.

6.4.1 Types of IP Addresses

There are two categories of IP addresses—static or dynamic and public or private.

Static and dynamic Internet protocol addresses As the name suggests, static IP addresses never change and dynamic IP addresses keep changing dynamically whenever users log on to the network. Many a time, dynamic IP addresses are issued using a leasing system. Therefore, the allocated IP address remains valid for a limited time. When the lease expires, the computer automatically requests a new lease. Similarly, when there is an IP address conflict, a request for another IP address is sent to the ISP automatically. The entire process of requesting IP addresses is automated and is therefore hidden from the users. Table 6.2 shows the differences between static and dynamic IP addresses.

Table 6.2 Differences between static and dynamic IP address

Static IP address	Dynamic IP address
This IP address is permanent.	This IP address is temporary and changes dynamically.
A computer retains its static address every time it accesses the Internet.	A computer is allotted a new dynamic IP address every time it accesses the Internet.
It is a reliable way to facilitate communication between remote devices.	It is not a reliable way to facilitate communication between remote devices.
This address reveals technical information about the continent, country, and city in which the computer is located.	Dynamic IP address does not reveal any such detail.

Table 6.2 (*Contd*)

Static IP address	Dynamic IP address
There are limited static addresses.	It can support a large number of users who do not require the same IP address always.
It is allotted to devices that connect to the Internet using a broadband connection.	It is allotted to devices using a dial-up connection to connect to the Internet.
Email servers and other web servers must have a static IP address.	It is not suitable for servers.
It is preferable for applications such as voice over IP, online gaming, and other applications that need to locate and connect to a particular computer on the Internet.	It is preferable for applications that work fine with temporary and one-time IP addresses.
It is less safe and requires extra security mechanism.	It is safe to use.
A user can configure his static IP address himself.	Dynamic IP address is allotted by the ISP server. This allocation is transparent from the user.

Public and private Internet protocol addresses Certain computers such as web servers and mail servers need to maintain a unique global IP address that is registered with the network information centre (NIC) to avoid address conflicts. This address is publically known and used by users all over the world. Therefore, such an IP address is called public IP address.

In striking contrast with public IP addresses, private IP addresses are allocated to devices that do not require public access. These devices are on the network but need to be uniquely identified only within an organization. For example, a network printer is assigned a private IP address to ensure that people from rest of the world are not able to connect with it.

The NIC has reserved certain addresses for private use which organizations can use to allot them to their devices that need not be identified over the Internet.

6.5 DOMAIN NAME SYSTEM

When you want to talk to a friend, you do not type his number. You may be having several friends and memorizing everyone's number is just not possible. Therefore, you save all important phone numbers along with their names in your phonebook. To connect with your friend, instead of dialling his 10-digit cell number, you just search for his name in the phonebook and click the *Call* button. Although you use the name, your call is not connected based on name. The name is converted into a number which is then used to establish the connection.

Coming back to the Internet, we have seen that every device has a unique IP address. To connect with a particular device you need to specify its address. However, we do not For example, if we want to connect to google.com, we just type

www.google.com. Then where is the IP address and how are we able to access the website? The answer to this question is the domain name system (DNS). Similar to the phonebook service, the Internet has a corresponding DNS service that translates domain names into IP addresses (for example, www.google.com into 74.125.224.72). This means that every time we use the Internet, we always use the DNS.

The DNS system works as a network of DNS servers. As maintaining a central database of all the computers on the Internet along with their names and IP address is quite unpractical, the DNS distributes the responsibility of storing domain names and their corresponding IP addresses to authoritative name servers. These name servers are responsible for the domain they support. The authoritative name servers may even delegate authority to other sub-domain servers. Besides providing speedy mapping, this authority delegation process ensures distributed and fault-tolerant service to Internet users.

In such a networked DNS environment, if one DNS server does not know the IP address of a particular domain name, it asks another server for the same. The process is repeated until a proper match between IP address and domain name is found. This concept is shown in Figure 6.3.

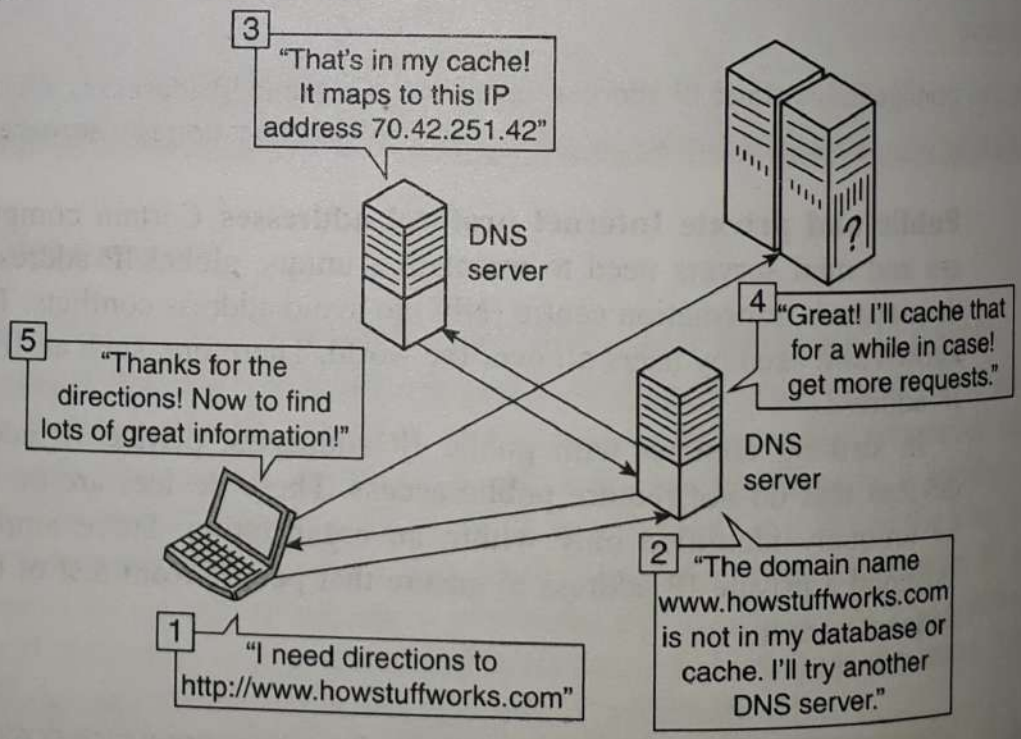

Figure 6.3 Working of DNS

DNS is a service that automatically converts domain names into IP addresses.

Points to Remember

Here are some key points about DNS:

- It assumes that IP addresses are assigned statically and will not change.
- It supports caching of requests.
- ISPs maintain their own DNS servers to resolve name to IP address mapping.
- Since DNS translation causes additional overhead when accessing any website on the Internet, ISPs cache DNS mapping in their DNS server so that that can automatically direct subsequent requests to the appropriate IP address.

Some commonly used domains are as follows:

gov Government agencies

edu Educational institutions

org Non-profit organizations

mil Military

com Commercial business

net Network organizations

int International organizations

Some country domains are as follows:

ca Canada

th Thailand

fr France

jp Japan

in India

us Unites States of America

uk United Kingdom

Other domain names include .museum (for museums), .info (informational websites), .name (personal websites), .pro (for professionals), .aero (for aeronautical companies), .coops (for co-operative organizations), .jobs (for job posting), .mobl (for mobile communication networks), etc.

Like our full names in which the general name or surname comes on the right and our specific name comes on the left, domain names are also organized from right to left, with general domains to the right, and specific domains to the left. For example, in the domain name www.google.com, there are three domain names, each separated by a dot. Here, .com is a general domain and google is a sub-domain, and www is a sub-domain prefix for the World Wide Web.

6.6 UNIFORM RESOURCE LOCATOR OR UNIVERSAL RESOURCE LOCATOR

A uniform resource locator (URL) specifies the unique address for a file that is accessible on the Internet. It is provided by the user in the address bar. For example, when you type www.google.com, after pressing the Enter key, there is a long sequence of characters in the address bar. This is the URL. This means that to access any page on the Internet, we need to provide its URL.

The file on the Internet that we want to access can be a web page, an audio file, video file, or image with extensions .htm, .php, .mp4, .avi, .jpg, .bmp, .gif, .asp, .cgi, .xml, etc.

The syntax for a URL is as follows:

Protocol://domain-name/path

where protocol specifies the name of the protocol to be used to access the file resource. Commonly used protocols are http, https, ftp, telnet, news, gopher, mailto, etc. This field specifies how to connect.

Domain name identifies the name of the website. This means that the domain field identifies where to connect.

Path is a hierarchical description that indicates the location of the file. It indicates to the web server what to connect.

For example, when we just write http://www.google.com, http is the protocol, www.google.com is the domain name, and by default, the home page which is saved as index.htm is displayed to the user. Refer to Figure 6.4 which shows another sample URL.

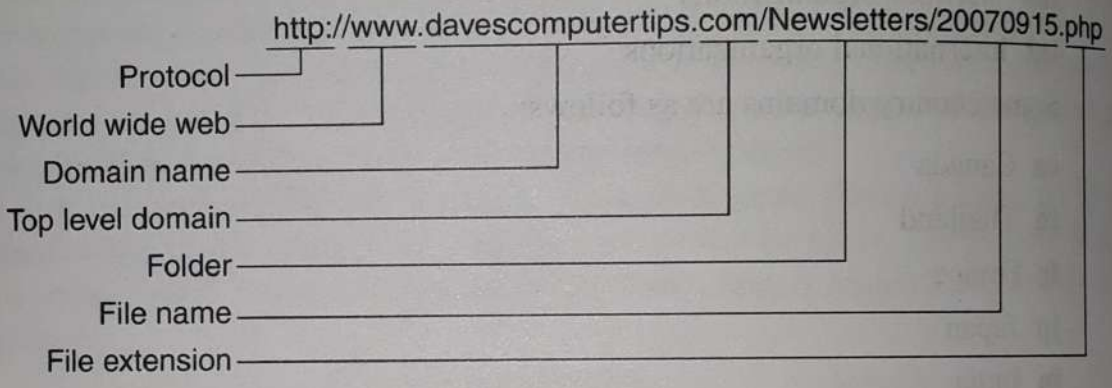

Figure 6.4 Uniform resource locator

If we provide the URL as, http://www.example.com/Student/ABC.TXT, then http is used to fetch the file AB.TXT from Student directory stored in the computer on which the website www.example.com is hosted.

There are basically two types of URLs as shown in Figure 6.5. While an absolute URL specifies the complete URL containing all three fields (protocol, domain, and path), relative URLs, on the other hand, contain only the one field which is the domain name.

Many a time, you must have observed a complex URL as the one given here, especially when you log in to your email account or search for a string on google.

http://www.google.com/cgi-bin/search.cgi?q=computer%20fundamentals

Although it seems complex, it is actually very simple to interpret. In the query, http is in the protocol, www.google.com is the domain, and search.cgi is a file in the cgi-bin directory. Anything following the question mark (?) in a URL is a pair of variable(s) and its value(s). In the URL, q=computer%20fundamentals means that q is a variable name, and computer%20fundamentals is the value of q. Since blank spaces are not allowed in a URL, blank space has been written as %20. Spaces can also be written as a +(plus) sign. In the query, the user is trying to search computer fundamentals on Google.

These values are sent by the user's computer to Google's server. Google will find relevant pages and will display the result on the user's screen. Similarly, when we log in to our email account, we supply two values to the server—username and password. In such a situation, multiple variables are separated with an ampersand (&) sign as shown here:

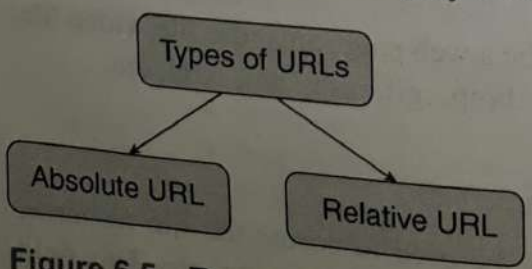

Figure 6.5 Types of URLs

http://www.gmail.com/config/passwd.cgi?u=erree&p=s2ejmd3

In the URL, there are two different variables—u with value erree and p with value s2ejmd3.

A domain name is not the same as URL because it is just a small part of the entire URL.

6.7 INTERNET PROTOCOLS

In the previous Chapter, we have studied the open system interconnection (OSI) model. Each layer in the model supports one or more protocols to exchange data between the source and destination machines. In this section, we will read about vital protocols that form the backbone of data communication over computer networks.

6.7.1 Internet Protocol

The term 'protocol' means a set of rules that must be followed to facilitate communication among diverse devices on the Internet. Internet protocol (IP) is basically a standard networking software which is pre-installed in your computer to enable you to interact with any computer in any country irrespective of the device and its manufacturer. This means that the same IP software is installed in a laptop, desktop, printer, or any other device that needs to be connected with the Internet.

In order to transfer data over the Internet, all devices use the TCP/IP technology. This technology, in turn, comprises various protocols such as TCP, IP, FTP, simple mail transfer protocol (SMTP), and so on. You may think of TCP/IP technology as a team of robot soldiers who are supposed to receive, handle, and transfer the data to the correct destination device.

Currently, two versions of IP are being used—IPv4 and IPv6 where v stands for version.

IP version 4 Currently, IPv4 is being widely used by most network devices. It is a 32-bit number (in binary) and can support a maximum of 2^{32} or 4.3 billion devices on the Internet. Addresses in IPv4 consist of 32 binary bits. The 32 bits are divided into four groups of eight bits where each group is separated by a dot. For example, 216.27.61.137 is an IP address written in decimal notation for better readability and understandability. The same address, when written in binary, can be given as 11011000.000110111.00111101.10001001. Figure 6.6 illustrates another example of an IP address using IPv4.

Although simple, the problem with version 4 is that as more and more devices are being added to the Internet every year, IPv4 addresses are getting exhausted.

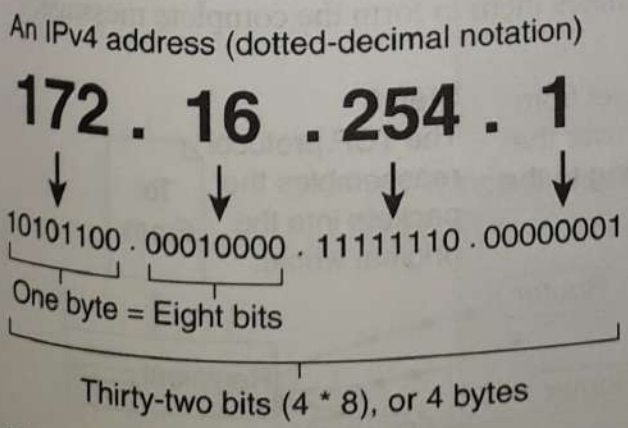

Figure 6.6 IP address

IP version 6 The newer version of IP is IPv6 and is slowly replacing IPv4. IPv6 is not more advanced than IPv4 but has many new features. Since an address in version 6 is 128-bits long, it can support 2^{128} devices on the Internet or approximately, 340, 282, 366, 920, 938, 463, 463, 374, 607, 431, 768, 211, 456 devices. Due to their large size, the address in IPv6 is specified in hexadecimal separated by colons. For example, 1124:1:0:C:0:42:0:512C is a valid IP address specified in version 6. Presently, IPv4 and IPv6 addresses exist but soon IPv6 will take over version 4.