

6

Fundamentals of Internet and Java Programming

6.1 Introduction

Internet is the world's largest computer network, the network of networks, scattered all over the world. It was created nearly 25 years ago as a project for the U.S. Department of Defence. Its goal was to create a method for widely separated computers to transfer data efficiently even in the event of a nuclear attack. From a handful of computers and users in the 1960s, today the internet has grown to thousands of regional networks that can connect millions of users. Using internet, organisations all over the world can exchange data, people can communicate with each other in a faster and effective way. With the help of video conferencing over the internet, it has become possible that people can even see each other while they are communicating. Even one can do all his shopping sitting back at home. He does not bother to visit crowded market place for wasting his valuable time. Gradually, shopkeepers are also interested to opt for electronic commerce which provides them greater reach, faster and better ways to do business over the internet. Don't get surprised, if tomorrow you come to know that the paanwalla in your locality has started selling his paan over the internet.

Thus, the internet has thrown up a number of technological challenges like using the net for secure, private and fast communication as well as supporting video

and 3D graphics. Given this scenario of the internet, there was an implicit need to come up with a programming language to enable authors to incorporate program application fragments (applets) into the web document.

Finally this gave birth to Java programming language. We will discuss about this language in detail in later part of this lesson.

6.2 Objectives

After going through this lesson you will be in a position to :

- explain various terminology used in internet
- use various services provided by internet
- search for desired information over internet
- enjoy internet surfing
- define e-mail and its various features
- explain the features of World Wide Web (WWW)
- explain the utility of Java programming language and its characteristics
- identify the relationship between java and the internet

6.3 Internet - The History

In 1969, the U. S. Defence Department funded a project to develop a network, which can withstand the bombing. Basically the idea was to develop a very secured network which can work even after a nuclear attack. This project was known as ARPANET. The proposed network was not supposed to have a central control-which would be an obvious target. Ten years of research brought Local Area Networks (LANs) and workstations were developed to get connected to LAN. These workstations and LANs were then connected to the ARPANET. For next decade the ARPANET grew and its decentralized features helped its rapid expansion. Computers connected to ARPANET used a standard or rule to communicate with each other. This standard used by ARPANET is known as NCP (National Control Protocol). Protocol is a network term used to indicate

the standard used by a network for communication. But the passing time and rapid change in information technology suppressed NCP and brought TCP/IP (Transmission Control Protocol/Internet Protocol) into the world of networking. TCP converts messages into streams of packets at the source, and they are reassembled back into messages at the destination. Internet Protocol handles the dispatch of these packets. IP handles the addressing, and makes sure that a packet reaches its destination through multiple nodes and even across multiple networks with multiple standards. This flexibility of TCP/IP to handle multiple protocols encourages other networks to get connected to ARPANET. Slowly the ARPANET became a massive network of networks and now it is known as 'Internet'.

Internet is termed by some people as the world of largest democracy with no government. It has no state head to control it.

Why do people want to get connected to Internet? May be because of the freedom it provides. The internet is a rare example of a large democracy with no head of state, no official censors, no bosses, no board of directors. Nobody controls the Internet and in principle, any computer can speak to any other computer, as long as it obeys the technical rules of the TCP/IP protocol. This freedom of Internet helped it to move out of its original base in military and research institutions, into elementary and high schools, colleges, public libraries, commercial sectors even into the shop of a vegetable vendor.

6.4 Services of Internet - E-mail, FTP, Telnet, WWW

But what does one do with the Internet? May be four things basically mail, discussion groups, long-distance computing, and file transfers. Internet mail (e-mail or electronic mail) is much faster as compared to normal postal mail. One can also send software and certain forms of compressed digital image as an attachment. News groups or discussion groups facilitate Internet user to join for various kinds of debate, discussion and new sharing. Long-distance computing was an original inspiration for development of ARPANET and does still provide a very useful service on Internet. Programmers can maintain accounts on distant, powerful computers which execute programs. File transfers service allows Internet users to access remote machines and retrieve programs, data or text.

(a) E-Mail (Electronic Mail)

E-mail or electronic mail is paperless method of sending messages, notes or letters from one person to another or even many people at the same time via the Internet. E-mail is very fast compared to the normal post. E-mail messages usually take only few seconds to arrive at their destination. One can send messages anytime of the day or night and it will get delivered immediately. You need not have to wait for the post office to open and you don't have to get worried about holidays. It works 24 hours a day, seven days a week. What's more, the copy of the message you have sent will be available whenever you want to look at it even in the middle of the night. You have the privilege of sending something extra even such as a file, graphics, images etc. along with your e-mail. The biggest advantage to using e--mail is that it is cheap, especially when sending messages to other states or countries and at the same time it can be delivered to a number of people around the world.

Although e-mail is faster and cheaper, it has many of the components of regular mail. It allows you to compose note, get the address of the recipient and send it. Once the mail is received and read, it can be forwarded, replied. One can even store it for later use, or delete. In e-mail even the sender can request for delivery receipt and read receipt from the recipient.

(i) Features of E-mail

- One-to-one or one-to-many communication
- Instant communication
- Physical presence of recipient is not required
- Most inexpensive mail service, 24-hours a day and seven days a week
- Encourages informal communication

(ii) Components of an E-mail Address

As in the case of normal mail system, e-mail is also based upon the concept of a recipient address. The e-mail address provides all the information required to get a message to the recipient from anywhere in the world. Consider the following e-mail ID

john@ hotmail.com

In the example above, "john" is the local part, which is the name of a mailbox on the destination computer, where finally the mail will be delivered. Hotmail is the mailserver where the mailbox "john" exists,.com is the type of organisation on net, which is hosting the mail server.

There are six main categories;

.com Commercial institutions or organization

.edu Educational institutions

.gov Government site

.mil Military site

.net Gateways and administrative hosts

.org Private organizations

(b) FTP (File Transfer Protocol)

File Transfer Protocol, is an Internet utility software used to upload and download files. It gives access to directories or folders on remote computers and allows software, data and text files to be transferred between different kinds of computers. FTP works on the basis of the same principle as that of Client/Server. FTP client is a program running on your computer that enables you to talk to and get stuff from remote computers. The FTP client takes FTP commands and sends them as requests for information from the remote computer, known as FTP servers. To access remote FTP server it is required but not necessary to have an account in the FTP server. When the FTP client gets connected, FTP server asks for the identification in terms of User Login name and password of the FTP client. If one does not have an account in the remote FTP server, still he can connect to the server using anonymous login. This has been properly shown in Fig. 6.1

Using anonymous login anyone can login to a FTP server and can access public file archives, anywhere in the world, without having an account. One can easily Login to the FTP site with the username anonymous and e-mail address as password.

The basic objectives of FTP are

- to give flexibility and promote sharing of computer programs, files and data.
- to transfer data reliably and more efficiently over network.
- to encourage implicit or indirect use of remote computers using Internet.
- to shield a user from variations in file storage systems among hosts.

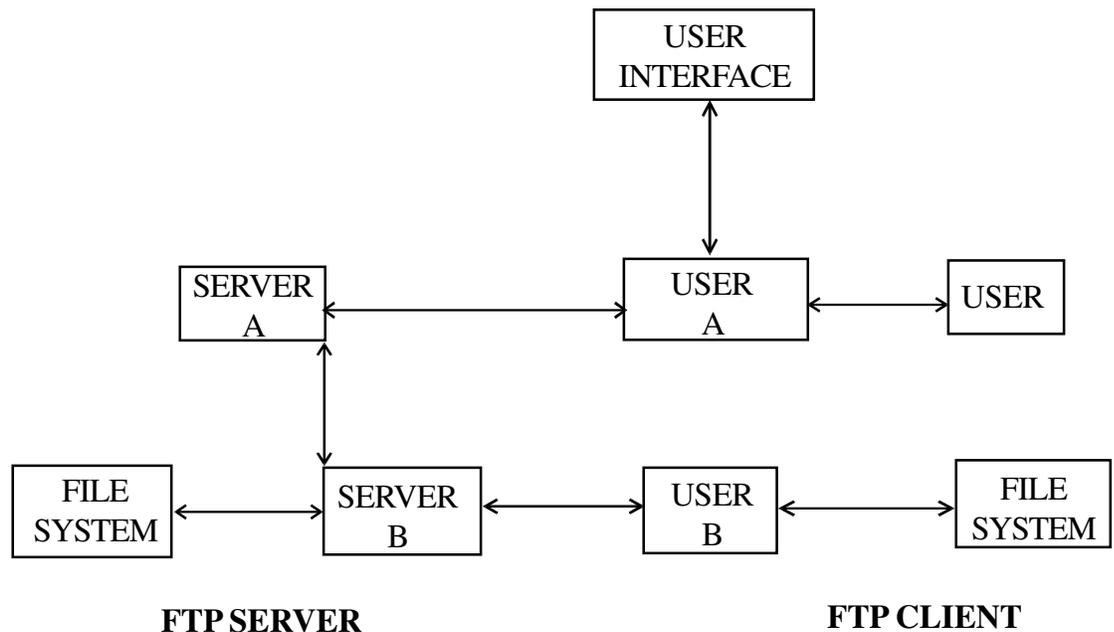


Fig. 6.1

The basic steps in an FTP session are:

- Start up your FTP client; by typing ftp on your system's command line c;>' prompt (or, if you are in a Windows, double-click on the FTP icon).
 - Give the FTP client an address to connect to. This is the FTP server address to which the FTP client will get connected.
 - Identify yourself to the FTP remote site by giving the Login Name
 - Give the remote site a password
-

- Remote site will verify the Login Name/Password to allow the FTP client to access its files.
- Look directory for files in FTP server
- Change Directories if required
- Set the transfer mode (optional);
- Get the file(s) you want; and
- Quit

(c) Telnet (Remote Computing)

Telnet or remote computing is telecommunication utility software, which uses available telecommunication facility and allows you to become a user on a remote computer. Once you gain access to the remote computer, you can use it for the intended purpose. The TELNET works in a very step by step procedure. The commands types on the client computer are sent to the local Internet Service Provider (ISP), and then from the ISP to the remote computer that you have gained access. Most of the ISP provides facility to TELNET into your own account from another city and check your e-mail while you are travelling or away on business.

The following steps are required for a TELNET session

- Start up the TELNET program;
 - Give the TELNET program an address to connect to
 - Make a note of what the "escape character" is;
 - Log in to the remote computer;
 - Set the terminal emulation;
 - Play around on the remote computer; and
 - Quit.
-

Intext Questions 6.1

1. Define Internet briefly.
 2. Write down the features of e-mail.
 3. What are the basic objectives of FTP?
 4. Fill in the blank.
 - (a) is very fast compared to the normal postal mail.
 - (b) is an Internet utility software used to upload and download files.
 - (c) The commands typed on the computer are sent to the local
 - (d) Internet is considered as the world's largest computer network, the of networks, scattered all over the world.
-

6.5 World Wide WEB (WWW)

WWW is the acronym for the World Wide Web. It is also commonly known as 'The Web'. The WWW is a hypertext based information retrieval tool. One can easily surf the Web by jumping from one document to another using the links in those documents. These documents can be in many formats, such as text, graphics, animation, sound and latest is video. They may also be a combination of all these. All the information on Internet are presented to the user as a document or more popularly known as Web Page. All these Web Pages are linked to each other or even to section within a Web Page and these links are known as Hyper Links.

The tool used to view these Web Pages on Internet is known as Internet browser or simply browser. It is a software program specifically developed to extract information on user request from the Internet and present them as a Web Page to the viewer. There are several browsers available in the market. However the most popular are Internet Explorer from Microsoft and Netscape from Netscape Inc. The process of using browser to view information on Internet is known as Browsing or Surfing. This has been show in Fig. 6.2

Fig.6.2

(a) Internet Address

Just like every house, every office, every location has an address every page on the Internet has a unique address. The address is used to get the web page for user from Internet.

Just as the address of a house or office is known as its postal address, the address on the Internet is known as URL (Uniform Resource Locator). A typical Internet

address or URL would look like:

`http://www.nios.org/computers/internet/url.htm`

The URL locates a particular web page, among all the computers connected to the Internet. The URL contains the components that specify the protocol, server, and pathname of an item. Let us examine the URL given above (`http://www.nios.org/computers/internet/url.htm`).

The protocol is followed by a colon (**http:**) the server is preceded by two slashes (`//www.nios.org`), and each segment of the pathname is preceded by a single slash (`/computers/internet/url.htm`). A protocol is a set of rules that tells the computer how to interpret the information at that address.

The first component, the protocol, defines the manner for interpreting computer information. Many Internet pages use **HTTP** (Hyper Text Transfer Protocol). Other common Internet protocols that one might come across are **FTP** (File Transfer Protocol), **NEWS** (Usenet news groups protocol), and **GOPHER** (an alternative transfer protocol). Gopher protocol is mostly obsolete now.

The second component, the server (**www.nios.edu**), identifies the computer system that stores the information you seek and is always preceded by two slashes. A server is a computer that has information stored on it and sends it to the client, when a request is made. Each server on the Internet has a unique address name whose text refers to the organization maintaining the server.

The last component (`/computers/internet/`), defines the path within the server where the requested item (**url.htm**) will be found. Most of the web pages will have **.htm** or **.html** as their secondary or extension name.

6.5.1 How to get connected to Internet

There are various types of connectivity to get connected to Internet. They all can be broadly classified as:

- Gateway Access
 - Dial-up Connection
 - Shell Connection
-

- TCP/IP Connection
- Leased Connection

Gateway Access

Gateway Access is also known as Level-One connection. It is the access to the Internet from a network, which is not on the Internet. The gateway allows the two different types of networks to "talk" to each other. But the users of the Gateway Network have limited access to the Internet. They might not be able to use all the tools available on Internet. The local Internet Service Provider (ISP) normally defines this limitation.

Good example of network with Level One Connectivity within India is that of VSNL (Videsh Sanchar Nigam Limited). All access to Internet from India are through VSNL gateway as shown in Fig. 6.4

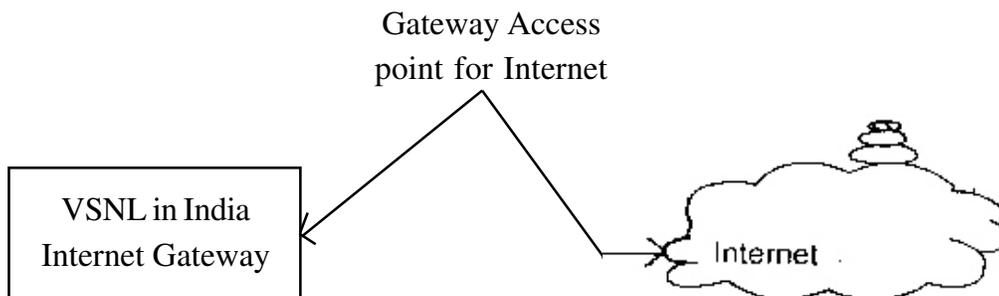


Fig. 6.4

Dial-up Connection

'Dial-up' connection is also known as Level Two connection. This provides connection to Internet through a dial-up terminal connection. The computer, which provides Internet access is known as 'Host' and the computer that receives the access, is 'Client' or 'Terminal'. The client computer uses a modem to access a "host" and acts as if it is a terminal directly connected to that host. So this type of connection is also known as 'Remote Modem Access' connection. And the host to which the client gets connected is actually connected to the Internet by a full time connection as shown in Fig 6.5

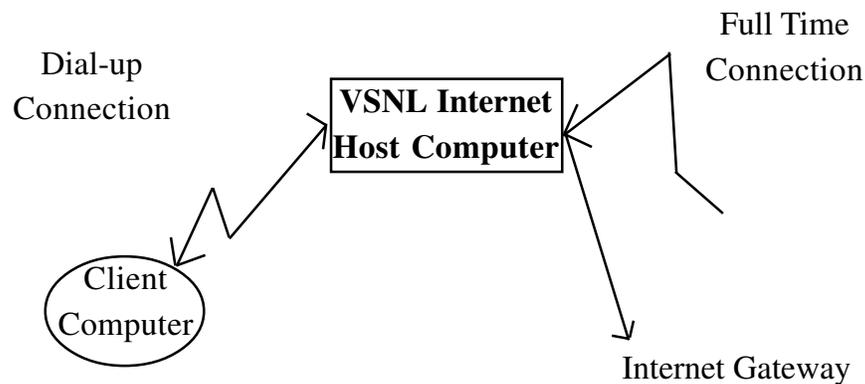


Fig. 6.5

In dial-up connection to Internet, Host carries all the command that are types on a client machine and forwards them to Internet. It also receives the data or information from the Internet on behalf of the 'Client' and passes it to them. The client computer acted as a 'dumb' terminal connected to remote host.

This type of connection can further be divided into two categories.

Shell Connection

In this type of Internet connection, the user will get only textual matter of a Web Page. This connection does not support Graphics display. However the user will be able to surf the Internet, do FTP, receive mail. Shell Accounts were the only type of Internet access available for many years before the Internet entered in to the world of graphics and became more users friendly.

TCP/IP Connection

Today's graphical World Wide Web browsers provides easier access with multimedia sound and pictures. The major difference between Shell and TCP/IP account is that shell can only display text and does not support graphics display, whereas TCP/IP can display both. Hence TCP/IP is more popular Internet connection. Shell accounts are slowly phasing out from the Internet scenario.

To access any of these dial-up accounts you need the followings;

- Computer
 - Modem
 - Telephone Connection
 - Shell or TCP/IP account from the ISP
 - Internet client software such as Internet browser
-

Leased Connection

Leased connection is also known as direct Internet access or Level Three connection. It is the secured, dedicated and most expensive, level of Internet connection. With leased connection, your computer is dedicated and directly connected to the Internet using high-speed transmission lines. It is on-line twenty-four hours a day, seven days a week. Leased Internet connections are limited to large corporations and universities who could afford the cost. These have been clearly shown in Fig. 6.6.

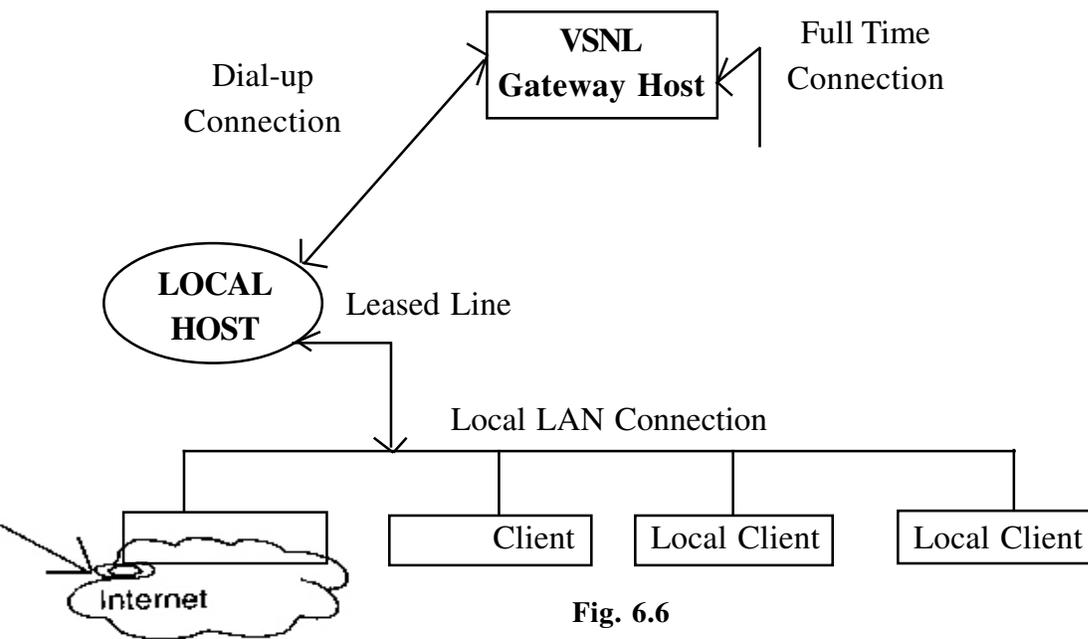


Fig. 6.6

Next Question 0.4

1. Define World Wide Web briefly
2. What are the various ways of connectivity to get hook on the Internet? Explain them briefly.
3. State whether the following statements are True or False:
 - (a) www is the acronym for Word Wide Web.
 - (b) In TCP/IP connection, the user will get only textual matter of a web page.
 - (c) Leased connection is also known as direct Internet access.
 - (d) Dial-up connection is also known as Level Two connection.

6.6 Java and C++

Java is a derivative of C and C++: simple, familiar syntax and with fewer complex features. It does not have many of the poorly understood, confusing and rarely used features of C++. There are no pointers in Java only tightly bounded arrays. This eliminates the possibility of over writing memory and corrupting data unwittingly. Pointers have been the source of raw power in C and C++ programs as well as the primary feature that helped introduce bugs into almost all programs. Java is sophisticated enough to help programmers express complex ideas using arrays and has an efficient automatic garbage collector based memory management scheme. In addition, unlike C or C++, Java does not support structures, enums or functions. Every programmable object is an instance of a 'class' in object oriented Java. This class definition permits both static and dynamic inheritance and hence full reuse of code.

Java does not support multiple inheritance whose semantic and usage has been quite controversial in other languages. Following the principles of structured programs there are no goto statements, no automatic typecasting or operator overloading.

6.7 Characteristic of Java

(i) Simple and Small

Java is easily programmable, with a minimum of training, since it is based on C++. Most of the development tools available today are huge in size and complexity, and require powerful development platforms. But Java's components are comparatively very small in size, enabling construction of compact software that can run 'stand-alone' even on small machines.

(ii) Object Oriented

An object-oriented design enables the development of small, modular, yet self-contained units, each of which could later be used as building block for any specific application. It also facilitates a clean definition of interfaces and allows 'plug-and-play' features, wherein reusable software components can be distributed easily across diverse hardware platforms. Programmers can even attach their applications and data together, and bundle the combination as a single

entity.

Java retains many of the object oriented features and the 'look and feel' of C++. Hence, programmers can migrate easily to Java and be productive quickly.

To be truly considered as 'object oriented' a programming language should support a minimum of four characteristics.

- Encapsulation - implements information hiding and modularity (abstraction).
- Polymorphism - the same message sent to different objects results in behaviour that is dependent on the nature of the object receiving the message.
- Inheritance - you define new classes and behaviour based on existing classes to obtain code re-use and code organization.
- Dynamic binding - objects could come from anywhere possibly across the network. You need to be able to send messages to objects without having to know their specific type at the time you write your code. Dynamic binding provides maximum flexibility while a program is executing.

Now let us see that are objects. They are software programming models. In your everyday life you are surrounded by objects: cars, coffee machines, trees and so on. Software applications contain objects : buttons on user interfaces, spreadsheets, spreadsheet cells and so on. These objects have state and behaviour. You can represent all these things with software constructs called objects, which can also be defined by their state and behaviour. A car can be modelled by an object. It has state (how fast it is going, in which direction, its fuel consumption and so on) and behaviour (starts, stops, turns etc.)

Classes are fundamental entities in Java, as they are in any object oriented language. These classes are ways of representing certain sets of data that have something in common and of providing an interface for the use of this data. Encapsulating the data makes it easy to use, safe from outside interference and also make changing the interface and data content easy. It is really simple to reuse a great portion of code already written in Java, without bothering about

how it is implemented. Java has a huge repository of reusable code, called the Application Programming Interface (API), which greatly simplifies basic programming.

(iii) Portable and Interpreted

A software application written in Java, be it a word-processor or spreadsheet, a multimedia tool or virtual reality designer, will run perfectly on any computer, on any platform. A Java application is a combination of a compiled and interpreted language. The source code written by a programmer is first compiled into Byte Code which is uniform for all machines. This Byte Code is compatible with the Java interpreter which is termed as Java Virtual Machine. The interpreter converts the Byte Code into specific machine code for direct execution, on any machine to which it has been ported.

So, you may write your code anywhere and run it anywhere else. This is very useful because most programmers worry whether their programs will run on other systems.

(iv) Architecture-Neutral

The Java Compiler generates an architecture-neutral object file, 'generic' Byte Code instructions, which have nothing to do with a particular computer architecture. This compiled code is executable on any processor, given the presence of the Java run-time system, which will translate it into native machine code on the fly. The same version of the software runs on all platforms, independent of any CPU or hardware architecture, across networks.

(v) Dynamic

By making interconnections between modules at run-time, Java completely avoids dependency on other software components like libraries. Therefore, Java applications are always ready-to-run, without any side-effects, irrespective of changes or revisions that may take place in those external components.

(vi) Distributed

Java has an extensive library of routines for easy distribution of applications as it abides by industry standard networking protocols like TCP/IP, HTTP, FTP. Java

applications can open and access objects across the net via URLs with the same ease that programmers are used to when accessing a local file system over a network.

(vii) Automatic Memory Management

The Java garbage collector keeps tracks of all objects generated, automatically freeing the memory used by objects that have no further use and are not referred to by other existing objects. This contributes enormously to making the code robust.

(viii) Multi-Threaded

Multithreading is a way of building applications with multiple processes. Support for multithreading enables the efficient execution of programs that potentially have multiple threads of control. Thus, the garbage collector is efficiently run as a background process overcoming the biggest drawback of garbage collector based languages. Multithreading is supported via inheritable thread class libraries. The result is better interactive response and near real-time features. This enables Java to interface and support many features of modern operating systems and new protocols.

Modern network based applications, such as the Hot Java WWW browser, typically need to do several things at the same time. A user working with Hot Java can run several animation concurrently while downloading an image and scrolling the page, Java's multithreading capability provides the means to build applications with many concurrent threads of activity. Multithreading thus results in a high degree of interactivity for the end user.

(ix) Robust

Java programs are robust because explicit memory manipulations by the programmer are prevented.

(x) Secured

Java programs are secured : distributed applications have to exhibit the highest levels of security concerns. A typecode verifier in the Java interpreter ensures that the compiled code is strictly language compliant, thus trapping all malafide modifications, more so the computer viruses parading as legal code.

6.8 How Java ignores the identity of your chip?

The chip inside your computer understands a machine code only. Since this is too complex, programmers use a high level language. This is the source code. This is converted into a machine code which the CPU understands. However, the machine code varies from one chip to another. A compiler is used to execute the conversion. However, the translation takes place in the software developer's office and it is the translated version you buy and install in your computer.

Naturally, an application converted into the machine code for an Intel chip will vary from the version for a Motorola chip, which will be different from the version for a Sparc Workstation, which will have nothing in common with that required for a Silicon Graphics machine and so on.

But, Java follows a different route. In this context, we should know more about compiling and interpreting. Compiled programs make the entire machine code available to the computer at one go. Everytime you use the application, every line of machine code is installed in the memory of your computer. In contrast, interpreted software is converted according to your commands : everytime you want to perform a particular operation, the interpreter seeks out the appropriate lines of source code and converts them, thus taking more time.

We have seen earlier that Java is perfectly portable across different computer platforms. A platform is a combination of the chip and the operating system, such as Intel-plus-Windows 95. Java is actually a combination of a compiled and interpreted language. First, the source code is compiled using the conventional system into a machine code. This is called byte code. The compiled version of Java is identical for all computers. This byte code is actually compatible with a computer that exists not as a hardware but as software : the Java Virtual Machine (JVM).

Essentially, a JVM is nothing but an interpreter. It takes the bytecode and converts it into the specific machine code for the actual chip of your computer. This offers perfect portability. All that a computer, which wants to run Java applications, will need is the appropriate interpreter which naturally will vary for different chips. To the software developer, your computer is no longer an Intel PC, a PowerMac, an Alpha Workstation or a Sun Spare Station; it is simply a JVM. So, he has to write only one version of a program which has to be compiled in only

one way, liberating you from having to worry about compatibility between software and hardware. The hardware configuration before and after Java is shown in Fig. 6.7 and Fig. 6.8 respectively.

SOURCE CODE

Fig.6.8 Hardware Compatibility Post-Java

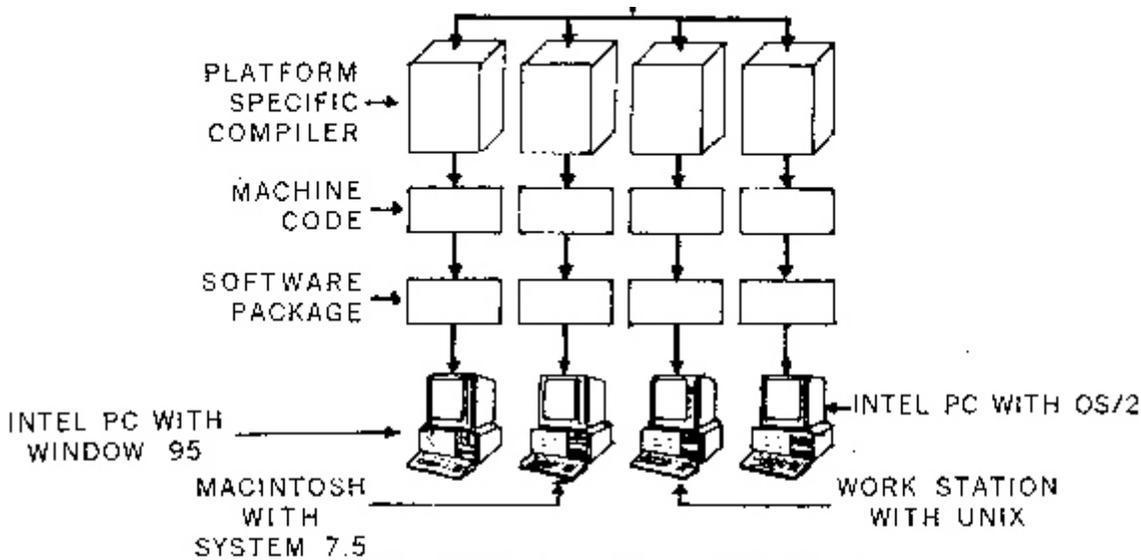
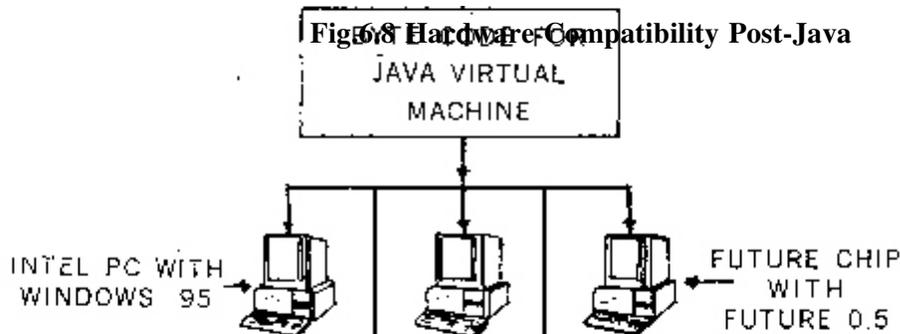


Fig. 6.7 Hardware Compatibility Pre-Java

SOURCE CODE

Fig.6.8 Hardware Compatibility Post-Java



6.9 Software Business after Java

Huge software packages with features that you may virtually never use will become redundant. Instead, computing will be dominated by tiny disposable applications - called applets - written for specific task only.

Applets are nothing but Java programs, usually small and having very limited functionality, so that they can be downloaded by a browser and run. This adds life to static Web contents with minimum effort on the part of the web page designer.

The applets are referenced by a special tag in an HTML file - the <applet> tag. Applets can be located anywhere, either on your local machine or somewhere out on the Internet. It has to be specified as a URL. The location of the applet is completely invisible to the user. The browser fetches and runs it.

Consider a stock market analyst who downloads the day's stock quotations from around the world and runs calculations on them. Today he must have the software on the hard disk and use the Net only as a data source. Post-Java, he will download from the Net, not just the prices, but along with them, an applet that lodges itself in the memory of his computer for say, half an hour. Its task will be to perform comparisons. If the analyst needs to turn the data into bar-charts, he has to use a different applet which will also be available on the Net. After his use, the applet will disappear from the computer.

You need no longer worry about the high prices for the packages and their upgrades. In the applet universe, users will need nothing more than a simple word processing package. If you want any other occasionally used feature, you may download for temporary use from the Net on a just-in-time-basis. You need not buy packages for permanent ownership. Instead, you will be billed on pay-per-use basis.

Further, Java will demolish the entry barrier of expensive distribution and retail networks that mega software vendors have created to keep small companies out of the market. Small, low-cost programs will become viable once they are distributed on the Net. Innovation and programming skills will dominate at the expense of hardsell. With respect to software the pre and post Java scene is illustrated in Fig. 6.9 and Fig. 6.10 respectively.

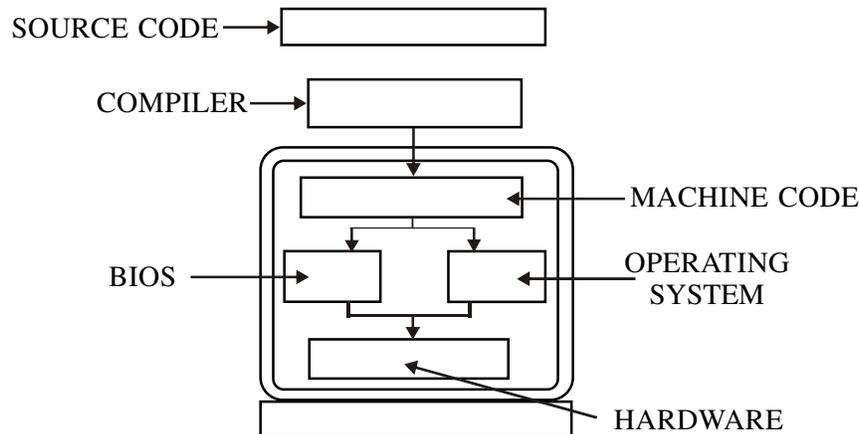


Fig. 6.9 A-Software Architecture Pre-Java

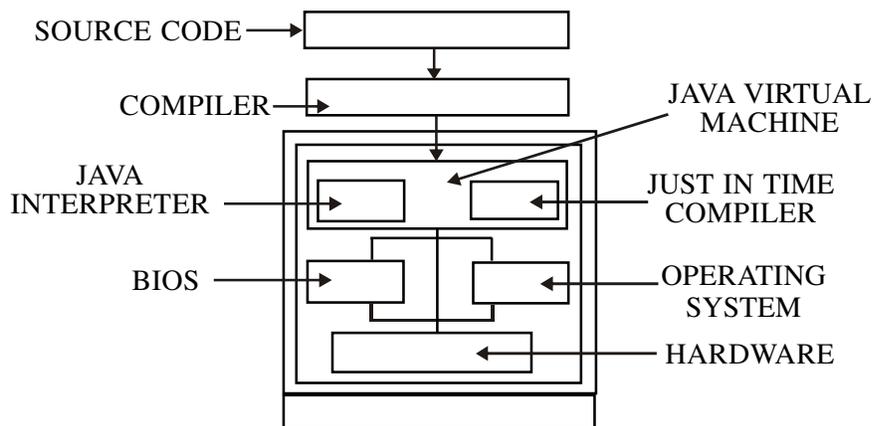


Fig. 6.10 Software Architecture Post-Java

6.10 Java and the Internet

The Java programming language enables the Web documents authors to deliver small application programs to anyone browsing the pages of the html documents. The page becomes alive because it can create game score boards, execute animated cartoons, audio files and video clippings. In addition, it changed the way Internet and WWW worked by allowing architecturally neutral compiled code to be dynamically loaded from anywhere in the network of heterogeneous systems and executed transparently. The Internet usage before and after Java is shown in Fig. 6.11 and Fig. 6.12.

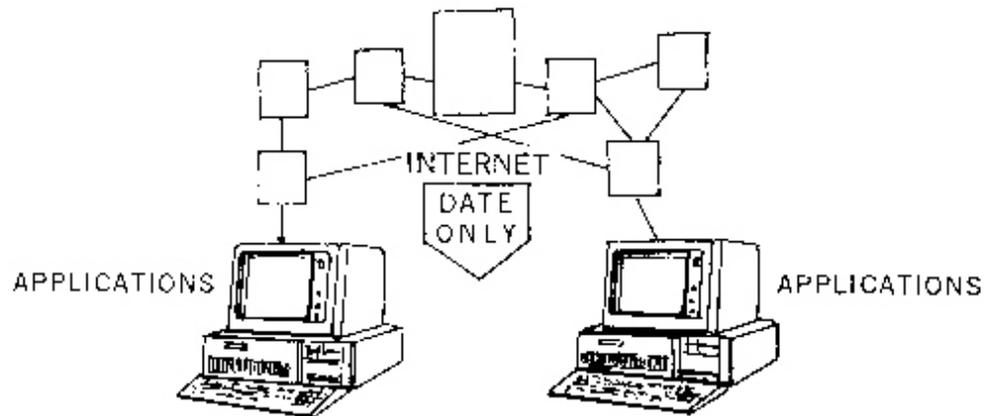


Fig.6.11 Internet Usage Pre-Java

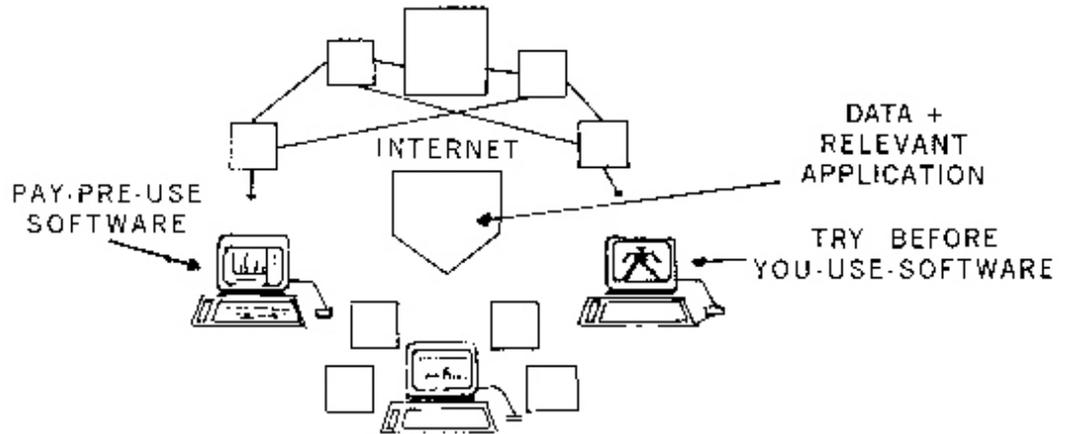


Fig. 6.12 Internet Usage Post-Java

With Java, data and programs - the twin staples of computing - do not have to be stored on your computer anymore. They can reside anywhere on the Internet, called up by whoever needs them and whenever they need them. The WWW introduced millions of users to the world of the Internet. But for their charm, most Web pages themselves are nearly as static as their book or magazine counterparts. Although the Web is technically equipped to supply video and sound, the user needs to have the right software to make use of them.

Java allows you to package software along with data. In other words, when you download a video clip, you also automatically get the software needed to play it.

One thing is certain. The Web has become a powerful computer which anybody can use, so costly desktop systems will soon be replaced by a simple computer connected to the Internet and capable of executing any program dynamically loaded from anywhere in the world. Companies will sell computing capabilities over the Internet, just like our electricity boards supply us with power. In the near future, a sizable part of our preferred activity will be over the Internet and our success depends on our ability to adapt to and use the Internet technologies.

Future of Java

Java runs slower than conventional programming languages and the software libraries that streamline a programmer's task are still being written for it. Java has been a programming language for clients with a rather weak server support: Most of the programs developed in Java are applets designed to perform small functions like animating logos, sketching cartoon characters, etc. Application software for client/server environments are to be developed. For these kinds of applications, Java needs a clean, higher-level interface to databases and servers, like ODBC (Object Data Base Connectivity) and OLE (Object Linking and Embedding), to access data.

While these issues are being addressed, India has also jumped on the Java bandwagon. Java is seen as a very good opportunity for the Indian software industry. With an online connectivity to the rest of the world and a steady growth rate in the industry, Java would probably catalyse the reorientation required for the Indian software industry to make its mark globally.

Intext Questions 6.3

1. Write down the various characteristics of Java Programming language.
 2. State whether the following statements are True or False:
 - (a) There are no pointers in Java-only tightly bounded arrays.
 - (b) Java does not retain many of the object oriented features and the 'look and feel' of C++.
 - (c) A Java application is a combination of a compiled and interpreted
-

language.

- (d) Java programs are robust but lack in security.
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6.11 What you have learnt

In this lesson, we have learnt the basic concept of Internet, its history and various types of services provided by the internet. In this process, we could get an idea about the use of e-mail and file transfer protocol. Now we have fair knowledge to access Internet and can put it to various uses. Java programming language along with its characteristics has been explained briefly in the last part of this lesson.

6.12 Terminal Questions

1. Write down a brief history of Internet.
2. Write down the various features of e-mail.
3. What are the basic objectives of FTP? Explain briefly.
4. State briefly about various types of connectivity to get hooked on to Internet
5. What do you know about Java programming language?

6.13 Feedback to In-Text Questions

In-Text Questions 6.1

1. Internet is considered as the network of networks, scattered all over the world. It is undoubtedly the world's largest network carrying information on almost any subject under the sun.
 2. Features of e-mail are:
 - (a) One-to-one or one-to-many communication.
 - (b) Instant communication
-

- (c) Physical presence of recipient not required
 - (d) Most inexpensive mail service, 24 hours a day and seven days a week.
 - (e) Encourages informal communication
3. Basic objectives of FTP are:
- (a) to give flexibility and promote sharing of computer programs, files and data.
 - (b) to transfer data reliably and more efficiently over network.
 - (c) to encourage implicit or indirect use of remote computers using Internet.
 - (d) to shield a user from variations in file storage systems among hosts.
4. (a) E-mail (b) FTP (c) ISP
- (d) network

In-Text Questions 6.2

1. The world wide web or simply the web is built on top of the Internet. It is hypertext based information retrieval tool.
2. Various ways of connectivity are:
- (a) Gateway Access
 - (b) Dial-up Connection
 - (c) Shell Connection
 - (d) TCP/IP Connection
 - (e) Leased Connection
3. (a) False (b) False (c) True (d) True
-

In-Text Questions 6.3

1. Various characteristics are:
 - (a) Simple and small
 - (b) Object oriented
 - (c) Portable and interpreted
 - (d) Dynamic and distributed
 - (e) Robust and Secure
 2. (a) True (b) False (c) True (d) False
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