

CS 638: Web Programming

Application development from one end of the wire to the other

The web is rapidly becoming the dominant medium for interacting with computerized systems. The goal of this class is to cover the conceptual underpinnings of web applications by presenting in a hands-on manner technologies widely used in industry to build web applications. More specifically, this class uses web protocols, programming and markup languages, and application frameworks such as HTML, C#, ASP.NET, SQL, JavaScript, XML, CSS, HTTP, and web services to exemplify the concepts of web programming.

Course topics – concepts covered

This course covers general concepts that apply to large-scale, distributed, client-server systems such as the web. While this class presents technologies currently popular in industry that will prove of immediate benefit to many of you in your first job after graduation, the underlying concepts are general and highly likely to benefit you throughout your career, even if the specific technologies you use will differ from those presented in this class. We group the concepts covered in this class under the five broad topics presented below.

1. ***System organization*** is a central aspect of any large system and a clear understanding of the underlying architecture is required for anyone extending the system. This class covers system organization concepts such as: protocol, client, server, client versus server side programming, remote procedure call, interface, sandboxing, thin clients, uses for relational databases, persistent versus temporary state, and the lifecycle of various objects interacting in a large system.
2. ***Software engineering*** considerations contribute significantly to the effectiveness of any framework used for large-scale software development. This class covers software engineering concepts such as: event-driven programming, event propagation models, the use of timers, tracing, debugging, verifying and validating user input, grouping multiple files into a project, scripting languages, and the use of associative arrays.
3. ***Data representation*** is central to any system dealing with complex repositories of data. This class covers data representation concepts such as: structured data, markup, hyperlinks, relative versus absolute addressing, encoding of data, document object models, separation between content and presentation, rendering, and methods for positioning document elements.
4. ***Multiple stakeholders*** exist when a complex system such as the web is designed and operated, and their differing (and sometimes contradictory) interests affect various components. This class also covers concepts motivated or shaped by the existence of multiple stakeholders: standards, de facto standards, cross-platform compatibility, split control between user and developer, privacy and its relationship to logging, authentication, authorization, confidentiality, and cryptographic certificates.

5. **Performance** is important whenever resource constraints exist and the web is no exception. While the performance of networked or distributed systems is not the main focus of this class, it covers performance-related concepts such as: throughput, latency, roundtrip time, pipelining requests, the difference between local and remote accesses, and caching.

Course topics - technologies covered

This class gives you a hands-on introduction to web technologies currently in wide use in industry. The goal of the class is not to cover the details of various technologies exhaustively, but to explain the underlying concepts and interactions and illustrate them with simple examples. It is a goal of this class to give you enough familiarity with these technologies so that you can build simple applications and quickly find the relevant sources of information if you need to delve deeper in one of the technologies covered.

The class is composed of 7 segments, each of which covers related technologies.

1. Web pages – HTML, cascading style sheets (CSS), images, http
2. The C# language – the language itself and the Visual Studio 2005 development environment
3. Interacting with databases – SQL, ODBC, ADO.NET
4. The ASP.NET framework for web applications – the structure of web applications, controls, events, keeping state
5. Client side programming with JavaScript – the core language, user interaction, events, DOM, interactive web pages
6. Web 2.0 – AJAX, XML, web services, SOAP, REST, WSDL
7. Networks and security – the Internet, TCP/IP, DNS, security, encryption, authentication, privacy, search engines

Class organization

The class has two 75 minute lectures every week. Many of the lectures are accompanied by demonstrative materials built specifically for this class (sample applications and web pages) and pointers to external online resources that allow students to deepen their understanding of details of the technologies presented. The lectures form 7 segments of 3 to 5 consecutive lectures each. Each segment consists of lectures on related technologies and the last lecture in the segment has a short review of the concepts and technologies covered. The last lecture of the class reviews and summarizes the material covered over the entire semester.

There is no single textbook that covers all the material presented in this class, and the available books are typically reference books for one of the technologies, not textbooks. The table below lists the most important reference books for the technologies covered in this class. The lecture slides, lecture notes and the auxiliary materials we developed are enough for you to complete their assignments and you do not need to purchase any of the reference books below.

Title	Authors	Publisher	ISBN
HTML: The Definitive Guide	Chuck Musciano and Bill Kennedy	O'Reilly & Associates	1-56592-492-4
Learning C# 2005	Jesse Liberty and Brian MacDonald	O'Reilly & Associates	0-596-10209-7
murach's ASP.NET 2.0 web programming with C# 2005	Joel Murach and Anne Boehm	Mike Murach & Associates	1-890774-31-6
Dynamic HTML: The Definitive Reference	Danny Goodman	O'Reilly & Associates	0-596-00316-1
Foundations of Ajax	Ryan Asleson and Nathaniel T. Schutta	Apress	1-59059-582-3
Javascript: The Definitive Guide	David Flanagan	O'Reilly & Associates	0-596-00048-0
Building XML Web Services for the Microsoft .NET Platform	Scott Short	Microsoft Press	0-7356-1406-7
C# Cookbook	Jay Hilyard and Stephen Teilhet	O'Reilly & Associates	0-596-10063-9

There are a number of topics covered in detail in other classes we will touch on only briefly. We will cover a number of programming and markup languages, but to learn more about programming languages and compilers, see CS 536. To learn about building system software (e.g. a web server), see CS 537. To learn more about graphics, see CS 559. To learn about building database systems and designing databases, see CS 564. To learn how the Internet and other computer networks work, see CS 640. To learn how you should determine what web-based applications should do to satisfy the needs of an organization see classes from the Information Systems program such as IS 365 and IS 371 (these classes also cover various web-related technologies).

Grading

30% of the overall score is based on 20 minute in-class quizzes. After each of the 7 groups of lectures, at the beginning of the next lecture, the students take a 20 minute in-class quiz on the topics covered in the group. The best 6 of the 7 quizzes count towards the overall score with a weight of 5% each.

40% of the overall score is based on programming assignments. There are 4 individual programming assignments, each contributing 10% towards the overall score. The programming assignments require the use of Windows lab machines supported by CSL. The theme for the assignments is building a system for managing information about courses, grades and students at a fictitious university. The assignments will ask you to design web pages and write the programs that allow the web site to interact with a database holding the fictitious information about courses, grades and students.

5% extra credit is available for those submitting an optional fifth programming assignment. This assignment will give you considerable freedom in choosing what problem to address using the web programming techniques presented in this class.

30% of the overall score is based on a cumulative final exam.