

Web Publishing in a First-Year *Foundations of Engineering* Course

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Abstract

Use of the World Wide Web by university faculty to publish course content is now becoming commonplace. However, student use of the Web has to date been mostly limited to “surfing” of the Web for information gathering for course assignments and projects. Some students may have personal homepages. As a component of the *Foundations of Engineering* course at the University of South Florida, methods for creating and publishing content on the Web as a means of professional communication are being taught to entering engineering students. *Foundations of Engineering* is a new first-year (freshman and transfer) course intended to teach students basic engineering skills, create student learning groups, overview the different engineering disciplines, and introduce basic design methods. The goals of the Web publishing project are to 1) teach the students the rudiments of client/server computing and the Internet, 2) teach the students by active learning methods how to use HyperText Mark-up Language (HTML) to create Web content, and 3) for each student to develop a professional homepage suitable for viewing by a prospective employer. This project demonstrates one more method of utilizing computer technology in engineering education.

Introduction

Foundations of Engineering (EGN 3000) is a new two-credit hour entry-level course required for all engineering students at the University of South Florida beginning in Fall 1998 with an enrollment of approximately 500 students each Fall semester and 250 students each Spring semester. Pilot versions of this course ran in Fall 1997 with 75 students enrolled and in Spring 1998 with 160 students. The primary goal of *Foundations of Engineering* is to reduce the attrition rate of engineering students. Many other universities than the University of South Florida have implemented first-year “freshman” design courses for engineering students, see for example [1] and [2]. The *Foundations of Engineering* course builds on this trend. The syllabus and outline for this course are in Appendices A and B.

The first three weeks of *Foundations of Engineering* are used to teach computer skills including how to use a word processor, presentation package, spreadsheet, Web browser, and email. These skills are then applied in three individual and team projects throughout the semester. A skill with emerging significance to all engineers is the active use of the Web to enhance communications among geographically dispersed team members and present information to clients and customers. That is, the skill of being able to publish content on the Web is becoming important. Publishing content on the Web means generating HTML (HyperText Mark-up Language) documents with images, links, forms, and other “Web features” and then uploading these objects to a Web server. Web content can be generated manually with a text editor and a knowledge of HTML, or automatically with “save to HTML” features in, for example, Microsoft Office97 Word and PowerPoint. In addition, sophisticated tools, such as Microsoft FrontPage98 are making publishing content on the Web much easier than as little as one year ago. Creation and uploading of Web content pose primarily mechanical complexities. Effective organization of information in a non-linear medium presents interesting intellectual challenges. It is the intent of the Web publishing project in the *Foundations in Engineering* course to:

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1. Teach the fundamentals of client/server computing and the Internet in the context of the Web.
2. Teach the fundamentals of a mark-up language, how to create Web content using HTML, and how to upload Web content to a Web server.
3. Teach how to organize information in a non-linear medium.
4. Teach and explore new methods for collaboration using the Web as an active medium.

This paper describes teaching methodologies implemented for (1), (2), and part of (3) above. Item (3) is implemented within the context of the students creating a professional homepage. The full implementation of (3) and (4) will be implemented in Spring and Summer 1999 with funding from an internal USF grant (see [3]). This funding will give additional support (for teachings assistants, faculty time, and equipment) to the *Foundations of Engineering* course which will enable the integration of Web publishing into all aspects of the course.

The remainder of this paper is organized as follows. Section 2 contains a background on *Foundations of Engineering* and experiences with Web publishing projects in previous semesters. Section 3 describes the Web publishing project. Section 4 describes future goals for integrating Web publishing into the entire course. Finally, section 5 is a summary and is followed by references and three appendices. The appendices contain the syllabus and outline for *Foundations of Engineering* and a description of the Web publishing project.

Background on Foundations of Engineering

Foundations of Engineering was developed to give entering engineering students (freshmen and transfer) an opportunity to experience engineering activities at an early stage of their academic careers and give them basic skills that will help them get through the highly demanding engineering curriculum. Many students decide to leave engineering based on experiences in calculus, physics, and chemistry rather than engineering. Currently, only 33% of entering freshman and 50% of entering transfer students that declare themselves as engineering majors graduate with an engineering degree from the University of South Florida. Similar experiences have been reported by other engineering schools throughout the country (see, for example, [4] citing a 40% attrition in the first two years and [5] citing 50% overall attrition). The objectives of *Foundations of Engineering* are:

1. To increase awareness of the engineering profession and professional behavior.
2. To introduce students to the concepts of problem solving and engineering design.
3. To build a network with the engineering community by acquainting students with members of the engineering profession; including practicing engineers, engineering faculty, and other engineering students.
4. To begin to develop "skills for success"; including, but not limited to, communication skills (both written and oral), study skills, and teamwork.

Beginning in Fall of 1997, all entering students were given an opportunity to participate in engineering projects in their first semester of attendance. In Fall 1997 and Spring 1998, students were introduced to the development of personal Web pages as an end-of-semester project. Although many found the project to be useful, we believe that more complete integration with the rest of the course material will strengthen the class. The development of independently created individual pages was time intensive and gave students who had strong computer backgrounds an edge over students who were novices at computer usage. Many new users were unable to complete the assignment to a quality level they have come to expect of themselves. The quality of the pages ranged from very poor to excellent, but most pages lacked professional content. Instead, the pages were a scrapbook of personal interests, some admittedly quite odd and immature, of the students. Seeing the integrative value of Web publishing to other topics being taught in the course, we moved the Web project to the beginning of the semester for Fall 1998. In addition, the use of a Web page as an online resume is stressed and the possible consequences of placing controversial and/or immature content on one's page is discussed. In addition, by changing the project to have a group focus, students will not only learn a new skill but will enhance team performance. Students with strong backgrounds can help students with weaker backgrounds rather than "compete" with them.

The Web Publishing Project

The Web publishing project is given to the students of *Foundations of Engineering* in the third week of the semester at the end of the computer skills component of the course. The project is introduced with a lecture describing

the Internet as an interconnection of computers throughout the world. These computers can be classified, broadly speaking, as servers and clients. A server computer contains resources accessed by one or more client computers. These resources can include files, database records, computing resources, printers, and Web content. Servers that contain accessible Web content are called “Web servers”. The stored Web content is viewed with a browser application on a client computer. Clients access information in a server via a request-response protocol such as the Hyper-Text Transfer Protocol (HTTP). The Transmission Control Protocol / Internet Protocol (TCP/IP) is used to ensure that HTTP commands are correctly delivered across the Internet. Figure 1 shows the Internet and the relationship of Web clients and servers. The basic organization of this hardware and software is fundamentally the same in all computers, whether PC’s, workstations, or even mainframes. Figure 2 show this basic organization and the relationship of the operating system (e.g., Microsoft Windows95) and the Web browser (e.g., Netscape Navigator) as an application. This figure helps students understand, at a very high level, the workings of clients and server computers.

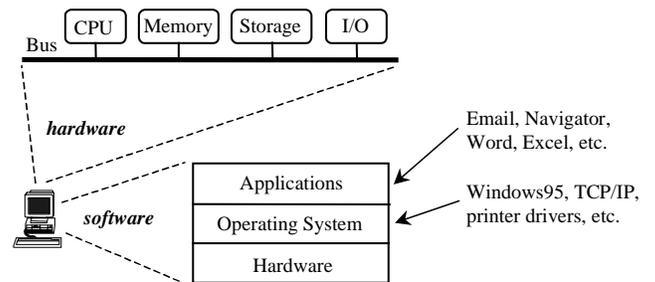
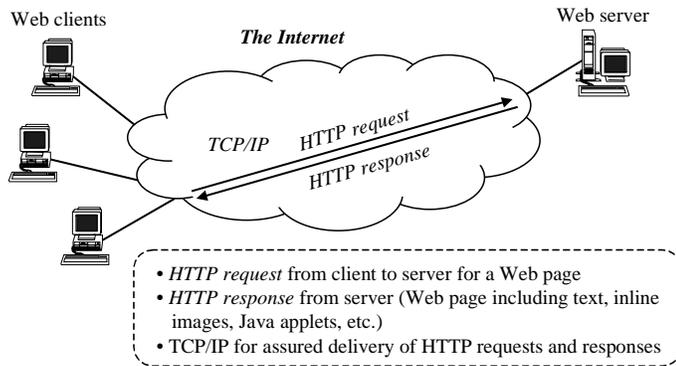


Figure 1 - Client/server computing in the Web

Figure 2 - Organization of hardware and software

Having been introduced to the basics of the Internet and computer organization, the students are ready to understand where and how HTML fits into Web. Specifically, HTML is a mark-up language that is interpreted by the Web browser in order to correctly display formatted text, images, links, forms, and other common Web features. HTML is taught to the students through a series of example pages. HTML pages are created using a text editor, such as DOS `edit` or Windows `Notepad` and are viewed directly from the C: drive via Netscape Navigator or Microsoft Explorer. Figure 3 shows a very simple Web page demonstrating the basic format of a page and the HTML commands to inline an image and provide a link to another Web page. The example shows how HTML commands are bracketed in “<” and “>” symbols and how certain commands are required in all pages (namely the `<html><body>` and `</html></body>`). An intentional teaching methodology is that the full set of HTML commands is *not* taught in class. Rather, students are expected to build on the fundamentals of mark-up languages taught in class by pursuing HTML tutorials on the Web, purchasing tutorial-type books, and viewing examples on the Web. Viewing HTML source code is easily done, both Navigator and Explorer have a view source option in their menus. A set of example pages (including, obviously, the HTML source) used for most Web features such as inlining of images, addition of links, construction of forms, addition of Java applets, and so on are included in the project home page (discussed later in this paper). This active learning of HTML usage is considered a valuable experience for the entering engineering students.

```

<html>
<!-- Feature #1 ---->
<title>Home Page for Ken Christensen</title>
<body>

Hello from my homepage. And, here is a link to the
<a href="www.eng.usf.edu">USF College of Engineering</a>.
</body>
</html>

```

Figure 3 - HTML source code for simple Web page

The students of *Foundations of Engineering* will begin to learn how to organize information in a non-linear medium via the assigned Web publishing project. The objective of the Web publishing project is for the students to learn HTML and then use HTML to create a professional homepage. A key decision made in the project assignment is to not allow students to use automated HTML generation tools (such as Microsoft FrontPage98). The reason for this is that we want the students to understand the fundamentals behind generating Web content. Using an automated HTML generation tool, it is believed, would obscure these fundamentals. In any case, the use of such tools is not prevented in future projects once the students have understood the fundamentals of a mark-up language (e.g., HTML) and its use for publishing material on the Web. For the assignment, the students are to create and publish their own professional homepage. The homepage is to be submitted on a diskette. Optionally, the homepage may be uploaded to the student's UNIX account. Each of the HTML features in the page must be labeled (following a given table of numbered features). Figure 3 shows how features can be labeled using the HTML comment command. The project requirements are:

1. Each student creates their own homepage.
2. A homepage must, in general, be professional in its content (e.g., something you would give to a prospective employer).

To satisfy the second requirement, the student must (at least) include their resume in their homepage. The basics of resume writing are covered when this project is presented to the students.

Grading of the project is based on evaluation of professional content of the page (25%) and evaluation of technical features (75%) according to the table of numbered features (see Table 1 and Appendix B). The features listed in Table 1 are those typically found in "good" Web pages and included advanced features such as Java applets. Tools to scan and manipulate images are made available for student use. These include PhotoShop and Microsoft PhotoEditor to scale, crop, and otherwise manipulate images as .gif and .jpg files. These hardware and software tools are made available to the students via an open-use Multimedia Laboratory.

Table 1 - Table of HTML features required

Grade = 25%	Grade = 50%	Grade = 75%
1. Title	11. Special characters	18. Frames
2. Background	12. Nested list	19. Clickable image map
3. Images	13. Mailto	20. Use of a pre-built Java applet
4. Headings	14. Form	
5. Different size, color fonts	15. Table	
6. Horizontal rule	16. Transparent bckgrnd image	
7. Links to pages not at USF	17. Multiple linked pages	
8. Links to other parts of page		
9. Ordered or unordered list		
10. Address		

The project is presented to the students via, appropriately enough, a Web site as shown in Figure 4. Included are the full set of PowerPoint overheads, saved in HTML format via the Microsoft Office97 "Save to HTML" feature, used in the course lecture. The *DOS cheat sheet* contains basics for creating and manipulating files and directories using the Windows command prompt. The *Example pages* contain most, if not all, of the features in Table 1. The *Online resources* page contain links to Web pages containing HTML tutorials, downloadable images, and downloadable Java applets. The *Other resources* page contains a short lists of books suitable for self-study of HTML, effective organization of information in a non-linear medium, and so on. Finally, the *Frequently Asked Questions* page contains a growing list of answers to questions frequently asked by the students. Finally, the *Updates* and *Notices* pages are used to broadcast updates made to the project pages and general notices to all students (e.g., related to administrative matters). The complete project description is in Appendix B.

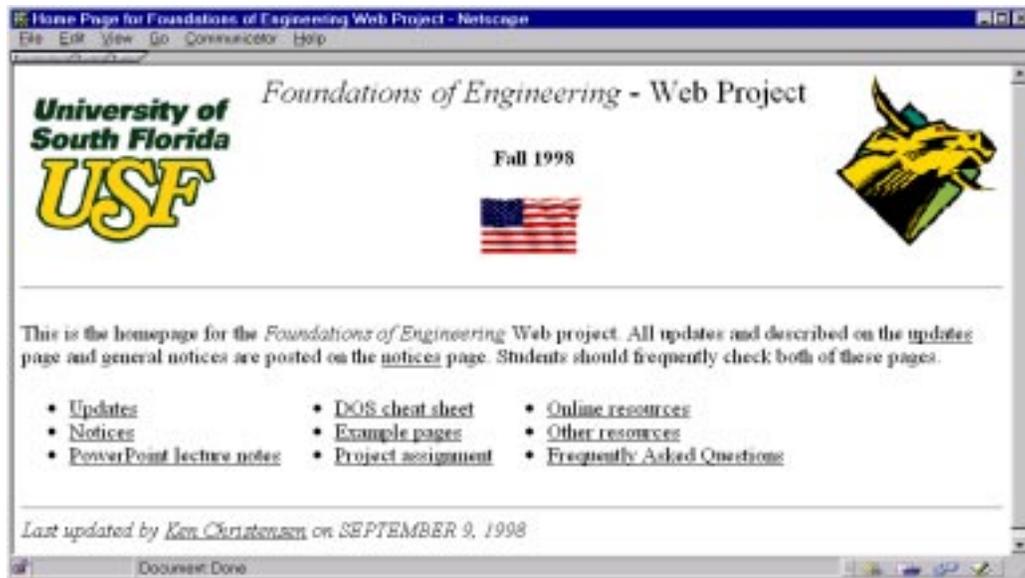


Figure 4 - Web project homepage (see [6] for URL)

Integrating Web Publishing into the Course

Future goals for the use of the Web in *Foundations of Engineering* include teaching how to organize information in a non-linear medium (see [7] and [8]) and the use of the Web for collaborative efforts (e.g., as in [9]). Integrating Web publishing into the existing design projects in *Foundations of Engineering* individual and team projects will be the most exciting part of this effort. In the existing syllabus, students are required to submit written (paper) reports created with a word processor and give oral presentations supported by overheads created with a presentation package. It is intended that draft and final reports be submitted via the Web and all presentation materials also be placed on the Web. In addition, use of the Web for student-student and student-faculty interaction during projects will be encouraged. For example, effective remote presentation of projects via the Web may be possible and should be explored. This sort of use of the Web would be very beneficial to off-campus commuting students for whom coming to campus is often difficult.

Other courses at other universities encourage students to publish final reports on the Web (see for example [10]). However, these are typically Senior or graduate-level courses and the actual Web-content is in most cases linear, that is the Web is used as simple replacement for paper publishing. With the growing impact of the Web to both personal and professional communications, the knowledge and skills gained from learning Web publishing will be useful to the students throughout their academic and professional careers. The success of this project will be measured by how much students use the Web to collaborate and the quality of final project reports and presentations as submitted on the Web. Evaluation will be done by both the faculty and peer students based on a set of guidelines to be developed.

Summary and Future Work

The two-credit hour *Foundations of Engineering* is an entry-level engineering design course at the University of South Florida. One of the assigned projects in this course is a Web project where students learn HTML and create a professional homepage. The goal of this project is to begin to teach the students how to use the Web as an active means of professional communication. Future plans include integrating Web publishing into all aspects of the course as an equal to "paper publishing".

References

1. S. Sheppard, R. Jenison (1997) "Examples of Freshman Design Education," *International Journal of Engineering Education*, Vol.13, No. 4, pp. 248 - 261.
2. G. Tonkay, R. Sause, L. Martin-Vega, and H. Stenger (1997) "Integrating Design into Freshman Engineering: A Lehigh Experience," *Proceedings of the 27th Annual Frontiers in Education*, pp. 1115 - 1119.
3. K. Christensen, A. Callahan, and R. Perez (1998) "Course Enhancement: Student Web Publishing as a Means of Professional Communications for Enhanced Student and Faculty Interaction," internal USF grant from the *USF Instructional Development Grants Program*. Grant proposal is available by request from the author.
4. P. Samaras (1991) "Integrating the First Two Years," *ASEE Prism*, November, pp. 17 - 19.
5. "Engineering Education: Preparing for the Next Decade, Undergraduate Curricula at Arizona State University" (1991), A Study by the Engineering Curriculum Task Force, Arizona State University, College of Engineering and Applied Sciences.
6. Foundations of Engineering - Web Project (1998), <http://www.csee.usf.edu/~christen/freshman/classf.htm>.
7. E. Tufte (1992) *The Visual Display of Quantitative Information*, Graphics Press.
8. B. White (1996) *HTML and the Art of Authoring for the World Wide Web*, Kluwer Academic Publisher.
9. S. Duerden, et al. (1997) "Trendy Technology or a Learning Tool?: Using Electronic Journaling on WebNotes for Curriculum Integration in the Freshman Program in Engineering at ASU," *Proceedings of the 27th Annual Frontiers in Education*, pp. 1549 - 1556.
10. R. Jain (1995) "Recent Advances in Networking (CIS788.08Q), Student Project Reports," Ohio State University, <http://www.cis.ohio-state.edu/~jain/cis788.htm>.

Appendix A - Syllabus and Outline for Foundations of Engineering

Objectives:

- To increase awareness of the engineering profession and professional behavior.
- To introduce students to the concepts of problem solving and engineering design.
- To build a network within the engineering community by acquainting students with members of the engineering profession including practicing engineers, engineering faculty, and other engineering students.
- To develop skills for success including oral and written communication skills, study skills, and teamwork.

Grading Policies:

Your final grade will be made up of the following components:

- Short quizzes: 25% (if you miss a class where a quiz is given you receive a “0” for that quiz unless you have a doctor’s note in case of illness or employer’s note in case of work-related absence)
- Individual assignments: 20% (Email, Word, PowerPoint, Excel)
- Group assignments: 32% (Mechanical engineering project, Electrical engineering project, Chemical engineering project, and Web page project)
- Group Presentations: 15%
- Evaluations by Group Members: 8%

Schedule: (all lectures are in ENA 105)

- 8/24 Lectures: Intro, PINE demo, Internet demo. Labs: PINE, Internet lessons (USF sites, library, searchers). ENB 116
- 8/31 Lectures: MSWORD demo. Study skills. Labs: MSWORD lessons and assignment. ENB 116
- 9/7 No lectures (Labor Day). Labs: Power Point lessons and assignment. ENB 116.
- 9/14 Lectures: ME scales project instruction with video. Labs: ME project. EMB 100.
- 9/21 Lectures: ME scales project refresher. ME careers. Labs: ME project. EMB 100.
- 9/28 Lectures: CS/E project instruction. Labs: CS/E project. ENB 116.
- 10/5 Lectures: CS/E project refresher. CS/E careers. Labs: CS/E project; ME project presentations. ENB 116.
- 10/12 Lectures: ChemE project instruction Labs: ChemE project. ENB 116
- 10/19 Lectures: ChemE project refresher. ChemE careers. Labs: ChemE project. ENB 116.
- 10/26 Lectures: Library orientation. CivE careers. Labs: ChemE and CS/E project presentations. ENB 116.
- 11/2 Lectures: EE project instruction and video. Labs: EE project. EMB 100.
- 11/9 Lectures: EE project refresher. EE careers. Labs: Vet Day for sections 018-021; others, EE project. EMB 100.
- 11/16 Lectures: Society and Engineering. IE careers. Labs: EE project for sections 018-021, EMB 100. Others, EE project presentation, ENB 116.
- 11/23 Lectures: Society and Engineering. Labs: EE project presentation for sections 018-021. Thanksgiving for sections 023-030. Others: EXCEL. ENB 116.
- 11/30 Effective writing. Wrapup. Labs: Wrapup. EMB 100 or ENB 116.
- 12/7 Final exam for 6:00pm lecture. ENA 105, 6 - 8 pm.
- 12/9 Final exam for 12:30pm lecture. ENA 105, 1 - 3 pm.

Appendix B - Web Publishing Project for Foundations of Engineering

This appendix contains the project assignment objectives, description, requirements, and other associated information.

Project Objectives:

The objective of this project is for the students of *Foundations of Engineering* to learn HTML and then use HTML to create a professional homepage.

Project Description:

You are to create and publish your own professional homepage. The homepage is to be submitted on a diskette. Optionally, we will help you upload your homepage to your student *suntan* account. Each of the HTML features, in your homepage must be labeled (following the numbered table below).

Project Requirements:

The following are the project requirements:

1. Each student creates their own homepage
2. A homepage must, in general, be professional in its content (e.g., something you would give to a prospective employer). At a minimum, your homepage must include your resume.
3. Additional requirements may be stated by your section instructor.

Grading:

Your project grade will be determined as follows

- 25% - Evaluation of professional content of page (e.g., quality of resume, project description, career goals, work experience, and etc.).
- 75% - Evaluation of technical features according to the numbered table below.

Your homepage has to be somewhat creative. A page that just says, "here's a header", "here's an image", "here's a link", and so on does not meet the requirement of being a homepage. Such a homepage will be deducted one letter grade. The following is a table of features. All features must be completed in a given column to earn the stated 25%, 50%, or 75%.

Grade = "25%"	Grade = "50%"	Grade = "75%"
<ol style="list-style-type: none">1. Title2. Background3. Images4. Headings5. Different size and color fonts6. Horizontal rule7. Links to pages not at USF8. Links to other part of your page9. Ordered or unordered list10. Address	<ol style="list-style-type: none">11. Special characters ("&" characters)12. Nested list13. Mailto14. Form15. Table16. Image with transparent background17. Multiple pages linked together	<ol style="list-style-type: none">18. Frames19. Clickable image map20. Pre-built Java applet <p>(These three features must all be viewable on the main (first) page)</p>

In addition to the numerical grade, there will be a subjective overall **best homepage contest** for the entire course. The best homepage will receive a gift certificate to a local restaurant. The winner will be announced in class and the gift certificate presented in class (yes, you have to be present to win). Second and third best pages will also be honored (but, not with a free dinner!).

Working Together:

Recognizing that some students have more experience with computers than others, you are encouraged to help each other within your class teams. If you already are an “expert”, please help those students that are not yet experts to learn the material. Note, however, that final submissions must represent your own work as described below.

Labeling of HTML Features:

In your HTML pages you must label the first use of the each feature in the table above. The labels should be HTML comments, for example:

```
<!-- Feature #1 -->
<title> Homepage for Jane Doe</title>
<!-- Feature #2 -->
<body background="back.jpg">
```

Use of HTML Generating Tools:

The purpose of this project is to teaching you how to create Web content using HTML. **You may not use an HTML generating tool (such as, Microsoft FrontPage) to create your project pages.** We will be checking for this when we grade your pages. Pages generated using an HTML generating tool will earn an “F” grade.

Submission of Homepage:

Your homepage is due on the date stated in class. Please submit in class a single sheet of paper with your name and list of features and, obviously, submit your diskette with homepage. **No late projects will be accepted.**

Copying and Other Issues:

The Web makes copying of other people’s work incredibly easy. This is both good and bad. The best way to learn HTML is to look at the source for other pages. You are encouraged to do this. When writing a research paper, you read many other people’s work and then you put your own ideas **in your own words**. In the few cases that it is necessary to use other peoples’ words you then quote and cite the source. The same applies to creating a homepage, look at other pages for examples and to learn, and then “put it in your words”. Submitting pages with HTML source identical to that of other students, or of pages elsewhere on the Web, is unacceptable. Using search and compare tools it easy for the graders to find cases of copying of HTML source.

Ken Christensen

Kenneth J. Christensen received his Ph.D. in Electrical and Computer Engineering from North Carolina State University in 1991. He is currently an Assistant Professor at the University of South Florida. His research and teaching interests are in the areas of computer network systems, architectures, and performance modeling with an emphasis on integrating voice, video, and data in existing and future networks. He has over fifteen conference and journal publications, nine U.S. patents, and several patents pending all in the areas of computer networks and performance modeling. He was awarded a USF 1996/1997 Outstanding Undergraduate Teaching Award. In 1998, he was awarded a NASA/ASEE summer faculty fellowship at Kennedy Space Center. Ken is a member of ASEE and ACM and a senior member of IEEE. His homepage is at, <http://www.csee.usf.edu/~christen>.

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