63

Running Software over Internet

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63.1 Introduction

A static Web site, which is generally written in HTML, does not provide functionality to dynamically extract information and to store it in a database [WT08]. Dynamic Web sites interact dynamically with clients by taking requests from clients. When receiving requests from a client, a server interacts with a database to extract required information, formats information, and sends it back to the client. HTML alone does not provide the functionality needed for a dynamic, interactive environment. Additional technologies are used to implement the dynamic behavior both on the client side (inside a Web browser) and on the server side to render a web page dynamically. Most common network programming tools used for developing dynamic Web sites on client side are JavaScript, and Java or ActiveX applets. Most common tools on the server side are PHP, Sun Microsystems' Java Server Pages, Java Servlets, Microsoft Active Server Pages (APS) technology, and Common Gateway Interface (CGI) scripts using scripting languages such as PERL and JavaScript, ActiveX and Python, or precompiled binary programs.

Communication through computer networks has become a popular and efficient means of computing and simulation. Most companies and research institutions use networks to some extent on a regular basis [MW01]. Computer networks provide ability to access all kinds of information made available from all around the world, and intranet networks provide connectivity for a smaller, more isolated domain like a company or a school. Users can run software through computer networks by interacting with user interface. Simulation through computer networks has several benefits:

- *Universal user interface on every system*: Every system can run software simulation with a web browser through user interface.
- *Portability*: Software located only on the center machine can be accessed at any time and everywhere.
- *Software protection*: Users can run software through computer networks but cannot own it.

- *Limitation*: Software can interact with any platform that is independent of the operation systems, users do not have to set up or configure software unless it is implemented on the server in the form of stored user profile.
- *Legacy software*: Old software can be run in dedicated environment on the server while its new user interface runs through a web browser on new systems for which the particular application is not available.
- *Remote control*: Computer networks are used to control objects remotely.

The Internet bandwidth is already adequate for many software applications if their data flow is carefully designed. Furthermore, the bandwidth limitation will significantly improve with time. The key issue is to solve problems associated with a new way of software development so that application of software will be possible through the Internet and Intranet. It is therefore important to develop methods that take an advantage of networks and then platform independent browsers. This would require solving several issues such as

- Minimization of the amount of data that must be sent through the network
- Task partitioning between the server and client
- Selection of programming tools used for various tasks
- Development of special user interfaces
- Use of multiple servers distributed around the world and job sharing among them
- Security and account handling
- Portability of software used on servers and clients
- Distributing and installing network packages on several servers
- Others

63.2 Most Commonly Used Network Programming Tools

For implementation, several different languages must be used simultaneously. The following sections review these languages and scopes of its application [MW01].

63.2.1 Hypertext Markup Language

Hypertext Markup Language (HTML) was originally designed to describe a document layout regardless of the displaying device, its size, and other properties. It can be incorporated into networked application front-end development either to create form-based dialog boxes or as a tool for defining the layout of an interface, or wraparound for Java applets or ActiveX components. In a way, HTML can be classified as a programming language because the document is displayed as a result of the execution of its code. In addition, scripting language can be used to define simple interactions between a user and HTML components. Several improvements to the standard language are available: cascading style sheets (CSS) allow very precise description of the graphical view of the user interface; compressed HTML allows bandwidth conservation but can only be used by Microsoft Internet Explorer. HTML is also used directly as it was originally intended—as a publishing tool for instruction and help files that are bundled with the software [MW01].

63.2.2 JavaScript

HTML itself lacks even basic programming constructs such as conditional statements or loops. A few scripting interpretive languages were developed to allow for use of programming in HTML. They can be classified as extensions of HTML and are used to manipulate or dynamically create portions of HTML code. One of the most popular among them is JavaScript. The only drawback is that although JavaScript is already well developed, still there is no one uniform standard. Different web browsers may vary a little in the available functions. JavaScript is an interpretative language and the scripts are run as the web page is downloaded and displayed. There is no strong data typing or function prototyping. Yet the language includes support for object oriented programming with dynamically changing member functions. JavaScript programs can also communicate with Java applets that are embedded into an HTML page.

JavaScript is part of the HTML code. It can be placed in both header and body of a web page. The script starts with `<script language="JavaScript">` line. One of the most useful applications of JavaScript is verification of the filled form before it is submitted online. That allows for immediate feedback and preserves the Internet bandwidth as well as lowers the web server load [MW01].

JavaScript has certain limitations due to the security model of its implementation by a Web browser. One of those limitations was inability to retrieve data on demand dynamically from the server. This was changed by adding a new library that is typically referred to by the name of Ajax Technology. Ajax technology allows a JavaScript program embedded inside a web page to retrieve additional documents or web pages from the server, store them as local variables, and parse them in order to retrieve data and use it for dynamic alteration of the web page where the JavaScript is embedded. The additional data is typically generated on the server by means of ASP or CGI used to interface the Ajax query to the database on the server. Data is then sent back typically in the format of an XML formatted web page. Typically everyday application of this technology is auto-complete suggestion list in a web page form, for example auto-complete suggestions in a search engine web page before a user clicks the search button.

63.2.3 Java

Java is an object-oriented programming language compiled in two stages. The first stage of compilation, to so-called byte-code, is performed during the code development. Byte-code can be compared to machine code instructions for a microprocessor. Because no processor understands directly byte-code instructions, interpreters, called Java Virtual Machines (JVM), were developed for various microprocessors and operating systems. At some point, JVM were improved so that instead of interpreting the code they do perform the second stage of compilation, directly to the machine language. However, to cut down the initial time to run the program, the compilation is done only as necessary (just in time (JIT)), and there is no time for extensive code optimization. At current state of the art of JIT technology, programs written in Java run about two to five times slower than their C++ counterparts. Adding a JVM to a web browser allowed embedding software components that could be run on different platforms [MW01].

63.2.4 ActiveX

Microsoft developed ActiveX as another technology allowing for the automatic transfer of software over the network. ActiveX, however, can be executed presently only on a PC with a Windows operating system, thus making the application platform dependent. Although this technology is very popular already, it does not allow for the development of applications running on multiple platforms. ActiveX components can be developed in Microsoft Visual Basic or Microsoft Visual C++. There is the only choice in cases when Java is too slow, or when some access to the operating system functionality or devices supported only by Windows OS is necessary. The easy access to the operating system form an ActiveX component makes it impossible to provide additional security by limiting the features or resources available to the components [MW01].

63.2.5 CORBA and DCOM

CORBA (Common Object Request Broker Architecture) is a technology developed in the early 1990s for network distributed applications. It is a protocol for handling distributed data, which has to be exchanged among multiple platforms. A CORBA server or servers must be installed to access distributed data. CORBA in a way can be considered as a very high-level application programming interface (API). It allows sending data over the network, sharing local data that are registered with the CORBA server among multiple programs. Microsoft developed its own proprietary API that works only in Windows operating system. It is called DCOM and can be used only in ActiveX technology [MW01].

63.2.6 Common Gateway Interface

CGI (Common Gateway Interface) can be used for the dynamic creation of web pages. Such dynamically created pages are an excellent interface between a user and an application run on the server. CGI program is executed when a form embedded in HTML is submitted or when a program is referred directly via a web page link. The web server that receives a request is capable of distinguishing whether it should return a web page that is already provided on the hard drive or run a program that creates one. Any such program can be called a CGI script. CGI describes a variety of programming tools and strategies. All data processing can be done by one program, or one or more other programs can be called from a CGI script. The name CGI script does not denote that a scripting language must be used. However, developers in fact prefer scripting languages, and PERL is the most popular one [MW01].

Because of the nature of the protocol that allows for transfer of web pages and execution of CGI scripts, there is a unique challenge that must be faced by a software developer. Although users working with CGI-based programs have the same expectations as in case of local user interface, the interface must be designed internally in an entirely different way. The web transfer is a stateless process. It means that no information is sent by web browsers to the web servers that identify each user. Each time the new user interface is sent as a web page, it must contain all information about the current state of the program. That state is recreated each time a new CGI script is sent and increases the network traffic and time latency caused by limited bandwidth and time necessary to process data once again.

In addition, the server-side software must be prepared for inconsistent data streams. For example, a user can back off through one or more web pages, give a different response to a particular dialog box, and execute the same CGI script. At the time of the second execution of the same script, the data sent back with the request may already be out of synchronization from the data kept on server. Therefore, additional validation mechanisms must be implemented in the software, which is not necessary in case of a single program.

63.2.7 PERL

PERL (Practical Extraction Report Language) is an interpretive language dedicated for text processing. It is primarily used as a very advanced scripting language for batch programming and for text data processing. PERL interpreters have been developed for most of the existing computer platforms and operating systems. Modern PERL interpreters are in fact not interpreters but compilers that pre-compile the whole script before running it. PERL was originally developed for Unix as a scripting language that would allow for automation of administrative tasks. It has many very efficient strings, data streams, and file processing functions. Those functions make it especially attractive for CGI processing that deals with reading data from the networked streams, executing external programs, organizing data, and in the end producing the feedback to the user in the form of a text based HTML document that is sent back as an update of the user interface. Support of almost any possible computing platform and OS, and existence of many program libraries make it a platform independent tool [MW01].

63.2.8 PHP

PHP, a server-side scripting language, is the most popular technology that is especially suited for developing the dynamic, interactive Web sites. PHP, which originally stood for "Personal Home Page," is the open-source software initially created to replace a small set of PERL scripts that had been used in Web sites. Gradually, PHP became a general purpose scripting language that is used especially for web development and now called as "Hypertext Preprocessor." PHP is embedded into HTML and interpreted on a web server configured to operate PHP scripts. PHP is a server-side scripting language similar to other server-side scripting languages like Microsoft's Active Server Pages and Sun Microsystems' Java Server Pages or Java Servlets. PHP resembles its syntax to C and PERL. The main difference between PHP and PERL lays in the set of standard built-in libraries that support generation of HTML code, processing data from and to the web server, and handling cookies [MW01]. PHP is used in conjunction with a database system, such as PostgreSQL, Oracle, and MySQL, to create the powerful and dynamic server-side applications.

Database comes to picture when it comes to storing a huge amount of information and retrieving back when it is needed by the web site. The database can contain information collected from the user or from the administrator. MySQL (written in C and C++) is an open source relational database management system (RDBMS) that is based on the structure query language (SQL) for processing data in the database and manages multi-user access to a number of databases. In a relational database, there are tables that store data. The columns define what kind of information will be stored in the table, and a row contains the actual values for these specified columns. MySQL works on many different system platforms, including Linux, Mac OS X, Microsoft Windows, OpenSolaris, and many others. PHP (Hypertext Preprocessor) and MySQL (a portable SQL server) together have made the task of building and accessing the relational databases much easier [WL04] [U07]. AQ1

63.3 Examples

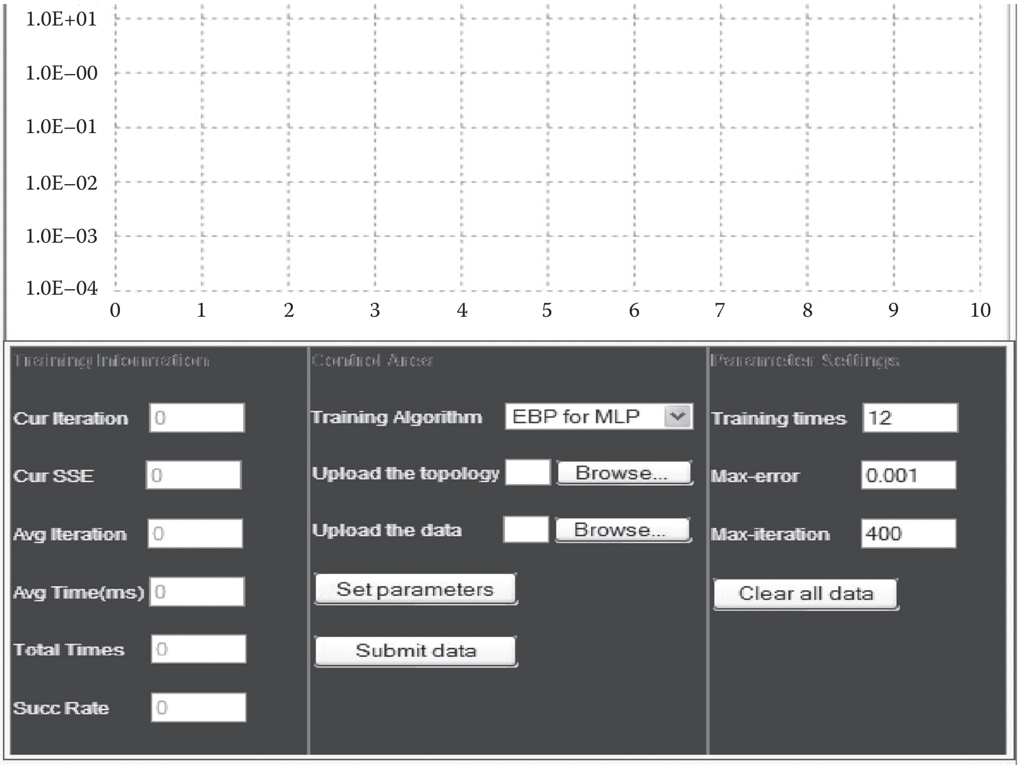
With the increase of Internet bandwidth, the World Wide Web (WWW) could revolutionize design processes by ushering in an area of pay-per-use tools. With this approach, very sophisticated tools will become accessible for engineers in large and small businesses and for educational and research processes in academia. Currently, such sophisticated systems are available only for specialized companies with large financial resources.

63.3.1 Neural Network Trainer through Computer Networks

Several neural network trainer tools are available on the market. One of the freeware available tools is "Stuttgart Neural Network Simulator" based on widely C platform and distributed in both executable and source code version. However, the installation of this tool requires certain knowledge of compiling and setting up the application. Also, it is based on XGUI that is not freeware and still single type architecture—Unix architecture [MWM02].

During software development, it is important to justify which part of the software should run on the client machine and which part should run on the server. CGI is quite different from writing Java applets. Applets are transferred though a network when requested and execution is performed entirely on the client machine that made a request. In CGI, much less information has to be passed to the server, and the server executes instructions based on the given information and sends the results back to the local machine that makes the request. In case of neural network trainer, it only makes sense to use CGI for training process. To send the trainer software through computer networks for every requesting time is not a wise choice because this makes the training process slower and software is not protected. Therefore, it is important to develop methods that take advantage of networks.

This training tool currently incorporates CGI, PHP, HTML, and Java-Script. A CGI program is executed on a server when it receives a request to process information from a web browser. A server then decides if a request should be granted. If the authorization is secured, a server executes a CGI program and sends the results back to a web browser that requested. The trainer NBN 2.0 is developed based on Visual Studio 6.0 using C++ language hosting on a server and interacting with clients through PHP scripts. Its main interface is shown in Figure 63.1.



Training Information

Cur Iteration 0

Cur SSE 0

Avg Iteration 0

Avg Time(ms) 0

Total Times 0

Succ Rate 0

Control Area

Training Algorithm EBP for MLP

Upload the topology

Upload the data

Parameter Settings

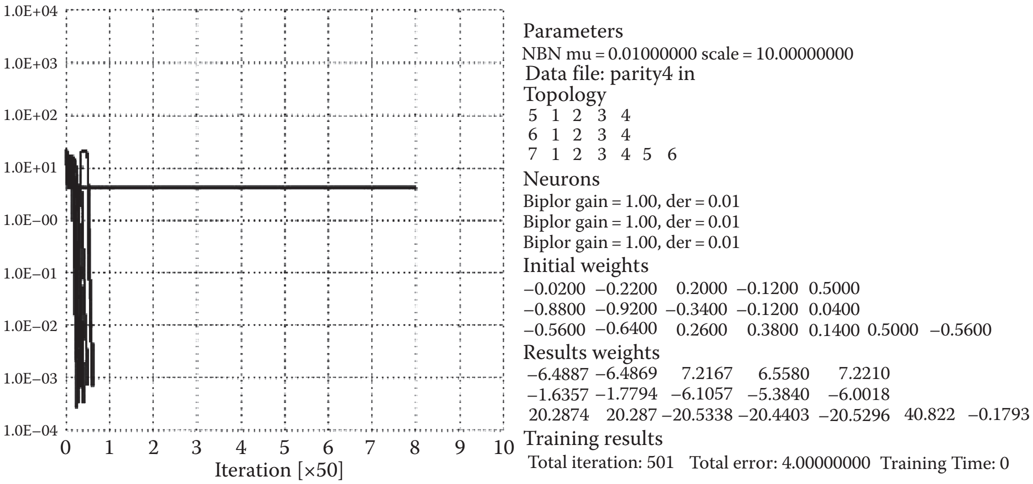
Training times 12

Max-error 0.001

Max-iteration 400

FIGURE 63.1 User interface of NBN 2.0.

The neural network interface will receive requests from users with uploading files and input parameters to generate data files and then send a command to the training software on the server machine. When all data requirements are set up properly, training process will start. Otherwise, training tool will send error warnings back to clients. If training process is successful, training result will be generated. Training result file is used to store training information and result such as training algorithm, training pattern file, topology, parameters, initial weights, and resultant weights (Figure 63.2). AQ2



```
Parameters
NBN mu = 0.01000000 scale = 10.00000000
 Data file: parity4 in
Topology
 5  1  2  3  4
 6  1  2  3  4
 7  1  2  3  4  5  6
Neurons
Biplor gain = 1.00, der = 0.01
Biplor gain = 1.00, der = 0.01
Biplor gain = 1.00, der = 0.01
Initial weights
−0.0200  −0.2200   0.2000  −0.1200  0.5000
−0.8800  −0.9200  −0.3400  −0.1200  0.0400
−0.5600  −0.6400   0.2600   0.3800  0.1400  0.5000  −0.5600
Results weights
 −6.4887  −6.4869    7.2167     6.5580     7.2210
 −1.6357  −1.7794   −6.1057   −5.3840   −6.0018
 20.2874   20.287  −20.5338  −20.4403  −20.5296   40.822  −0.1793
Training results
 Total iteration: 501   Total error: 4.00000000  Training Time: 0
```

FIGURE 63.2 Training results.

Neural network trainer can be used remotely through any network connection or any operating system can be used to access, making the application operating system independent. Also, much less installation time and configuration time is required because the training tool locates only on central machine. Many users can access at the same time. Users can train and see training results directly through networks. And the most important thing is that the software developers can protect their intellectual property when network browsers are used as user interfaces.

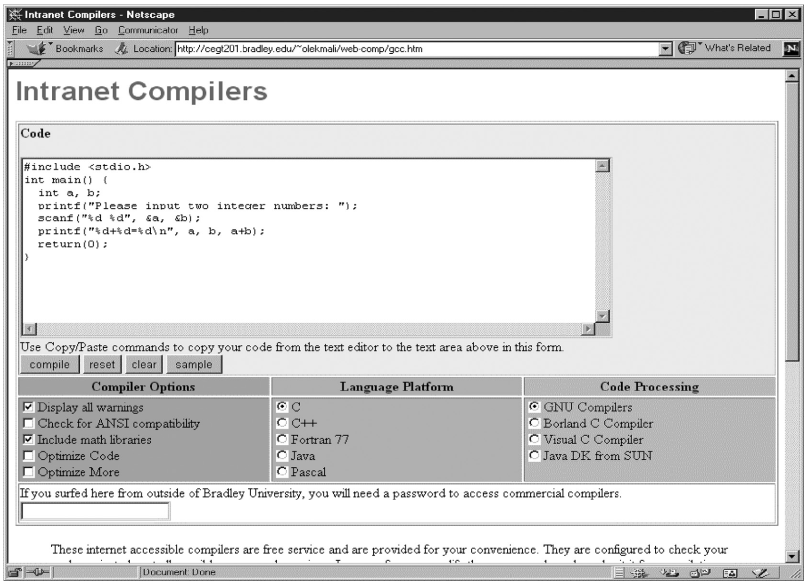
63.3.2 Web-Based C++ Compiler

During the process of software development, frequently more than one compiler package is required. Some products are known to be very useful for locating errors or debugging, while others perform extremely well when a program or library is in the final stage of development and should be optimized as much as possible. Also, when facing obscure error messages, which may result in a time-consuming search for the error, a different error message from the second compiler frequently cuts that time dramatically [MW00].

Therefore, students should be to some extend exposed to different compilers at some point in their software courses curriculum. Although all necessary software is installed in the computer laboratories, most students prefer to work on their computers at home or dormitory and connect to the university network. That situation creates unnecessary burden either for the network administrators who have to install additional software on many machines of non-standard configuration, or on students who must purchase and install on their own several software packages along their full course of study.

In order to solve the problem at least partially in the area of programming, a software package was developed that allows for web-based interfacing of various compilers. Web-page based front end allows to access them without any restrictions regarding the computer system requirements, thus allowing for their use on different operating system platforms and also on older machines with lesser performance.

A common front end is used for all compilers and is presented in Figure 63.3. This HTML page allows for selecting a vendor and a language, and for setting a few basic compilation options. User uses copy and paste commands to enter the source code into the compiler front end. There are three menus located under the source code area as shown. The middle menu is used to select the programming language


Intranet Compilers - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://cegt201.bradley.edu/~olekmali/web-comp/gcc.htm
What's Related
Document: Done

Intranet Compilers

Code

```
#include <stdio.h>
int main() {
  int a, b;
  printf("Please input two integer numbers: ");
  scanf("%d %d", &a, &b);
  printf("%d+%d=%d\n", a, b, a+b);
  return(0);
}
```

Use Copy/Paste commands to copy your code from the text editor to the text area above in this form.

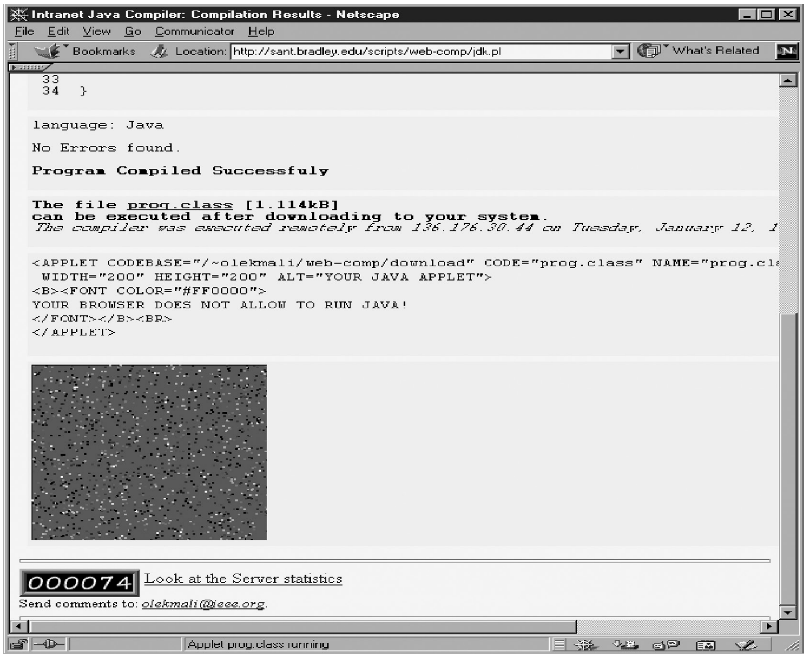
compile
reset
clear
sample

Compiler Options	Language Platform	Code Processing
☑ Display all warnings	● C	● GNU Compilers
□ Check for ANSI compatibility	○ C++	○ Borland C Compiler
☑ Include math libraries	○ Fortran 77	○ Visual C Compiler
□ Optimize Code	○ Java	○ Java DK from SUN
□ Optimize More	○ Pascal	

If you surfed here from outside of Bradley University, you will need a password to access commercial compilers.

These internet accessible compilers are free service and are provided for your convenience. They are configured to check your

FIGURE 63.3 The common Web-based front-end to C++ compilers.


Intranet Java Compiler: Compilation Results - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://sant.bradley.edu/scripts/web-comp/jdk.pl
What's Related

```
   }
```

```
language: Java

No Errors found.

Program Compiled Successfuly

The file prog.class [1.114kB]
can be executed after downloading to your system.
The compiler was executed remotely from 136.176.30.44 on Tuesday, January 12, 1
```

```
<APPLET CODEBASE="/~olekmali/web-comp/download" CODE="prog.class" NAME="prog.cla
 WIDTH="200" HEIGHT="200" ALT="YOUR JAVA APPLET">
<B><FONT COLOR="#FF0000">
YOUR BROWSER DOES NOT ALLOW TO RUN JAVA!
</FONT></B><BR>
</APPLET>
```

000074 Look at the Server statistics

Send comments to: olekmali@ieee.org.

FIGURE 63.4 The result page.

while the right menu is used to select the compiler vendor. Currently the Intranet Compilers package supports C, C++, Ada, Fortran, Modula, Pascal, and Java languages. It utilizes MinGW (Minimalistic GNU for Windows ver. 3.4), Borland (ver. 5.0), and Microsoft (VS 2005) compilers for C and C++, compiler for Fortran and Pascal, and Sun's JDK (ver. 2.6) for Java.

One of the preset compiling configurations can be selected from the left menu. User can decide whether aggressive binary code optimization or strict error checking and ASNI style violation checking are necessary. The compiler vendor and version can be selected from the right menu. In case of selecting one of the commercial compilers while working at off-campus location, the user is requested to input a password to verify his or her legibility to use licensed products.

One of the major advantages of consolidating more than one compiler is the ability to cross-reference error message among different vendor products used from the same interface. The process of compilation is performed in batch mode. After setting the desired options and pasting the source code into the appropriate text box, the task can be started by pressing the COMPILE button. As a result, another web page with HTML wrapped information is sent back to the user. The result page is displayed in another browser window so that the user can correct the source code in the original window and resubmit it if necessary (Figure 63.4).

63.3.3 SPICE-Based Circuit Analysis Using Web Pages

The common problem being faced by many electronic engineers in the industry is that their design tools often operate on several different platforms such as UNIX, DOS, Windows 95, Windows NT, or on Macintosh. Another limitation is that the required design software must be installed and a license purchased for each computer where software is used. Only one user interface handled by a network browser would be required. Furthermore, instead of purchasing the software license for each computer, electronic design automation (EDA) tools can be used on a pay-per-use basis [WMR01].

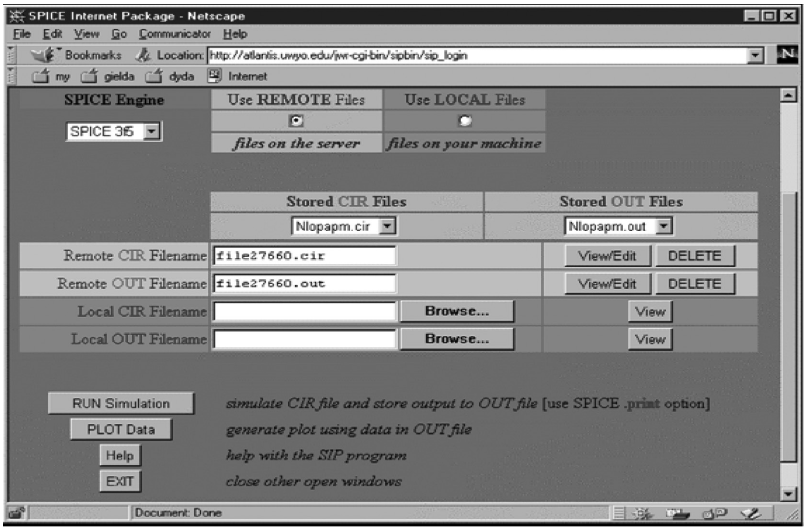
Network programming uses distributed resources. Part of the computation is done on the server and another part on a client machine. Certain information must be frequently sent both ways between client and server. It would be nice to follow the JAVA applet concept and have most of the computation done on client machine. This approach, however, is not visible for three major reasons:

- EDA programs are usually very large and thus not practical to be sent entirely via network as applets.
- Software developers are giving away their software without the ability of controlling its usage.
- JAVA applets used on-line and on demand are slower than regular software.

The Spice implementation used in this presentation is just one example of a networked application. An application called the Spice Internet Package has been developed for use through Internet and Intranet networks. The SIP provides an operating system independent interface, which allows Spice simulation and analysis to be performed from any computer that has a web browser on the Internet or an Intranet. The SIP has a user-friendly GUI (Graphical User Interface) and features include password protection and user accounts, local or remote files for simulation, editing of circuit files while viewing simulation results, and analysis of simulated data in the form of images or formatted text.

In the case of the Spice Internet it would be impossible to send the Spice engine through the network every time it was requested and this would be extremely slow. Java technology could also be used for functions like generating and manipulating graphs and implementing the GUI on the client side. The SIP program currently incorporates CGI, PERL, HTML, and JavaScript. A unique feature of the SIP versus other Spice simulators is that it is operating system independent. Anyone that has access to the Internet and a web browser, such as Mozilla Firefox or MS Internet Explorer, can run a Spice simulation and view the results graphically from anywhere in the world using any operating system (Figure 63.5).

The server is configured to accept requests from web browsers through network connections. The server processes the request for Spice simulation or analysis and returns the results to the requesting web browser as an HTML document. The heart of the software is a server-located PERL script. This script is executed first when the user logs in to SIP. Then each time the user selects any activity, a new dialog box in the form of an on-the-fly generated JavaScript enhanced HTML web page is sent back. Such pages may contain a text editor, a simulation report, a graphic postprocessor menu, or graphic image of plotted results. To complete some tasks, the PERL script may run additional programs installed only for the server such as the main CAD program, i.e., Berkeley Spice; GnuPlot, which generates plots; and some utility programs (netpbmp) to convert plotter files into standard images recognized by all graphical web browsers.



Location: http://atlantis.uwyo.edu/jwr-cgi-bin/sipbin/sip_login

SPICE Engine: SPICE 3f5

Use REMOTE Files ● *files on the server*

Use LOCAL Files ○ *files on your machine*

Stored CIR Files: Nlopapm.cir

Stored OUT Files: Nlopapm.out

Remote CIR Filename: file27660.cir

Remote OUT Filename: file27660.out

Local CIR Filename:

Local OUT Filename:

RUN Simulation — *simulate CIR file and store output to OUT file* [use SPICE .print option]

PLOT Data — *generate plot using data in OUT file*

Help — *help with the SIP program*

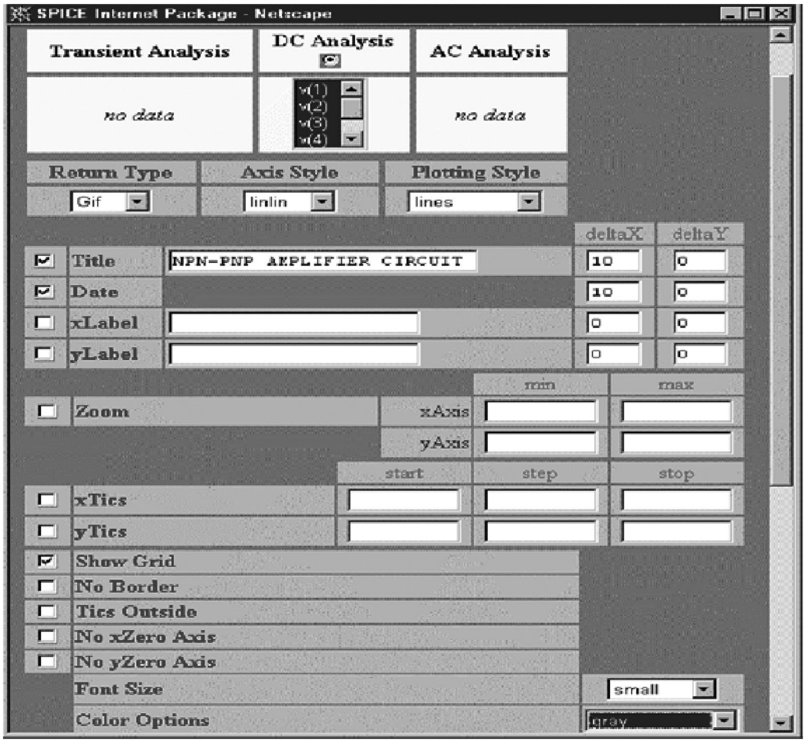
EXIT — *close other open windows*

FIGURE 63.5 Graphical user interface for SIP package.

SIP is a very good example for network traffic considerations. The amount of data produced by a single simulation may differ significantly from a few hundred bytes to a few hundred KB, depending on the number of simulation steps requested. In case of large data files, it is better to generate graphical images of plots and send them to the user. Users frequently inspect the obtained results a few times, for example, by changing the range or variables to display. In case when there may be many requests for different plots of the same data, it could be better to send the data once together with a custom Java applet that could display the same information in many different forms without further communicating with the server.

Several features make the Spice Internet Package a desirable program for computer-aided engineering and design. Only one copy of the Spice engine needs to be installed and configured. One machine acts as the server and other machines can simultaneously access the Spice engine through network connections. Remote access to SIP allows users to run Spice simulations from any computer on the network, and that might be from home or another office in another building or town. Also, the current Spice engine being used is Spice3f5 from Berkeley, which allows an unlimited number of transistors, unlike various "student versions" of Spice programs that are available (Figure 63.6).

Computer networks are also used in the systems for controlling objects as robots, database management, etc. [MW01] [WM01] [WM00]. A web server is used to provide the client application to the operator. Client uses custom TCP/IP protocol to connect to the server, which provides interface to the specific robotic manipulators. Sensors and video cameras provide feedback to the client. Many robotic manipulators may be connected at a time to the server through either serial or parallel ports of the computer. In case of autonomous robots, the servers pass the commands addressed to the robot. In case of simple robot, the server runs a separate process that interfaces to the robot. Data monitoring and control through a computer network or some other proprietary network is no longer prohibitively expensive, and thus restricted only to industrial or luxurious products. Continuously decreasing cost of microprocessors and network interfaces opened additional possibilities in the home automation applications.


SPICE Internet Package - Netscape

Transient Analysis	DC Analysis	AC Analysis

no data	v(1)
	v(2)
	v(3)
	v(4)
		no data

Return Type	Axis Style	Plotting Style
Gif	linlin	lines

			deltaX	deltaY
☑	Title	NPN-PNP AMPLIFIER CIRCUIT	10	0
☑	Date		10	0
□	xLabel		0	0
□	yLabel		0	0

			min	max
□	Zoom	xAxis		
		yAxis		

		start	step	stop
□	xTics			
□	yTics			

☑ Show Grid
□ No Border
□ Tics Outside
□ No xZero Axis
□ No yZero Axis

Font Size: small
Color Options: gray

FIGURE 63.6 Upper part of the plotting configuration screen.

63.4 Summary and Conclusion

The chapter shows how to use the new opportunity created by Internet technologies for efficient and platform independent usage of software applications. The presented examples are just examples, but they show a way in which the technology can be implemented. They also illustrate how significant is the impact of the particular data flow on the programming tools and approaches taken to implement the Internet access to the server installed software. The authors are convinced that such approach will spread and it will revolutionize the general approach toward software development [MW01].

This approach will also have a synergetic effect on the development of better software applications since the market will increase significantly. Availability of software application via the Internet will boost design process in many new communities and improve our education processes at universities by allowing students to use the same sophisticated software as is used by leading industries.

Several features make the software run over Internet a desirable program. Only one copy of the software engine needs to be installed and configured. One machine acts as the server and other machines can simultaneously access the server engine through network connections. Remote access to server allows users to run simulations from any computer on the network. This may be from home, or another office in another building, or town.

References

[WT08] L. Welling and L. Thomson, *PHP and MySQL Web Development*, 4th edn., Addison-Wesley Professional, October 11, 2008. AQ3

[MW01] A. Malinowski and B. M. Wilamowski, Internet technology as a tool for solving engineering problems, *The 27th Annual Conference of the IEEE Industrial Electronics Society* (tutorial), Denver, CO, pp. 1622–1630, Nov. 29–Dec. 2, 2001.

[WL04] H. E. Williams and D. Lane, *Web Database Applications with PHP & MySQL*, 2nd edn., O'Reilly Media, Sebastopol, CA, May 16, 2004.

[U07] L. Ullman, *PHP 6 and MySQL 5 for Dynamic Web Sites*: *Visual QuickPro Guide*, Peachpit Press, Berkeley, CA, Dec. 29, 2007.

[MWM02] M. Manic, B. M. Wilamowski, and A. Malinowski, Internet based neural network online simulation tool, *Proceedings of the 28th Annual Conference of the IEEE Industrial Electronics Society*, Sevilla, Spain, pp. 2870–2874, Nov. 5–8, 2002.

[MW00] A. Malinowski and B. M. Wilamowski, Web-based C++ compilers, *ASEE 2000 Annual Conference*, St. Louis, MO, CD-ROM session 2532, June 18–21, 2000.

[WMR01] B. M. Wilamowski, A. Malinowski, and J. Regnier, Internet as a new graphical user interface for the SPICE circuit simulator, *IEEE Transactions on Industrial Electronics*, 48(6), 1266–1268, Dec. 2001.

[MW01] A. Malinowski and B. M. Wilamowski, Controlling robots via internet, *Proceedings of the First International Conference on Information Technology in Mechatronics*, Istanbul, Turkey, pp. 101–107, October 1–3, 2001.

[WM01] B. M. Wilamowski and A. Malinowski, Paper collection and evaluation through the Internet, *Proceedings of the 27th Annual Conference of the IEEE Industrial Electronics Society*, Denver CO, pp. 1868–1873, Nov. 29–Dec. 2, 2001.

[WM00] B. M. Wilamowski and A. Malinowski, GradeWatch—The software package displaying on web pages students grades, *ASEE 2000 Annual Conference*, St. Louis, MO, CD-ROM session 2793, June 18–21, 2000.