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ABSTRACT

The World Wide Web has been regarded as the most important information technology revolution of the 1990s. It not only has drastically changed the nature of information technology in business and education, but has also imposed a great challenge to developers of information systems (IS) curricula worldwide. To provide IS students with an education that will help them face the challenge of the new technology, Internet-related courses have become an essential component of IS curricula. Two courses have been developed at Georgia State University for teaching Web applications development to IS students. This paper discusses the structures of and lessons learned from these two courses. An improved course structure is also proposed, based on the experience gained in teaching the courses. A proposed Web application course syllabus and lecture notes outline are appended. (Contains 23 references.) (Author/AEF)

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# TEACHING WEB APPLICATIONS DEVELOPMENT TO INFORMATION SYSTEMS STUDENTS

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*The World Wide Web has been regarded as the most important information technology revolution of the 1990s. It not only has drastically changed the nature of information technology in business and education, but has also imposed a great challenge to developers of information systems (IS) curricula worldwide. To provide IS students with an education that will help them face the challenge of the new technology, Internet-related courses have become an essential component of IS curricula.*

*Two courses have been developed at Georgia State University for teaching Web applications development to IS students. This paper discusses the structures of and lessons learned from these two courses. An improved course structure is also proposed, based on the experience gained in teaching the courses.*

## INTRODUCTION

The World Wide Web (WWW or Web) has profoundly changed information technology in the 1990s. It has not only moved information sharing to a global level, but also penetrated deep into the heart of corporate information systems. Commercial Web sites, Intranets and Extranets have taken root in almost all organizations. According to a recent Forrester Report, the Internet commerce software market will reach \$3.2 billion by the year 2000 [Forrester 97].

Web applications have drastically changed since the inception of the Web by Tim Berners-Lee at CERN in 1989. In the beginning, Web applications were simple Web pages used mainly for information sharing. Today, Web applications have expanded into the commercial sector and evolved into sophisticated corporate information systems, such as human resource management, order tracking, travel reservation systems, etc. As shown in the same Forrester Report [Forrester 97], some commercial Web projects cost as high as several million dollars.

Consequently, developing Web applications is no longer a simple task of HTML editing. Corporate Web applications must integrate with various

operations of the organization and existing corporate data sources. Unfortunately, conventional systems analysis and design methodologies are inadequate to address the unique design requirements of the Web. For example, conventional systems design methods cannot address the issue of Web page design, nor integration of these pages with corporate data sources based on high-level data models (e.g., Entity Relationship models). The conventional methods are also inadequate for translating process models (e.g., workflow models) into the design of navigation methods (e.g., indexing, guided tour, etc.) and server-side code that accesses various data sources. Thus, a course focusing on Web application development is needed.

To meet the demand, we have taught courses on the development of Web applications at Georgia State University. The primary objective is to provide adequate education for our students in order for them to compete in today's job market. Skills in this area are in high demand, as shown in a recent career report in ComputerWorld magazine [Engler 97].

The first section of this paper describes the structures of the two courses and the experience

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gained in teaching them. A proposed Web application course syllabus based on our experiences is presented in the second section.

## WEB APPLICATIONS DEVELOPMENT COURSES

In Spring Quarter 1996, we offered the first Web applications development course. It was offered as an advanced topic course for students with a major in Computer Information Systems (CIS). Enrollment comprised 30 undergraduate students, all of them seniors.

A similar but improved course was offered as an advanced topic course for graduate CIS students in Fall Quarter 1996. The total enrollment of the class was 35, and consisted of second-year graduate students.

Prerequisites for both classes were the same. Students were to have taken a programming course in a high level language (such as C, C++, or Visual Basic) and have completed a database management course.

### The Scope of the Courses

As Web applications development deals with a wide range of subjects, there are many different approaches to designing such a course. On one end of the spectrum, the course can be taught with a very strong management orientation. The focus is then on strategic, marketing, and sales issues (e.g., [Carrol 96]). Such a course can be categorized as an Electronic Commerce course. Many schools have developed courses in this category, as listed in the Electronic Commerce Course Page of ISWorld Net [ISWorld Net] and the Internet, Etc. section of Global IS Education [GISE]. Examples of such courses can be found in [Bento], [Dekleva], [Galletta], and [Williams].

On the other end of the spectrum, the course can focus on technical issues such as internetworking, TCP/IP, CGI, and Java programming. Such a course falls into the category of Internet Technology, and can be found in typical computer science curricula. Examples of such courses can also be found in the Internet, Etc. section of Global IS Education [GISE] and other individual course descriptions (e.g., [Beguelin], [Chatterjee]).

We have chosen a third approach and focused on Web applications development. This subject falls in the area of systems analysis and design and cannot be adequately addressed by courses in either electronic commerce or Internet technologies. However, as discussed earlier conventional systems analysis and design does not address the unique characteristics and design requirements of Web applications. Our intent is to fill the void.

### The Structure of the Courses

The following discussion is derived primarily from the graduate course because it followed—and took advantage of the experience gained from—the undergraduate course. Appendix A lists the textbooks used and the lecture plan of the course as posted on the Web site for that class (<http://cis.gsu.edu/~shong/teaching/cis849/>). Appendix B shows the table of contents of the lecture notes of the class.

**TABLE 1**

### SUBJECTS COVERED IN THE COURSE

Topics	Description	Ratio	Assignments
Introduction	WWW, HTML, multimedia	13.3%	Build home pages for each team
Web Servers	HTTP, Web server installation & administration	6.7%	Set up a Web server on home computer
Design methods	Web site design issues, design guide, and design methods for Web applications	23.3%	<ul style="list-style-type: none"> <li>• Read Web design guides and design methods</li> <li>• Apply the design method to team projects</li> <li>• Present the design in class</li> </ul>
CGI programming	CGI programming in Perl, file and database access, database gateway software	16.6%	Complete a CGI programming assignment
Java programming	Network-computing concept, Java and Java Script	13.3%	Complete a Java applet assignment
Advanced topics	Web security, Intranet, legal issues, including guest lectures	20%	<ul style="list-style-type: none"> <li>• Read selected articles</li> <li>• Conduct a literature survey on a selected topic.</li> </ul>

The class comprised four components: lectures, team projects, individual assignment, and exams. All lectures were conducted in a room in which the instructor and students had computer workstations. The topics and time ratios of the lectures are listed in Table 1.

### **Team Projects**

The team projects lasted the entire quarter. Each team consisted of at most three team members who were responsible for finding a local company that would sponsor a Web project. The team conducted several interviews with sponsors at the beginning of the quarter to determine project requirements. During the quarter, teams maintained close relationships with project sponsors, reporting progress and obtaining feedback.

By the end of the quarter, each team gave a formal, on-site presentation to their sponsors, in addition to a class presentation. Each team also prepared thorough documentation for their sponsor. Prior to the project presentation, the instructor wrote a letter to thank each sponsor and to request a written, sealed evaluation of the team.

There were two specific project requirements. One was that the project must be database-driven. (That is, all dynamically changed data had to be stored in a database.) The other was that two interfaces had to be provided, one for public browsing and another for administration. The latter was a protected interface for authorized users only, and was designed for maintaining the application once the project was completed. The maintenance pages allowed a sponsor to use a Web browser to access the database and to update information without coding.

The feedback received from the sponsors on the maintenance pages was very positive. They felt that the facilities these pages provided greatly simplified updates and reduced maintenance costs.

### **Computer Software and Hardware**

A special Web server that provided the applications and exercises need to run CGI

programs was set up for the class. As with most universities, Georgia State University does not give students full access authorizations to its Web servers for security reasons. This restriction was also true for the project sponsors that had their own Web servers. Thus a standalone, dedicated Web server was an essential component of the class.

The hardware for setting up such a Web server does not have to be a high-powered computer. The computer we used was a Pentium 66 with 16 MB memory and a 640 MB hard drive. It was connected to the Computer Information Systems department's Token Ring network. We found that this configuration was adequate for supporting both classes.

Database gateway software (Allaire's Cold Fusion [Cold Fusion]) was installed on the Web server to reduce the amount of CGI programming necessary. Cold Fusion allows the development of database-driven applications without CGI programming, requiring knowledge only of HTML and SQL. As discussed earlier, developing Web applications was the main focus of this class, and adopting this software tool allowed the students to focus more on the design issues than coding.

As shown in Table 1, students were asked to set up Web servers on their personal computers. The database gateway software Cold Fusion [Cold Fusion] and several popular Web servers (e.g., [WebSite], [ZBServer]) provide 30- or 60-day free evaluations. Setting up a Web server at home involved no additional cost to the students. There were several reasons for such a requirement. First, students could acquire the knowledge and skills of Web server installation and administration. Second, it allowed students to develop and test their applications on their own computers before uploading the applications to the Web server. Third, a large number of the students were part time and allowing them to work remotely reduced commuting time. Finally, since most work was done at home there was less need for server administration, and no need for a dedicated computer lab. Students developed their applications at home, then used FTP to upload their applications to the server.

## Individual Exercises

Two small programming exercises were assigned to each student. In addition, each student was also required to conduct a literature research on a selected topic and write a survey paper. Four outstanding papers were selected and presented in class. As shown in Appendix B, the papers discussed Internet security, Intranet, and legal issues.

## Outcomes and Lessons Learnt

Students in both classes encountered two major difficulties. The first difficulty was collecting project requirements from project sponsors. This difficulty was experienced more often in projects involving the development of commercial Web sites, whereas Intranet applications were usually well defined.

Most corporations have found it difficult to translate their business success to cyberspace. Their initial attempts, prompted by a tidal wave of other companies moving onto the Web, were sometimes intended merely to establish an Internet presence—any Internet presence. These attempts often lacked the necessary understanding of the power and limitations of the Web. The lessons we have learned from the mistakes of the past suggest that education on issues relating to electronic commerce is required if the next generation of IS graduates is to successfully exploit the power of the Web.

The second major difficulty experienced by the project teams was adopting and applying analysis and design methods. Because the Web has evolved so rapidly, there were few design methods available when the two courses were offered. Those methods that were available were extensions of design methods for hypermedia applications, such as the RMM method proposed by Isakowitz and his colleague [Isakowitz 95]. Our solution was to define an analysis and design method by combining features in the RMM method with conventional analysis and design methods [Hong 93]. However, the students found it difficult to apply the design method because of impedance between selected analysis and design features. The problem calls for a well-defined and well-tested method for developing Web applications.

We strongly recommend adopting a Web application development tool. No such tool was adopted in our first class; students manually wrote CGI programs to produce dynamic Web pages. Cold Fusion was adopted for the second class, which made significant differences in both the complexity and quality of the projects. (Please refer to the project pages of those two classes [CIS485 Proj] [CIS849 Proj].)

Overall, students viewed the two classes as very valuable. Many students from the classes are now working on Web-related projects in their organizations. Altogether the project teams developed twenty-three Web applications for companies ranging from small businesses to Fortune 100 companies. More than half of the projects have been converted into official Web sites. The student teams were highly motivated and made a great effort to produce high quality applications beyond the expectation of project sponsors, as reported by the sponsors in their evaluation letters.

## A PROPOSED COURSE

There is more than one way in which Web applications development can be incorporated into CIS or MIS curricula. One way is to integrate the subject into systems analysis and design courses. The advantage of this approach is that existing curricula do not need to be changed and the subject can be integrated into the instruction of conventional systems analysis and design.

We propose a different approach, a separate course for Web applications development. We believe that there are too many topics within this area to be covered as a part of another course. A separate course gives sufficient time to treat the topics of developing Web applications in reasonable depth.

### Prerequisites

There are several prerequisites for the proposed course. First, students should have completed a database course. As databases are an essential component of Web applications, familiarity with database management and SQL is necessary.

Second, students should have taken at least one programming course, such as C, C++, or Visual

Basic. These skills are necessary for writing CGI programs, and the Web applications development course should not attempt to teach introductory programming. If a software tool like Cold Fusion [Cold Fusion] is adopted for this class, the programming prerequisite could be optional.

Another optional prerequisite would be a course in systems analysis and design. If students have already had such a course, the discussion of design methodology could build upon their established knowledge of systems analysis and design.

## Objectives

This course should focus intently on the development of Web applications. Ideally, when students have completed this course they should be qualified to pursue jobs as Webmasters, Web application developers, or related careers.

## Computer Software and Class Lab

Two types of computer software are essential: a Web server, and database gateway software or a Web application development tool. The Web server is used to host all student projects and exercises. Our experiences suggest Microsoft Internet Information Server on a Microsoft NT workstation. The selection of this platform is based on its simple administration and low cost (IIS is free with NT server). A standalone Web server gives students the capability of running Web applications with minimal constraints.

A database gateway software or development tool (e.g., [Cold Fusion], [IntraBuilder], [JDesigner], [NetDynamics], or [Visual InterDev]) helps lower the learning curve and reduce the time required for coding Web applications. Such software is very critical for schools in quarter systems. Our experience has strongly suggested that adopting such software tools allows students to focus on design instead of coding.

Server side database software is not required. In our classes, we allow students to develop their applications using Microsoft Access. The selection of Access is based on its wide availability and low cost. Our students first created a database on a personal computer, then

uploaded it to the Web server to support their applications. The major benefit of such an approach is that it requires no database administration such as creating user accounts. We used this approach for the two classes and have not had any problems with it.

A designated lab for the class was not necessary because students could access the Web server from any computer that had Internet access either directly or remotely. However, the room for such a class must have at least an instructor workstation with Internet access. This allows the instructor to demonstrate various Internet technologies.

The cost for setting up an adequate Web server for such classes is estimated as follows:

Internet connection:	free (assuming the school has already had Internet connection)
Web server hardware:	\$2,000.00 to \$2,500.00 (e.g., a Pentium Pro 200 with 64 MB memory and 4.0 GB disk space)
Operating system:	\$400.00 and up (e.g., \$399.95 for Microsoft NT Server)
Web server software:	\$0.00 to \$800.00 (e.g., free for Microsoft Web server and Netscape Web server, or up to \$790.00 for WebSite Professional 2.0)
Web application development software:	\$500 to \$1,000.00 (e.g., Cold Fusion, InterDev, IntraBuilder, etc.)

Thus, the total estimated cost for computer software and hardware would be between \$2,900.00 and \$4,700.00. Note that database software is not included in the list. It assumes that small databases such as Microsoft's Access are available at no additional cost.

## Course Topics

Table 2 shows the major topics of the proposed course. It is based on the experience gained from the two classes as discussed earlier.

**TABLE 2**

**PROPOSED COURSE TOPICS  
AND LECTURE HOUR RATIOS**

Topics	Description	Ratio	Assignments
Introduction	Discusses WWW, HTML and introduces Web applications Intranet and Extranet	10%	Build and maintain their a team project Web site
Web Servers	Introduces HTTP and Web server set up and administration	10%	Set up a personal Web server on student home PCs
Electronic Commerce	Discusses issues related to strategic planning, marketing, and sales in cyberspace	15%	Study commercially successful Web sites
Design of Web Applications	Introduces design issues and design methods for Web applications	25%	Apply the method to the design of team projects
Web application implementation	Introduces CGI programming, Java Script, Java, and tools for developing Web applications	25%	Complete a CGI programming assignment
Advanced topics	Discuss issues related to Web security, and Intranet	15%	Literature research project

Compared with the topics listed in Table 1, there are several changes as explained below:

1. We decreased the time for introduction. We assume that students already have some familiarity with HTML and setting up simple home pages. The introduction should focus on advanced HTML tags such as form tags.
2. The time slot for the discussion of Web servers has been slightly increased. Several popular Web servers, such as WebSite [WebSite] and ZBServer [ZBServer], provide simple, straightforward installation procedures. They all supply GUI administration tools that make the administration rather easy. These Web servers usually allow students to download a 30- or 60-day free evaluation copy.
3. A new topic, electronic commerce, has been added. As we discussed earlier, our experiences have shown that it is important to have basic knowledge of cyberspace

strategies, marketing, and sales. Such knowledge stimulates discussions between students and their project sponsors, and helps identify critical areas contributing to the commercial success of Web applications.

4. Lectures devoted to the discussion of Web applications development have been slightly increased. Given the lack of off-the-shelf methods, instructors may have to combine conventional systems analysis and design methods with design methods of hypermedia applications.
5. CGI and Java programming remains, but with decreased time. It is believed that students should understand the concepts and techniques of Internet programming in terms of CGI and Java. Although software tools could eliminate the need for coding in this class, knowledge and basic skills in CGI and Java programming lay a foundation for students who want to pursue advanced Internet applications programming in subsequent studies.
6. The final section of the lecture would be reserved for discussing development in WWW. The topics covered would be left to the discretion of instructors.

**Projects**

Team projects should an important cornerstone of the class. There is a high demand for setting up Web sites and developing Web applications; therefore students should have no problem finding suitable projects. The project should be designed to accomplish several objectives:

1. Expose students to challenges in a real world setting.
2. Apply processes and techniques to the analysis and design of Web applications.
3. Develop basic skills in the development of Web applications.
4. Gain an in-depth understanding of the development of Internet technology and industry trends.

As class projects can easily be shown to prospective employers, the projects may strengthen students' resumes as examples of "real world experience." Having such international exposure can motivate students to do their best. Instructors must be sure to

maintain the projects on-line after the class ends and to keep a close eye on the quality of the projects. For instructors, such project Web pages can be a good promotion for the class.

## CONCLUSION

We have described the Web development courses developed and taught at Georgia State University. We have also proposed a similar course based on the experience we gained in those two courses. Our experiences have shown that such courses are very important for preparing IS students facing the challenge of new technologies and competing in today's job market.

Preparing for such a class is time-consuming. It requires instructors to develop both lectures and lab exercises. Adequate curriculum development time must be allocated. Instructors must have sufficient time to reeducate themselves about the new technology and become Internet literate.

The cost for computer resources for such a class is comparable with other IS courses. If instructors have strong technical backgrounds, administrating the class Web server should not be a major problem. In the two classes taught at Georgia State University, the instructor performed all administrative tasks after the Web server was set up with the help of a computer support technician. The complexity of administrating Web servers has been reduced greatly by newly released server software.

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[IntraBuilder] IntraBuilder, Borland International Inc., World Wide Headquarters, 100 Borland Way, Scotts Valley, CA 95066 , <http://www.borland.com/intrabuilder/>.

[Isakowitz 95] T. Isakowitz, E.A. Stohr, & P. Balasubramanian, "RMM: A Methodology for Structured Hypermedia Design," *Communications of the ACM*, Vol. 38, No. 8, August, 1995, pp. 34-44.

[ISWorld Net] Electronic Commerce Course Page, <http://www.isworld.org/isworld/ecourse/home.html>, Editor, Blake Ives, ISWorld Net.

[JDesigner] JDesignerPro, BulletProof Corporation, 15732 Los Gatos Blvd. #525, Los Gatos, CA 95032, <http://www.bulletproof.com/>.

[NetDynamics] NetDynamics, NetDynamics, Inc., 185 Constitution Drive, Menlo Park, CA, <http://www.netdynamics.com/>.

[Visual InterDev] Visual InterDev, Microsoft Corporation, <http://www.microsoft.com/vinterdev/>.

[WebSite] WebSite Server, O'Reilly Software, <http://software.ora.com/>.

[Williams] Russ Williams, "A Brief Introduction to the Internet and Electronic Commerce for Small Businesses", <http://gwis2.circ.gwu.edu/~rwill/sbrc20.htm>, Electronic Commerce Resource Center for Small Businesses and SME's, George Washington University, Washington DC.

[ZBServer] ZBServer, ZBSoft Corporation, 1917 Wilson Avenue, Madison, IN 47250, <http://www.zbserver.com/>.

## APPENDIX A CIS 849 SYLLABUS (EXCERPT) FALL QUARTER, 1996

### Textbook

#### Required textbooks:

- [S] Lincoln D. Stein, *How to Set Up and Maintain a World Wide Web Site: The Guide for Information Providers*, 1995, Addison-Wesley Publishing Company, ISBN 0-201-63389-2
- [HSS] A.V. Hoff, S. Shaio, and O. Starbuck, *Hooked on Java: Creating Hot Web Sites with Java Applets*, 1996, Addison-Wesley Publishing Company.

#### Optional textbooks:

- [B] T. Boutell, *CGI Programming in C & Perl*, Addison-Wesley Developers Press, 1996, ISBN 0-201-42219-0
- [EH] G. Eddy & B. Hausch, *Web Programming with Visual Basic*, Samsnet, 1996, ISBN 1-57521-106-8

#### Selected Readings Reserved and on the Web.

### COURSE PLAN

- 9/25 Class Introduction & Team Project Discussion  
Team Project Assignment  
Research Paper Assignment
- 9/30 Introduction to the Web & HTML  
Reading: [S] ch 1, 2, 5;  
[Readings] 1, 2, 3, & 8

- 10/2 Web Server Installation & Configuration  
**Reading:** [S] ch 3  
**Project plan due**
- 10/7 Creating Multimedia HTML Documents  
**Readings:** [S] ch 6
- 10/9 Introduction to CGI Programming  
**Readings:** [S] ch 8, 9  
**Requirements document due**
- 10/14 Web Page Design Guideline  
**Readings:** [S] ch 7, [Readings] 4, 5, 6 & 7
- 10/16 A Design Method for Web Applications (1)  
**Readings:** [Readings] 4, 5, 6 & 7
- 10/21 A Design Method for Web Applications (2)  
**Middle term research paper due**
- 10/23 CGI Programming (1)  
**Reading:** [B] or [EH]
- 10/28 CGI Programming (2)  
**Reading:** [B] or [EH]
- 10/30 **Project design presentation**  
**Project design document due**
- 11/4 CGI Programming (3)  
**Reading:** [B] or [EH]
- 11/6 Introduction to Java (1)  
**Reading:** [HSS] ch. 1 & 2  
[Readings] 9 & 10
- 11/11 Introduction to Java (2)  
**Reading:** [HSS] ch. 3 & 4
- 11/13 Web Security  
**Reading:** [S] ch 4
- 11/18 Introduction to Intranet  
**Reading:** TBD
- 11/20 **Project preparation**
- 11/25 **In Class Exam**
- 11/27 - 11/29 Thanksgiving Holidays**
- 12/2 Special topics
- 12/4 Project presentation,  
6:00 p.m., Wednesday,  
December 4, 1996

**FINAL PROJECT REPORT DUE**

**APPENDIX B**  
**CIS 849A Lecture Notes Outline**

1. Introduction to WWW
2. Introduction to Basic HTML Tags
3. Introduction to Web Servers

4. Advanced HTML Features
  - ♦ Try the form submission example
5. Introduction to CGI Programming
  - ♦ Try a simple searchable document using ISINDEX
  - ♦ Try the Hello. World CGI script
  - ♦ A CGI script printing all environment variables
  - ♦ A form submission example and its source code
  - ♦ CGI4VG for CGI Programming in Visual Basic developed by Kevin O'Brien, which according to the author, supports standard I/O.
6. Web Application Design & Evaluation
7. Web Application Design Methods (Part I)
8. Web Application Design Methods (Part II)  
(See handout)
9. Advanced CGI Programming
  - ♦ How to set up a personal WebSite Server for running Perl scripts
  - ♦ Download the cgi-lib.pl
  - ♦ Download the CGI.pm library
  - ♦ Form process example and its CGI code
  - ♦ CGI-LIB Form process example and its CGI code
  - ♦ CGI-LIB file upload example and its cgi code
  - ♦ CGI.pm Form process example and its CGI code
  - ♦ More script examples created with CGI.pm by Lincoln Stein
10. CGI Programming: Files & Databases
  - ♦ The simple counter Perl code (18 k zipped)
  - ♦ Tutorial & Example Applications came with the Cold Fusion 2.0
  - ♦ Example applications came with the Cold Fusion 2.0
  - ♦ Install & test Cold Fusion at a home PC and the Student Information System Example (33 k zipped)
  - ♦ Test-drive the Student Information System example
  - ♦ An IDC file example (sample.idc) for MS IIS
  - ♦ A HTX file example (sample.htx) for MS IIS
11. Introduction to Java
  - ♦ Download the Java Developer's Kit from JavaSoft
  - ♦ Timothy Arnold's Java Lab
  - ♦ The lecture examples (pkzipped, 15k)
  - ♦ Test the lecture examples
12. Introduction to JavaScript
  - ♦ JavaScript Authoring Guide from NetScape Communications Corporation.
  - ♦ Lecture JavaScript Examples (pkzipped, 4k)
  - ♦ Test the lecture JavaScript examples
13. Special topics: Application Design Discussion  
CGI Programming in Visual Basic by Shannon Wade
  - ♦ Shannon Wade's Home Page for CGI Programming in Visual Basic
  - ♦ Shannon Wade's Visual Basic CGI Example Source Code (pkzipped 5k). It contains three Visual Basic files
14. Internet Security 1 by Pi-Lien Cheng  
Internet Security 2 by Rick MacConnell
15. Intranet by Mary Depledge, Paul Lytle, & Nethaniel St. John
16. Legal Issues in Internet by James Kohm  
Developing Intranet applications by Alessandro Marsili



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