Part 1

Introduction

It's important that you know about HTML5's semantic markup basics and wide variety of APIs. For the introduction, we'll cover these concepts briefly, but in heavy detail, to ramp you up.

If you're already building sites with HTML5's new tag structure you could skip this section. However, you'll miss advanced markup concepts such as ARIA and microdata (if you aren't already familiar with them).

1 HTML5: from documents to applications

This chapter covers

- The basics of using HTML5
- New semantic markup and media features
- New JavaScript APIs
- Closely related web specifications

HTML5 is one of the hottest topics in web development, and with good reason. Not only is it the latest version of the markup language for the web, but it also defines a whole new standard for developing web applications. Previous iterations of HTML (and its rigid XML-based sibling, XHTML) have been centered primarily on the concept of HTML as a markup language for documents. HTML5 is the first version to embrace the web as a platform for web application development.

HTML5 defines a series of new elements that you can use to develop rich internet applications as well as a range of standard JavaScript APIs for browsers to implement natively. A good example of HTML5's new elements is `<video>`, which provides a means of playing video content in the browser without requiring an additional plug-in. HTML5 also provides the Media Element Interface that allows you to control video playback with JavaScript. It lets you create games, build mobile applications, and much more.

In this chapter, you'll learn

- About great new features introduced in HTML5 and how to immediately use them in your web applications.
- How to provide fallbacks and workarounds for users with older or incompatible browsers.
- How to use ARIA (Accessible Rich Internet Applications) roles and microdata to further enhance the semantics of your HTML pages.
- The wide range of JavaScript APIs available in HTML5 itself, as well as a number of closely related API specifications you can use in your applications.

By the end of this chapter, you'll have a broad sense of what HTML5 has to offer and be able to use it in your own web applications.

Documents (HTML4) versus applications (HTML5)

Initially the web was all about documents. Forms were added by the Mosaic browser in 1993, but this was merely data entry; all application logic remained on the server. The introduction of JavaScript in 1995 made browser-based applications theoretically possible, but things didn't really take off until after the arrival of the `XMLHTTPRequest` object in 1999. The last major version of the HTML specification, 4.01, only became a recommendation in 1999. So it's not surprising that the 4.01 spec still concentrated almost entirely on the use of markup to describe documents, what we now normally refer to as *semantic markup*.

The next version of HTML has been a long time coming, and the web has changed a lot in the meantime. As you'll see in the following sections, HTML5 contains improvements in the area of semantic markup. The majority of the differences and improvements in HTML5 over HTML4, however, are in facilities for building browser-based applications with JavaScript. Because of that, and because this book is focused on the new features of HTML5, we spend a lot more time dealing with JavaScript than with markup. We do cover some markup, but, as you'll see, JavaScript is the *real* big deal in HTML5.

To get started, we'll show you how to get up and running by creating an HTML5 document.

1.1 Exploring the markup: a whirlwind tour of HTML5

The best way to learn what's new in HTML5 is to jump right in and explore. The goal of this section isn't only to give you a high-level tour of the new features but also to give you enough knowledge to be able to update your existing applications to use HTML5 conventions, without upsetting users who don't have the latest and greatest browsers.

In this section, you'll learn

- How to create a basic HTML5 document structure.
- How to use the new semantic elements to lay out a page.
- How to deal with older versions of Internet Explorer that don't recognize the new elements.
- About the new form features you can implement immediately in HTML5.
- How to use new UI elements, such as progress bars and collapsible sections.

Let's get started by examining the basic structure of an HTML5 document. If you're not interested in the basics, you can read quickly until you reach section 1.2, which goes beyond semantic markup and into the HTML5 ecosystem.

1.1.1 Creating the basic structure of an HTML5 document

HTML5 documents are structured in the same way as older versions of HTML: you put a `<!DOCTYPE>` declaration at the top of the document and open and close the HTML document with matching `<html>` and `</html>` tags. Between these tags, you have a `<head>` section, where you place `<meta>` information and other noncontent items such as stylesheets, and a `<body>` section, where your page content should go. If you've written HTML pages or applications before, none of this will be new to you, but you need to be aware of some subtle differences, which we'll cover in this section:

- The HTML5 DOCTYPE declaration syntax.
- How to use the opening `<html>` element.
- How to use the shorter versions of the various elements in the `<head>` section.

Let's look more closely at these differences by examining hello.html, the HTML5 equivalent of a "Hello, World!" application, shown in the following listing.

Listing 1.1 hello.html—The basic structure of an HTML5 document

```
<!DOCTYPE html>
```

The DOCTYPE declaration in HTML5 is short and sweet—no ridiculously long DTDs and URLs to remember. This DOCTYPE will force standards mode in all modern browsers, so you can start using it in your applications immediately, without negative consequence.

```
<html lang="en">
<head>
```

The xmlns attribute from XHTML isn't valid in the HTML serialization of HTML5, so don't use it (see the sidebar "HTML and XML"). You should always use the lang attribute to specify the language of your documents.

```
    <meta charset="utf-8">
    <title>Hello, HTML5!</title>
```

The <meta> element now supports a charset attribute, allowing for a more memorable syntax than the older combination of http-equiv and content attributes for defining the page's character set (in this case we're using 8-bit Unicode). Note that in the XML serialization of HTML5 this tag is required to be self-closing (e.g., <meta charset="utf-8"/>). See the sidebar "HTML and XML" for further details.

```
    <link rel="stylesheet" href="style.css">

    <script src="app.js"></script>

</head>

<body>

    <h1>Hello, HTML5!</h1>

</body>

</html>
```

All modern browsers will assume that a stylesheet's <link> element will have a type of text/css by default, so you can safely omit that attribute in your HTML5 documents.

Browsers assume that <script> elements have a type of text/javascript, so you don't need to specify the attribute unless you're using it for something other than JavaScript.

That's a basic page structure. Next, we'll show you how to use the new semantic elements to construct a page—in this case, a sample blog post page.

HTML and XML

Previous versions of what we think of as the HTML specification were either HTML or XHTML. HTML markup was designed to be fairly forgiving, whereas XHTML was built around XML and a strict parsing model. XHTML required all elements to have closing tags (`<br/>` instead of `<br>`, for example) and all tags and attributes to be lowercase. A single error would cause the whole page to fail. Because of this draconian error handling, most websites never properly implemented XHTML. They tended to use XHTML syntax forms but send pages with a content type of `text/html`, causing HTML parsing of the XML markup.

HTML5 unifies everything in a single specification by allowing both HTML and XML serializations; that is, the specification provides a vocabulary that can be expressed in either HTML or XHTML. The XHTML serialization must be sent with an XML content type such as `application/xml+xhtml`. It also conforms to XML parsing rules rather than HTML ones, requiring an `xmlns` declaration, closing tags, and so on. In the code download there are two additional versions of listing 1.1 showing the same markup in valid and invalid XHTML markup: hello-invalid.xhtml, which uses HTML syntax in an XML document, and hello-valid.xhtml, which corrects the markup to valid XML.

1.1.2 *Using the new semantic elements*

If you've read about HTML5 before you picked up this book, chances are you've heard plenty about the new semantic elements. They're important, particularly if you want search engines and assistive technologies such as screen readers to understand your pages better, but they're no more difficult to use than the elements you know and love from HTML4.

Don't get too excited about this new set of tags. If you're expecting these new elements to do something magical in terms of how they look on your page, you're in for some disappointment. Using these new elements on your page is functionally equivalent to using a series of `<div>` elements; they behave as block elements by default and can be styled as required using CSS. Their importance comes from the standard semantic meaning they have.

Consider, for example, a typical blog post, in which the web page contains a series of sections. First, you'd have the site heading and navigation, maybe some sidebar navigation, a main content area, a footer area with further navigation links, and perhaps some copyright and legal links. The next listing demonstrates how such a blog post might have been marked up in HTML4 or XHTML.

Listing 1.2 html4-blog.html—HTML4 markup for a blog post

```
<div class="header">
    <h1>My Site Name</h1>
    <h2>My Site Slogan</h2>
    <div class="nav">
        <ul><!-- Main Site Nav here --></ul>
    </div>
</div>

<div class="sidebar">
    <h3>Links Heading</h3>
    <ul><!-- Sidebar links --></ul>
</div>

<div class="main">
    <h4>Blog Post Title</h4>
    <div class="meta">
        Published by Joe on 01 May 2011 @ 12:30pm
    </div>
    <div class="post">
        <!-- Actual blog post -->
    </div>
</div>

<div class="footer">
    <ul><!-- Footer links --></ul>
    <!-- Copyright info -->
</div>
```

The previous code isn't wrong. It's perfectly valid to use it in HTML5, and you can absolutely continue to use `<div>` elements with semantic class names if you wish. But from a semantic point of view, this approach poses a couple of problems:

- By using the old standard, you wind up separating areas of the blog post using named classes. This is fine, but the class-naming convention is up to the author. Our "header" might be your "heading"; we call the main section "main," but you might call it "body" or "article."
- Some people may prefer to use IDs instead of classes. They may use id="header" whereas others might use class="header."

In short, a search engine or other computer-controlled application has no way to reliably determine what each section represents.

This is where the new semantic elements come into play. Rather than using classes and IDs for sections like headings, navigation, and footers, you now use several different

HTML elements, shown in the following listing. Add this code between the `<body>` tags of the hello.html file.

Listing 1.3 html5-blog.html—HTML5 markup for a blog post

```
<header>

    <hgroup>

        <h1>My Site Name</h1>
        <h2>My Site Slogan</h2>

    </hgroup>

    <nav>
        <ul><!-- Main Site Nav Here --></ul>
    </nav>

</header>

<nav>
    <h1>Links Heading</h1>
    <ul><!-- Sidebar links --></ul>
</nav>

<section>

    <article>

        <header>
            <h1>Blog Post Title</h1>
            <div class="meta">

                Published by Joe on
                <time datetime="2012-05-01T12:30+00:00">
                    01 May 2012 @ 12:30pm
                </time>

            </div>
        </header>
        <section>
            <!-- Actual blog post -->
        </section>
    </article>
</section>

<footer>

    <ul><!-- Footer Links --></ul>
    <!-- Copyright info -->
</footer>
```

Reusable element for the title and other important details (blog post title, permalink, meta information).

Group's numbered headings (<h1> to <h6>).

You can have an <h1> in your <hgroup> and a separate <h1> in your <article>. Heading structure doesn't operate as it did in HTML4.

Section of links within the article's page. Specification says only "major navigation blocks" should use the <nav> element, such as the main nav or table of contents.

Defines a chunk of content, such as a major wiki article section or an important form. Sections can have their own headers, navigation, and footers.

Marks a self-contained publishable component, which can be redistributed on its own, such as RSS entries, blog posts, comments, forum posts, news entries, and so on. Articles also allow headers, navigation, and footer elements.

If the datetime attribute has been set, then the content of the <time> element can be any text you want (e.g., "next Tuesday"), but if the datetime attribute is omitted, then the content has to be valid date and/or time format (see appendix B for examples).

Parsing dates is difficult, because of the many ways they're presented. <time> allows you to present the date/time format of your choice to the user along with a value computers can easily understand in the datetime attribute.

This usually appears at the bottom of a page or section, typically used for things like related posts or links, copyright information, and metadata.

TWO OTHER IMPORTANT HTML5 ELEMENTS: <ASIDE> AND <MARK>

We don't want to move on without telling you about two other important HTML5 elements that you'll use a lot: `<aside>` and `<mark>`. You can use the `<aside>` element to define a section of a page that's separate from the content area in which it's defined.

In a book or magazine, this might be represented as a sidebar that contains information on the same topic but doesn't quite fit into the main article itself. For example, if you had a blog, you may have advertisements displaying alongside posts—these could be placed in an `<aside>` element. In a web application, you might use `<aside>` for a pop-up or a floating window that appears over the main part of the application itself.

You can use the `<mark>` element to represent a part of text in your document that should be marked or highlighted. A common use for this would be to highlight search terms within a document.

With the new semantic elements, not only is your page's markup easier on the eye, but search engine spiders and assistive technologies will also more easily understand your pages. Speaking of assistive technologies brings us to our next important topic: ARIA roles.

1.1.3 Enhancing accessibility using ARIA roles

When building web applications, you must ensure that your application is accessible to all users, including those who require assistive technologies such as screen readers. Ensuring that your documents are accessible requires careful consideration when it comes to the semantic meaning of your markup. Using simple HTML markup makes this relatively straightforward, and HTML5's new elements improve the semantics even further. But when you're creating web applications, it becomes much more difficult to cater to assistive technology. The increasing amount of JavaScript code used to dynamically modify web pages in modern web applications makes it far more difficult to deliver accessibility through good markup alone. This is where the Web Accessibility Initiative (WAI) and ARIA standards come into play.

The WAI-ARIA specification aims to improve web applications by expanding on the accessibility information provided by the author of an HTML document. ARIA roles, relationships, states, and properties allow you to define exactly how your web application works in a way that an assistive technology such as a screen reader can understand. If, for example, you build a drop-down list out of a text input and an unordered list, you can apply the ARIA role `combobox` to the input element so that it can be rendered appropriately to the user's device. The following listing shows an example of this style of markup taken directly from the WAI-ARIA 1.0 spec.

Listing 1.4 ARIA combobox example from www.w3.org/TR/wai-aria/roles#combobox

```
<input type="text"
  aria-label="Tag"
  role="combobox"
  aria-autocomplete="list"
  aria-owns="owned_listbox">
<ul role="listbox"
  id="owned_listbox">
    <li role="option">Zebra</li>
    <li role="option">Zoom</li>
</ul>
```

The role attribute allows you to declare what sort of widget it is.

ARIA has a number of autocomplete types; in this case, a list will provide the combo values.

The element providing the autocomplete options will have this ID.

The unordered list has the role listbox, to complement the type provided in the ARIA annotation.

This ID corresponds to the one given previously.

The HTML5 specification explicitly states that you may use the ARIA `role` and `aria-*` attributes on HTML elements as described in the ARIA specification; this wasn't allowed in HTML4. HTML5 also defines a set of default ARIA roles that apply to certain HTML elements. For example, it's implied that a checkbox `<input>` element has an ARIA role of `checkbox`, and you shouldn't explicitly use `role` or `aria-*` attributes that differ from those implied in these cases.

You'll also find HTML elements where the native semantics can be modified so that they behave differently. For example, you might create an `<a>` element that behaves like a button and use it to submit a form after performing some validation. The HTML5 specification defines a list of valid semantics for these elements. When you use the `<a>` element to create a hyperlink, it assumes the `link` role by default, and if this is modified, its role can only be changed to one of the following: `button`, `checkbox`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `tab`, or `treeitem`.

For a complete list of the default, implied ARIA semantics, and the restrictions on how you can modify the semantics of certain elements, see the WAI-ARIA section of the HTML5 specification at http://mng.bz/6hb2.

1.1.4 Enabling support in Internet Explorer versions 6 to 8

A subject you may wonder about as you consider HTML5 elements is compatibility with older browsers, and rightly so. Each new version of HTML brings with it new elements that you can use in your documents. HTML5 is no different. Most modern browsers are more than capable of rendering these elements, even versions that don't specifically support them. The way that most browsers handle unrecognized elements is by rendering them like normal in-line `<span>` elements. All that is required is to set them to display: `block with CSS`. Unfortunately, Internet Explorer (IE) is the one exception. In versions prior to IE9, the browser would render unrecognized elements but wouldn't allow you to style them using Cascading Style Sheets (CSS). As you can imagine, this makes it difficult to start using the new HTML5 elements in a production application, because your users may still be using IE6, 7, or 8.

RENDERING NEW ELEMENTS PROPERLY IN IE

Fortunately, this problem has a simple remedy. If you want to use the element `<header>` on your page and need to apply CSS styles, include the following snippet in the `<head>` section of your page. This will force IE to apply the CSS rules to the tag, even if the version of IE used doesn't support a particular element natively:

```
<!--[if lte IE 8]>
<script>document.createElement("header");</script>
<![endif]-->
```

You'll need to execute an equivalent of this JavaScript statement for every HTML5-specific element you wish to use in your page. As you're doing this, it will cause IE versions 6 to 8 to render the style correctly, with the problem persisting if you attempt to print the page.

Rendering new elements properly on pages printed from IE

Fortunately, a solution known as IE Print Protector fixes the printing issue. But rather than reinvent the wheel, we recommend you use an HTML shiv script. The most popular HTML5 shiv was originally created by Remy Sharp and has since been improved by many others. For more information and to get the latest version of the script, see http://mng.bz/50dt.

WARNING The HTML5 shiv solution requires JavaScript. If you want a JavaScript-free solution, you can use HTML5's XML-based sibling, XHTML5, instead. See Eric Klingen's post on the subject at http://mng.bz/QBIw.

What else can you do to boost the presence of your existing applications using HTML5? How about integrating easy features that jazz up your forms? Even though forms are ubiquitous, in HTML5 that doesn't mean they have to be boring and plain.

1.1.5 Introducing HTML5's new form features

It rarely receives acclaim, but the humble web form has played a major role in the emergence of the web as a platform for application development. HTML5's focus on web applications led to many improvements in web forms, all of which you can use today, without breaking compatibility with older web browsers.

Improving the semantics of data input using new form input types

The basic text field has been used far beyond its primitive capabilities. In the same way that the `<div>` element was used in HTML4 for all sorts of block content, the text input is used for all sorts of textual input. HTML5 aims to ease its burden by offering a number of new and backward-compatible types, each of which provides enhancements over the simple text field. Table 1.1 identifies the new input types in HTML5.

Table 1.1 The new form input types introduced in HTML5

`color`	`date`	`datetime`	`datetime-local`	`email`
`month`	`number`	`range`	`search`	`tel`
`time`	`url`	`week`		

You can use these new input types in your web pages immediately because older browsers will fall back to a standard text input type when they find a type they don't understand. Some of the new input types will also allow browsers to provide standard widget controls for given types of form fields. Figure 1.1 shows examples of these new widgets.

In chapter 2, you'll learn about Modernizr, an HTML5 feature-detection script. Using Modernizr, you'll be able to detect if a browser supports a given input type, providing a fallback JavaScript-powered widget if required.

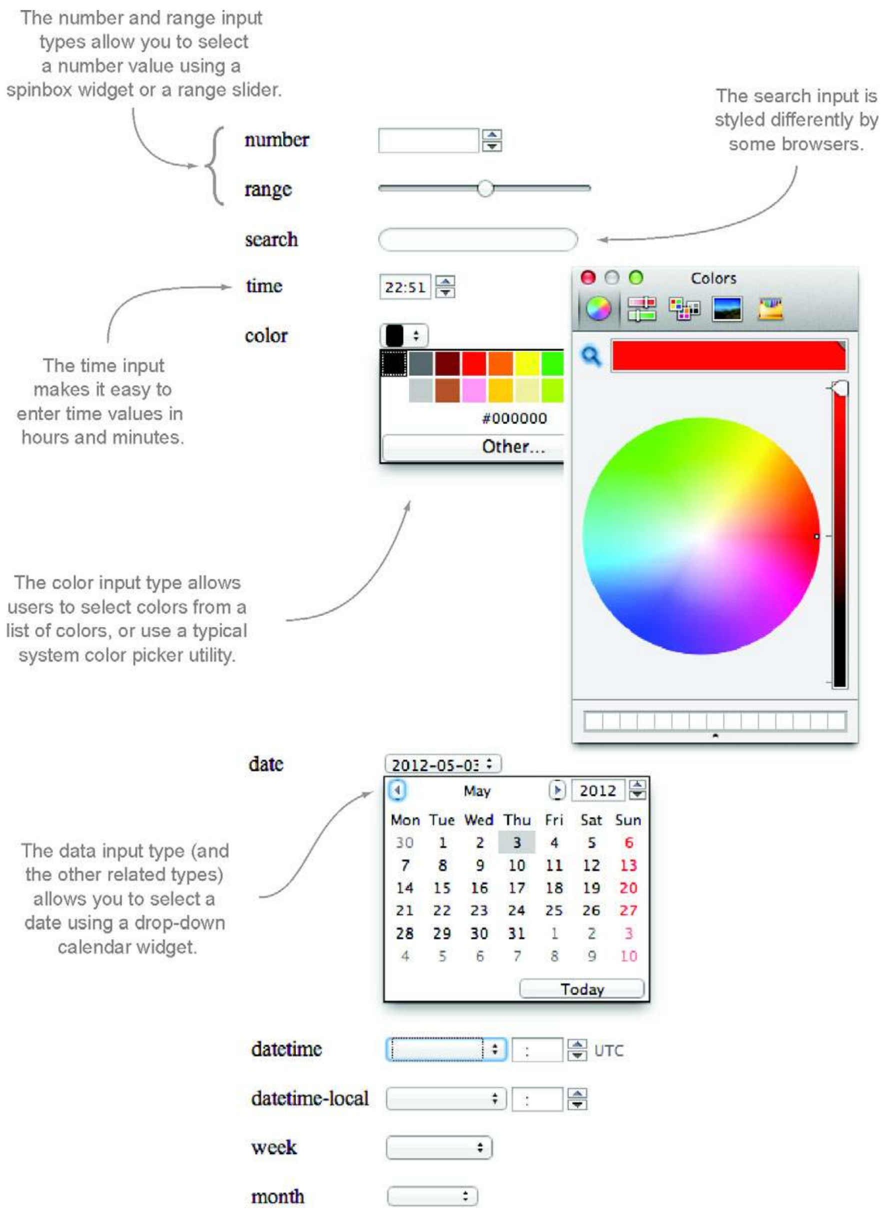

The number and range input types allow you to select a number value using a spinbox widget or a range slider.
The search input is styled differently by some browsers.
number
range
search
time
22:51
color
#000000
Other...
Colors
The time input makes it easy to enter time values in hours and minutes.
The color input type allows users to select colors from a list of colors, or use a typical system color picker utility.
date
2012-05-03
May
2012
Mon Tue Wed Thu Fri Sat Sun
Today
The data input type (and the other related types) allows you to select a date using a drop-down calendar widget.
datetime
UTC
datetime-local
week
month

Figure 1.1 Examples of some of the new form input widgets introduced in HTML5. Note that not all browsers provide support for widgets yet.

NEW ATTRIBUTES FOR ALTERING THE BEHAVIOR OF FIELDS

In addition to new form field types, HTML5 introduces ten common attributes, shown in table 1.2, that allow you to alter the behavior of a given field. The `placeholder`

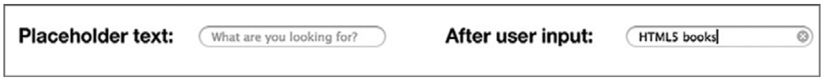


Figure 1.2 You can use the new `placeholder` attribute to provide a piece of text that should be displayed in a field when it's empty. This text is typically gray and will be removed when you populate the field with a value.

attribute is an example of one of these new attributes, and it allows you to define text that will appear in the field before it contains a value. This is illustrated in figure 1.2.

Table 1.2 provides a list of the new input attributes introduced in HTML5. You'll look at which attributes apply to which input types in chapter 2.

Table 1.2 HTML5's new input element attributes

`autocomplete`	`autofocus`	`list`	`max`	`min`
`multiple`	`pattern` `placeholder`	`required`	`step`	

New attributes for performing client-side validation

Some of these attributes allow the browser to perform client-side validation without JavaScript. For example, the `required` attribute specifies that a field must be populated, or the browser will produce an error. The `pattern` attribute allows you to define a regular expression that the input value will be tested against. The `max` and `min` attributes allow you to restrict the maximum and minimum values on `number` and `date` field types.

In addition, the browser will perform validation on some of the new input types to warn users when they have entered values in an incorrect format. If the user enters an invalid email address in an `email` input field, for example, the browser will flag an error and prevent the form from being submitted to the server.

> **WARNING** You should never rely solely on client-side validation, whether it's the new native browser validation in HTML5 or JavaScript validation code. It's easy to bypass client-side validation, so you should always check input on the server side. Client-side validation should be used to improve the user experience, not as application security.

You'll learn much more about the new input types and attributes in chapter 2. First we'll show you other new elements introduced in HTML5 that you can easily, and immediately, integrate into your applications.

1.1.6 Progress bars, meters, and collapsible content

HTML5 defines a series of new elements that you can use to convey information to the user. These include widgets that developers would previously have relied on third-party JavaScript libraries for, such as progress bars, meters, and collapsible sections.

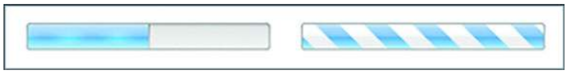


Figure 1.3 The left-hand progress bar is an example of a determinate progress bar. In this example, the value of the bar is set to 50 percent, and the appearance of the bar reflects this because it's half filled. The right-hand progress bar is an indeterminate bar and doesn't have a value. It displays an animated full bar to indicate that something's happening, but the percentage complete isn't known.

USING PROGRESS BARS TO SHOW PERCENTAGE COMPLETION

The `<progress>` element allows you to present the user with either a determinate or indeterminate progress bar. A determinate progress bar has a given value, and the bar will fill up to that value—this is useful for displaying the progress of a file upload, where you dynamically update the value of the progress bar as the file is uploaded. An indeterminate progress bar has no particular value, and the bar will be full but animated—this is useful for informing the user that the application is loading when you're unsure of the exact progress of the operation. An example of both types of progress bar is shown in figure 1.3.

The code to create the progress bars in figure 1.3 is as follows:

```
<progress value="50" max="100"></progress>
<progress></progress>
```

Determinate progress bar must have a value and optionally a max attribute.

Indeterminate progress bar has no value.

USING METERS TO SHOW USERS MEASURES WITHIN KNOWN RANGES

Following along the same path as the `<progress>` element is the `<meter>` element. You'd use the `<progress>` element primarily to show the percentage of completion of a task and you'd use the `<meter>` element to give a representation of a scalar measurement within a known range. In addition to showing the value using a filled bar graphic, the `<meter>` element allows you to define low, high, and optimum ranges that you can use to give further meaning. When the value is in the low range, the meter will display in red; in the medium range, it'll display in yellow; and in the high and optimum ranges, it'll display in green. Figure 1.4 illustrates the appearances the `<meter>` element can have.

The code for the `<meter>` element in figure 1.4 is as follows:

Define the ranges of a meter using the min, max, low, high, and optimum attributes.

```
<meter min="0" max="10" low="3" high="7" optimum="9" value="0"></meter>
<meter min="0" max="10" low="3" high="7" optimum="9" value="1"></meter>
<meter min="0" max="10" low="3" high="7" optimum="9" value="4"></meter>
<meter min="0" max="10" low="3" high="7" optimum="9" value="7"></meter>
<meter min="0" max="10" low="3" high="7" optimum="9" value="10"></meter>
```

USING DETAILS AND SUMMARY TO CREATE COLLAPSIBLE CONTENT WITHOUT JAVASCRIPT

In the past, the only way to create collapsible content sections was to use JavaScript to toggle the display CSS property of the section so it would show or hide. HTML5

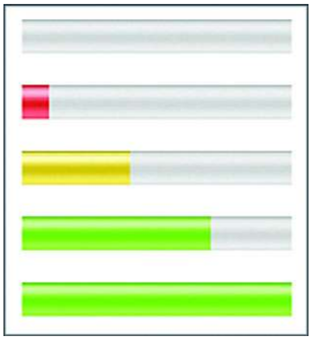


Figure 1.4 A screenshot of the states in which you can represent a `<meter>` element: empty, low, medium, high, and full.

introduces the `<details>` and `<summary>` elements to provide a script-free method for providing such functionality. Figure 1.5 illustrates these new elements in action.

The code to create the `<details>` and `<summary>` example is as follows:

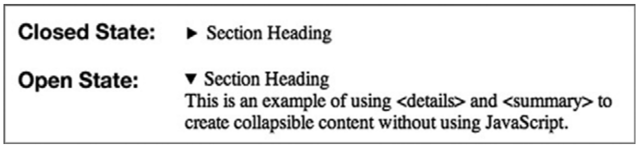
```
<details>
    <summary>Section Heading</summary>
    This is an example of using &lt;details&gt; and &lt;summary&gt;
    to create collapsible content without using JavaScript.
</details>
```

Unfortunately, browser support for these new elements has been rather slow to date. Fortunately, it's simple to provide a fallback for this using JavaScript, several of which are provided at http://mng.bz/cJhc.

Using the techniques you learned in this section, you should now be able to update your existing applications to use HTML5 conventions, without having a negative impact on users who lack the latest and greatest browser. In the next section, you'll learn how you can take things further by going beyond HTML markup and using related concepts such as CSS3 and JavaScript to improve the style and interactivity of your documents.

1.2 Beyond the markup: additional web standards

As we mentioned, the web is no longer all about documents; it's a platform for application development. As a result, HTML5 doesn't include only markup for outlining document structure; it also encompasses many more features and associated specifications



Closed State: ▶ Section Heading

Open State: ▼ Section Heading
This is an example of using <details> and <summary> to create collapsible content without using JavaScript.

Figure 1.5 An example of the `<details>` and `<summary>` elements in action, first in the closed state, where only the code inside the `<summary>` element is visible, and second in the open state, where the entire contents of the `<details>` element are visible.

for ensuring that your applications look great and provide the best possible experience to the user. One example of this is microdata and the associated Microdata API, which enable you to provide additional semantics in your documents and then retrieve and modify them. Another example is CSS3; its evolved stylesheets allow you to apply the latest innovations in styling and effects—without relying on external images and JavaScript hacks.

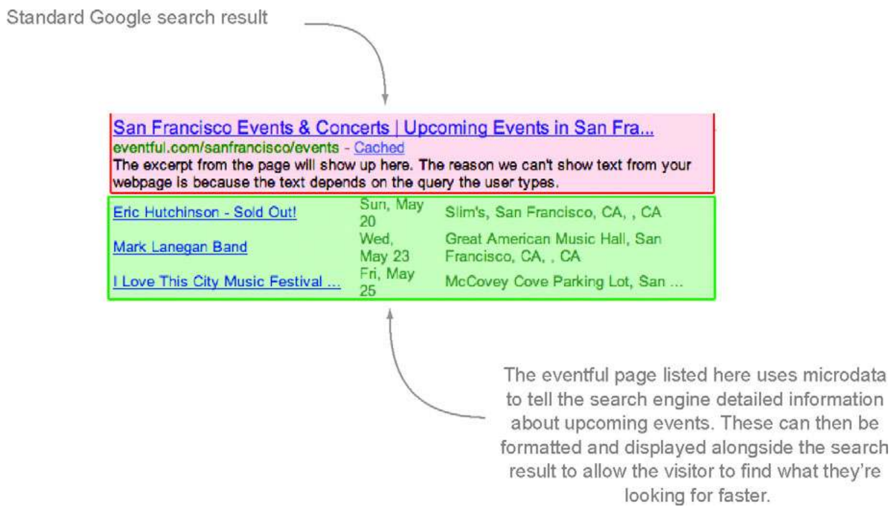
In this section, you'll learn

- How to use microdata and microdata vocabularies to provide search engines with better information about your pages.
- The microdata DOM API that lets you dynamically retrieve and modify microdata items using JavaScript.
- Several of the new features in CSS3 that allow you to enhance the visual appeal of your applications while providing better user interactions and feedback.
- How HTML5 treats JavaScript as a first-class citizen with detailed specifications and advanced APIs.

To begin, let's look at microdata.

1.2.1 *Microdata*

Microdata in HTML5 allows you to add semantic information to a web page, which in turn could be used by applications such as search engines and web browsers to provide additional functionality to the user based on that data. An example of how Google uses microdata to provide smart search results is illustrated in figure 1.6.


Standard Google search result
The eventful page listed here uses microdata to tell the search engine detailed information about upcoming events. These can then be formatted and displayed alongside the search result to allow the visitor to find what they're looking for faster.

San Francisco Events & Concerts | Upcoming Events in San Fra...
eventful.com/sanfrancisco/events - Cached
The excerpt from the page will show up here. The reason we can't show text from your webpage is because the text depends on the query the user types.

Eric Hutchinson - Sold Out!	Sun, May 20	Slim's, San Francisco, CA, , CA
Mark Lanegan Band	Wed, May 23	Great American Music Hall, San Francisco, CA, , CA
I Love This City Music Festival ...	Fri, May 25	McCovey Cove Parking Lot, San ...

Figure 1.6 Google reads microdata from HTML documents to provide improved search results to users. By using microdata in your pages, you enable Google to provide similar search result listings for your website or application.

To use microdata, you need a vocabulary, which defines the semantics you'll use. You can define your own vocabularies, but more likely you'll want to use a published vocabulary, such as those provided by Google at www.data-vocabulary.org/, including Event, Organization, Person, Product, Review, Review-aggregate, Breadcrumb, Offer, and AggregateOffer. By using a published vocabulary, you can be sure search engines and other applications will interpret your microdata consistently.

Listing 1.5 illustrates microdata in action using an event item that adheres to Google's Event microdata vocabulary at www.data-vocabulary.org/Event. This code creates a snippet of HTML code for an event, with defined microdata properties that will allow a search engine to unambiguously interpret the event information and use it to enhance search results, perhaps by showing the event date in a calendar or as a location on a map.

Listing 1.5 html5-microdata.html—Microdata in action

```
<div itemscope itemtype="http://data-vocabulary.org/Event">
    <a href="http://example.com/event/1" itemprop="url">
        <span itemprop="summary">John's 40th Birthday Party</span>
    </a>
    <span itemprop="description">To celebrate John turning 40,
    we're throwing a BBQ party in his honour this Friday evening
    at close of business. Please come and bring your friends and
    family!</span>

    Location:
    <span itemprop="location"
          itemscope
          itemtype=http://data-vocabulary.org/Address>
        <span itemprop="street-address">500 Market Way</span>
        <span itemprop="locality">Ballincollig</span>
        <span itemprop="region">Cork</span>
    </span>

    Date and Time:
    <time itemprop="startDate" datetime="2011-05-06T18:00+00:00">
        Fri, May 6th @ 6pm
    </time>
</div>
```

The itemscope attribute tells the parser that this element and everything contained inside it describes the entity being referenced. The value of this attribute is Boolean and is usually omitted. The itemtype attribute defines the URL at which the vocabulary for the item being specified is found.

The itemprop attribute indicates the name of the microdata property that the content of the element should be assigned to. This attribute is the one you'll likely use the most when working with microdata.

The HTML5 specification also defines a DOM API that you can use to dynamically retrieve and modify microdata items using JavaScript. Descriptions of the API are provided in table 1.3.

Table 1.3 The microdata DOM API

Method/property	Description
`document.getItems([types])`	Gets all elements that are top-level microdata items (elements with an `itemscope` attribute). You can use the `types` argument to filter by one or more `itemtype` attribute values.

Table 1.3 The microdata DOM API *(continued)*

Method/property	Description
`element.properties`	Gets all item properties (those elements with an `itemprop` attribute) for a given microdata item (`element`).
`element.itemValue [= value]`	Gets or sets the value of an item property.

Using microdata is an excellent way to improve how your application (or document) looks in search results. In the next section, you'll learn how you can use CSS3 to make your application visually stunning with the new styles and effects it has to offer.

1.2.2 CSS3

If you've been developing on the web for a long time, you may remember when styling HTML documents was facilitated by the use of elements like `<font>` and the clever use of `<table>` elements. Thankfully, the introduction of Cascading Style Sheets has meant that such approaches are no longer necessary.

As the web has evolved, developers have come up with innovative ways to present content, using effects like drop shadows, rounded corners, and gradients to improve their application's visual appeal. Even more impressive has been the use of transition and animation to provide better feedback to and interaction with the user. The main issue with all of these wonderful enhancements is that they've traditionally required a degree of trickery to implement using images and JavaScript (or at least required the use of a JavaScript library). CSS3 sets out to change that. Table 1.4 lists some of the new style features available in CSS3—all without JavaScript or the clever use of images.

Table 1.4 A partial list of the new features in CSS3

New selectors	New pseudo-classes	Rounded borders	Border images
Gradients	Box shadow	Box sizing	Background sizing
Text shadow	Word wrapping	Multiple columns	Web fonts
Multiple backgrounds	Alpha color channels	Media queries	Speech style
Transitions	Animations	3D transforms	2D transforms

As you work through the samples in this book, you'll learn to build applications primarily using HTML and JavaScript. We do use CSS3 throughout for styling, but we won't be covering it in the chapters themselves. You can download the CSS source for all the examples from the book's web page. If you're looking for detailed insight into CSS3, check out *Hello! HTML5 and CSS3* (Manning, 2012). Rob Crowther, the author of that book, is one of this book's coauthors.

1.2.3 JavaScript and the DOM

JavaScript and the Document Object Model (DOM) play a hugely important role in modern web applications. The ability to dynamically interact with elements on the page has enabled developers to provide rich functionality and interactivity previously found only in desktop applications. The advent of Asynchronous JavaScript and XML (AJAX) has removed the burden of page refreshes, allowing server-side actions to be updated inline, providing a much-improved user experience. JavaScript Object Notation (JSON) has become the de facto data interchange format for web applications, with most server-side languages and frameworks now supporting it natively. In addition, a range of powerful JavaScript frameworks and libraries has risen to provide an abstraction of JavaScript that allows developers to worry less about the cross-browser inconsistencies that plagued earlier web development, concentrating their efforts more on crafting highly functional applications.

WARNING Each and every chapter in this book shows you to how to build powerful applications using HTML5 and JavaScript. But this isn't a book for JavaScript beginners. At the least, you should be familiar with JavaScript syntax and the basics like variable declarations, conditional statements, functions, closures, callbacks, and scopes as well as other concepts like AJAX, JSON, and interacting with the DOM. If you have experience using JavaScript libraries such as jQuery, you should be able to follow along. To learn more about JavaScript or if you're feeling rusty, check out *Ajax in Action* (Manning, 2005) by David Crane and Eric Pascarello with Darren James and *Secrets of the JavaScript Ninja* (Manning, 2012) by John Resig and Bear Bibeault.

In previous versions of the HTML (and XHTML) specification, the only coverage of JavaScript was a minor section on use of the `<script>` element and some of the attributes that could be added to HTML elements to provide event-handling functionality. In HTML5, JavaScript is treated as a first-class citizen, with each section of the specification detailing what DOM API methods and properties are available for any given element. In addition, HTML5 defines advanced APIs that allow you to develop applications that use audio and video, work offline, store data locally on the client, and do much more. We'll cover these APIs briefly later in this chapter and in greater detail throughout the book.

HTML5 vs. HTML Living Standard vs. HTML5 for web developers

The HTML5 specification has a long history. Without getting caught up in the details, the end result is that the specification has two versions, both with the same editor: Ian Hickson of Google. The HTML5 specification is published by the W3C, whereas the HTML Living Standard specification is published by WHATWG (Web Hypertext Application Technology Working Group). To make things even more confusing, WHATWG also published a document, "HTML5: A technical specification for web developers," which is more concise and easier to read.

(continued)

The specifications are similar in many respects, but you'll find considerable differences. For example, the HTML Living Standard specification includes several APIs that are published as completely separate specifications by the W3C, such as Microdata, Web Storage, and Web Workers. For the latest differences between the specifications, see "Is this HTML5?" in the HTML Living Standard specification at http://mng.bz/PraC.

In this chapter, we treat the APIs that exist in the HTML Living Standard as "part of HTML5 itself" and any APIs outside of that specification as separate. As you progress in the book, you'll see that we're much less concerned about the differences and treat any of the new specifications as "HTML5." For further discussion of the differences between the WHATWG and W3C versions as well as the differences in approach between the WHATWG and W3C themselves, see appendix A.

In the next section, we'll take a look at the DOM APIs currently included in the HTML5 specification itself.

1.3 The HTML5 DOM APIs

DOM APIs exist for nearly everything in HTML5. In fact, many have been around for a long time but have never been defined in the HTML specification itself. These include features that enable you to get a DOM element by its ID attribute and that allow you to manipulate form element values. All of this is included in HTML5 and the specification also defines new DOM APIs for developing advanced applications, many of which aren't at all associated with HTML elements.

This section provides an overview of the new DOM APIs in HTML5:

- 2D Canvas
- Audio and Video
- Drag and Drop
- Cross-document Messaging
- Server-sent Events
- WebSockets
- Document Editing
- Web Storage
- Offline Web Applications

We cover all of these topics in great detail throughout the book, with full working examples that often integrate multiple APIs at once. In this chapter, you'll get a glimpse of what's to come, starting with the new `<canvas>` element and its associated API.

1.3.1 Canvas

HTML5 provides numerous elements that allow you to present information on a web page. You can style these in many different ways, and you can use JavaScript to animate them and apply dynamic effects. If you're comfortable with complex JavaScript code (and expect your users to be running high-performance browsers), you can do amazing things with HTML and JavaScript.

The problem is, designers and developers have many things they may want to implement that HTML doesn't cater to. What if you want to insert a circle, square, or other shape? What if you want to display an image and dynamically alter it based on user selections, on the fly? You could use static images or a server-side solution, but these aren't optimal. The only viable solution had been to use a third-party plug-in such as Adobe Flash.

HTML5 introduces the `<canvas>` element and a series of related drawing APIs that will allow you to do amazing things, without requiring the user to install a plug-in. The `<canvas>` element's name describes this new feature well: it's a canvas for your web pages. Figure 1.7 depicts a game, "Canvas Break," which we created entirely in HTML5 and JavaScript, with the game's visuals output on a `<canvas>` element. Neat, huh? You'll learn how to use the Canvas API as you build this game yourself in chapter 6.

The Canvas API defines a 2D context, which provides a series of methods for drawing on the canvas. These include methods to create shapes, define paths, use color and gradients, provide text, and much more. The API also provides developers with a way to export the current content of the canvas as a PNG or JPG format image using data URLs or `Blob` objects.

1.3.2 Audio and video

The majority of internet bandwidth in recent years has been driven by the delivery of multimedia content: video and audio. Today, the majority of web video is deployed in Flash video (FLV) format, an Adobe Flash container for various types of video codec. If users have a Flash plug-in installed, they can view the video. Some developers have raised questions about the security and performance of Flash as a platform for video

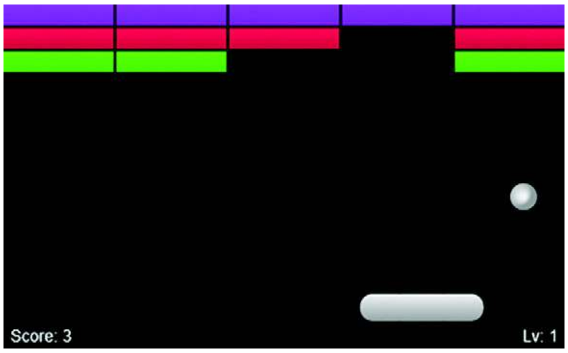
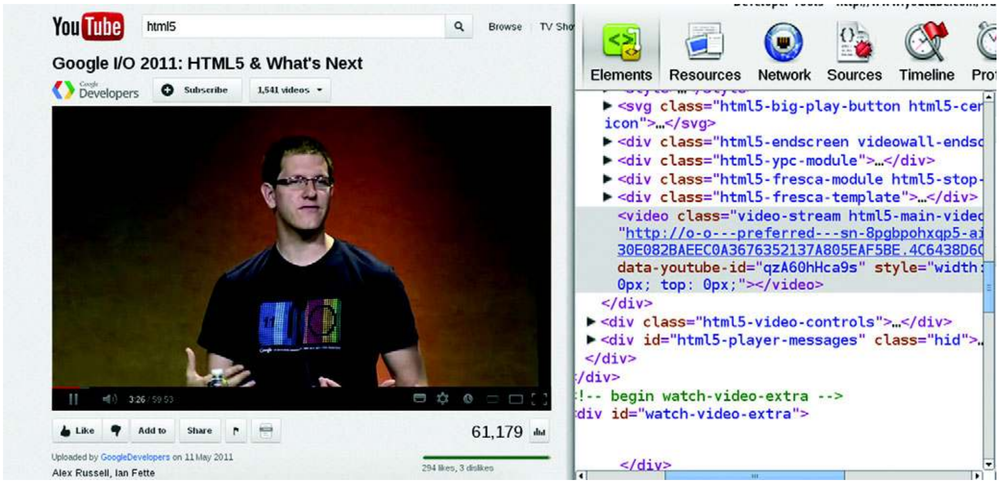


Figure 1.7 The `<canvas>` element allows developers to present information in more creative ways. You'll learn how to build this game in chapter 6.



```
  ▶ <svg class="html5-big-play-button html5-cer
  icon">…</svg>
  ▶ <div class="html5-endscreen videowall-endsc
  ▶ <div class="html5-ypc-module">…</div>
  ▶ <div class="html5-fresca-module html5-stop-
  ▶ <div class="html5-fresca-template">…</div>
    <video class="video-stream html5-main-videc
    "http://o-o---preferred---sn-8pgbpohxqp5-ai
    30E082BAEEC0A3676352137A805EAF5BE.4C6438D6C
    data-youtube-id="qzA60hHca9s" style="width:
    0px; top: 0px;"></video>
  </div>
▶ <div class="html5-video-controls">…</div>
▶ <div id="html5-player-messages" class="hid">.
</div>
/div>
!-- begin watch-video-extra -->
div id="watch-video-extra">


  </div>
```

Figure 1.8 YouTube HTML5 video in action. As you can see from the code in the inspector, the YouTube video in this screenshot doesn't use the Adobe Flash plug-in but is fully implemented using the HTML5 `<video>` element and related APIs.

delivery and are looking for alternative solutions. In addition, the lack of support for Flash on mobile devices has meant that if you want your multimedia content to be available on devices such as the iPad, you're out of luck.

HTML5 provides a solution for this with the new `<video>` and `<audio>` elements, which allow supported multimedia files to be played back natively by the browser, with no third-party plug-ins required. An example is shown in figure 1.8.

The `<video>` and `<audio>` elements both support the `<track>` element, which you can use to deliver accompanying text content such as subtitles. You can use the `<source>` element to provide a variety of file formats, ensuring that visitors can consume the content, regardless of what OS or browser they're using.

HTML5 also defines an API with a series of methods for controlling the playback of a video or audio file. These include methods for playing, pausing, fast-forwarding, rewinding, adjusting the volume, and more. You'll learn about these APIs in detail as you build a working video jukebox with telestration capabilities in chapter 8.

1.3.3 *Drag and drop*

Lack of drag-and-drop interactivity had been an issue that has plagued web application developers for a long time. This type of functionality has been prevalent in desktop applications for as long as graphical UIs have been around. As a result, users have come to expect to be able to drag objects around applications and are sometimes shocked to learn that their favorite web applications can't do it.

Attempts at implementing drag and drop in the browser began in the late 1990s, with Netscape 4.0 providing a basic implementation and Microsoft following up with a more complete offering in IE 5.0. At the time, it was seen as a nonstandard,

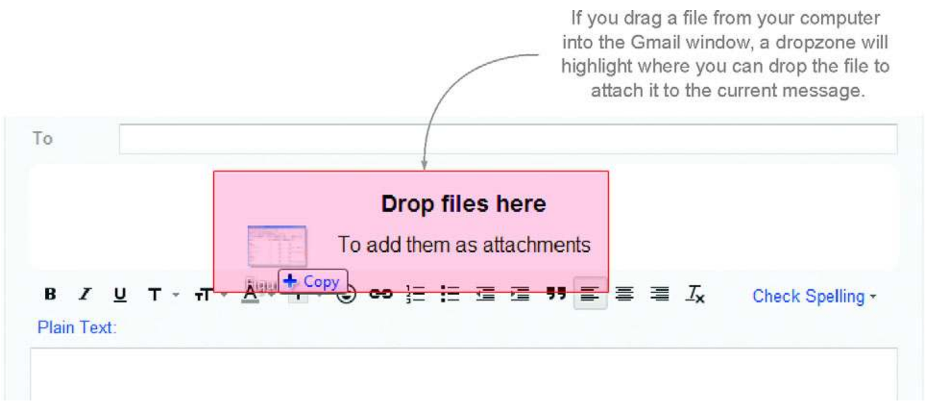

If you drag a file from your computer into the Gmail window, a dropzone will highlight where you can drop the file to attach it to the current message.
To
Drop files here
To add them as attachments
+ Copy
Check Spelling
Plain Text:

Figure 1.9 Gmail allows you to drag files into the browser window and drop them into a designated area to add them as attachments to your messages.

browser-specific extension to IE, but over time other browser vendors adopted the same API, leading to its eventual inclusion in HTML5.

The great news is that HTML5 drag and drop is supported on all modern browsers, including IE from version 5.0 up. The bad news is that the original Microsoft implementation used is, quite frankly, terrible. Ian Hickson, the editor of the HTML5 specification, once tweeted, “The drag-and-drop API is horrible, but it has one thing going for it: IE6 implements it, as do Safari and Firefox.”

To use drag and drop in HTML5, you can use the `draggable` attribute on an element to explicitly define that element as draggable. (Many elements, such as images, are draggable by default.) You can then use a series of events to listen for changes as the user drags the element into and out of other elements and indeed when the user drops the element. The API allows you to set the data you want to associate with the drag operation and then to read this back when dropped.

A new feature of HTML5 drag and drop is the ability to drag files from your computer and drop them into a web application. An example of this functionality can be seen in Gmail, as shown in figure 1.9.

You’ll learn how to use drag and drop to import and export files from an application in chapter 3.

1.3.4 Cross-document messaging, server-sent events, and WebSockets

Web applications work on a request-response model, where the client issues a request to the server, and the server in turn sends a response to the client. After this, if the client requires further information from the server, the client needs to initiate another request. This makes it difficult to send changes from the server to the client, without frequently sending requests to check for these changes. In this section, you’ll learn about some of the new messaging features in HTML5 that allow the server to communicate with the client. Before that, let’s look at how to use messaging to send updates between documents.

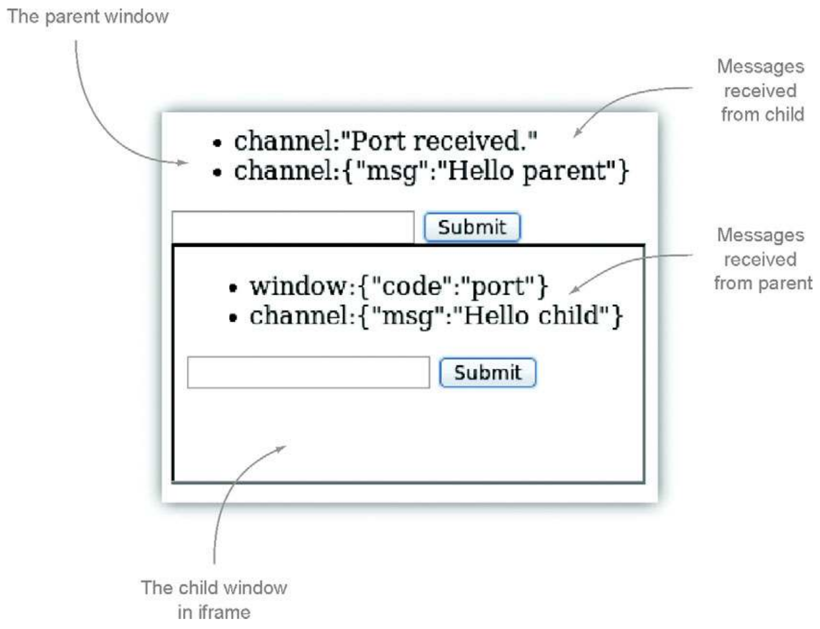
Enabling communication between clients with cross-document and channel messaging

When working with web applications that use multiple browser windows, you'll often want to pass messages between the documents in each window. Traditionally, this was accomplished using direct DOM manipulation. For example, an old airline reservation system may have opened a calendar widget in a new browser window, and when the user clicked a date, it would directly manipulate the value of the date form field on the parent window.

One problem with direct DOM manipulation is that it directly connects the two documents; each document has to have detailed knowledge of the structure of the other in order to manipulate each other to share information. HTML5 provides a much-improved solution in the form of cross-document messaging and channel messaging, illustrated in figure 1.10.

Cross-document messaging enables documents to communicate with each other via messages—one document posts a message, and the other document has an event handler registered to listen for any messages posted by the other document.

Another issue with direct DOM manipulation surfaces when you consider the security of including remote script files in your application—a common use case for implementing the likes of Google Analytics and Facebook "Like" buttons in your applications. These scripts have complete access to your entire DOM—it's not possible to give them only partial access when they're loaded this way. Cross-document messaging works cross-domain, enabling messages to be sent between separate applications without exposing each application's DOM.


The parent window
Messages received from child
Submit
Messages received from parent
Submit
The child window in iframe

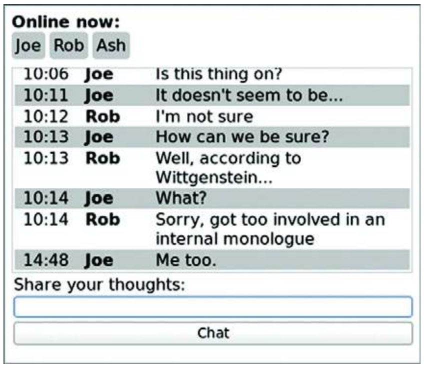
```
• channel:"Port received."
• channel:{"msg":"Hello parent"}
```

```
• window:{"code":"port"}
• channel:{"msg":"Hello child"}
```

Figure 1.10 A simple application demonstrating channel messaging. You'll build this in appendix J, one of the companion appendices to chapter 4.

ENABLING ONE-WAY COMMUNICATIONS FROM SERVER TO CLIENT WITH SERVER-SENT EVENTS

Cross-document messaging is a great way to communicate between two clients—but what if you want to allow your web server to send messages that can be read by the browser? Server-sent events are designed to do that. Using the `EventSource` interface, your application can subscribe to a server-side event stream, which will only receive messages when the server sends an update. This is a considerable improvement over approaches like AJAX long polling, which can be cumbersome to implement. This works well for a chat application, where you can post new chat messages using AJAX and receive any chat messages from other users over the event stream. Figure 1.11 is a screenshot of such an application, which you'll build later on.



10:06	Joe	Is this thing on?
10:11	Joe	It doesn't seem to be...
10:12	Rob	I'm not sure
10:13	Joe	How can we be sure?
10:13	Rob	Well, according to Wittgenstein...
10:14	Joe	What?
10:14	Rob	Sorry, got too involved in an internal monologue
14:48	Joe	Me too.

Figure 1.11 A chat application implemented using server-sent events

ENABLING TWO-WAY COMMUNICATIONS BETWEEN SERVER AND CLIENT WITH WEBSOCKETS

The obvious drawback with server-sent events is that they only facilitate one-way communication—messages can only be sent from the server to the client, not vice versa. If you need two-way communication, HTML5 provides WebSockets—bare-bones networking between clients and servers, without the overhead associated with HTTP. WebSockets are great for passing small amounts of data quickly, which is critical in applications like online multiplayer games and time-sensitive financial systems.

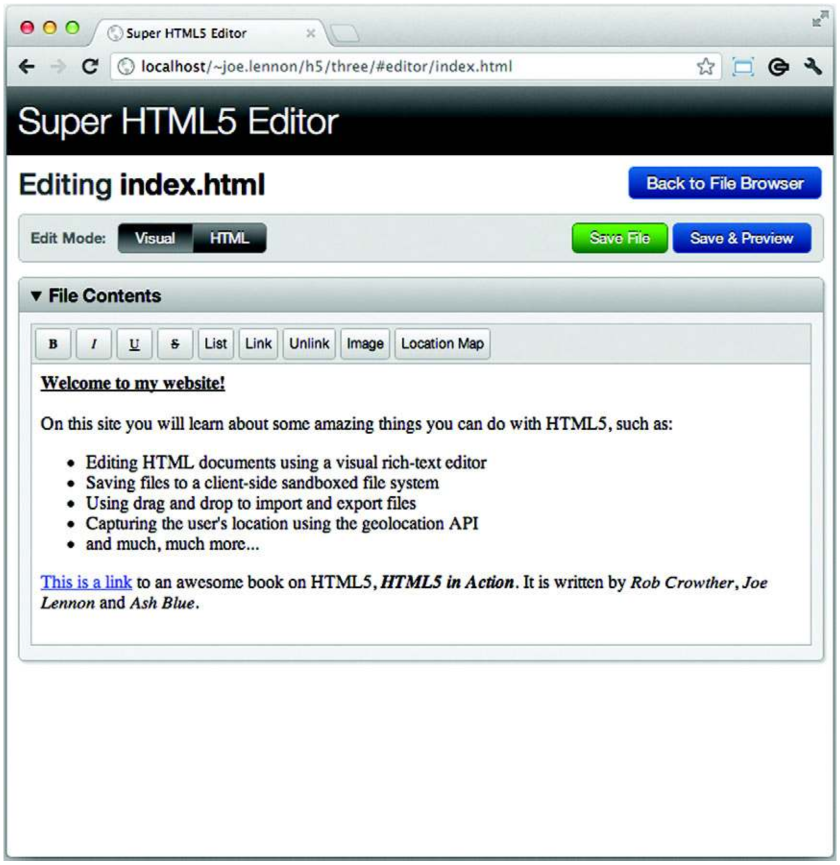
In chapter 4, you'll learn how to use all three of these new messaging technologies as you build a simple chat application and a multiuser planning board, using server-sent events and WebSockets via Node.js, and then allow them to communicate with each other through cross-document messaging.

1.3.5 Document editing

Earlier in this chapter, we talked about the new forms features in HTML5. Web forms are a great means of capturing simple plain-text user input, but they don't allow the user to edit HTML content. Sure, you could load HTML source code in a `<textarea>` element and allow the user to edit that, but wouldn't it be great if you could allow the user to edit the content using a series of rich-text editing controls?

HTML5 defines two new attributes that allow you to enable rich-text editing in your HTML documents. The first, `contenteditable`, can be set on any HTML element in your page to make that element editable. The second, `designMode`, can be set on the HTML document itself to make the entire document editable.

These attributes are supported by all modern browsers and were first introduced by Microsoft in IE 5.5.



Welcome to my website!

On this site you will learn about some amazing things you can do with HTML5, such as:

- Editing HTML documents using a visual rich-text editor
- Saving files to a client-side sandboxed file system
- Using drag and drop to import and export files
- Capturing the user's location using the geolocation API
- and much, much more...

This is a link to an awesome book on HTML5, ***HTML5 in Action***. It is written by *Rob Crowther*, *Joe Lennon* and *Ash Blue*.

Figure 1.12 The Super HTML5 Editor application that you'll learn to build in chapter 3 uses the `designMode` attribute and the Editing DOM API to allow users to edit HTML markup using a set of rich-text editing controls. The toolbar in this screenshot allows you to use Bold, Italic, Underline, Strikethrough, List, Link, and Image formatting commands on the contents of the area below the toolbar.

When an element or document is editable, you can manipulate its content using the API method `document.execCommand`, part of the Editing DOM API in HTML5. This method accepts a wide selection of commands that will be applied to the current selection or block, such as Bold, Italic, CreateLink, and many others. An example of the type of editor you can create with this functionality is shown in figure 1.12; even better, you'll learn how to use these new features as you build that rich-text editor in chapter 3.

1.3.6 Web storage

For many years, web applications have used cookies to store small chunks of data in the client that persist for the session or between multiple sessions. This is the technology underlying web authentication systems—they store on the client a cookie that holds some form of identifier used to tell the application who's logged in. Cookies present a number of issues, making them less useful for storing all but the smallest chunks of data.

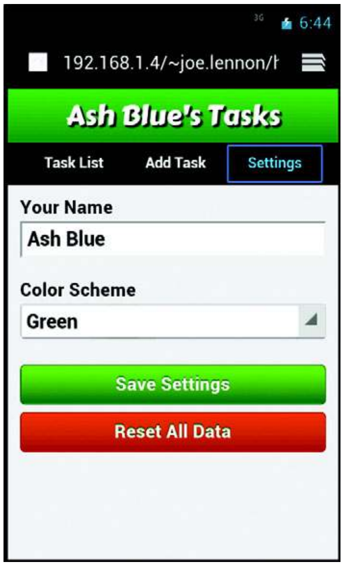
The first issue is that most browsers limit the size of cookies to 4 kilobytes, and the number of cookies stored per domain to 20. After reaching these limits, the browser will start discarding older cookies to make way for the newer ones, which means there's no guarantee it'll keep them. Another issue is that when an application uses cookies, those cookies are sent in every HTTP request made for the session, adding overhead to each and every transaction. This might not be an issue if you're using one or two cookies, but what if you use several? And consider that the cookies will be sent along with every HTTP request—slowing down every page load and AJAX request your application makes.

The Web Storage DOM API provides a JavaScript alternative to cookies for web applications. It defines two interfaces:

- `sessionStorage`—Client-side data storage that persists for the length of the current session only
- `localStorage`—Client-side data storage that persists for multiple sessions

These APIs expose methods that allow developers to store simple key/value pair data in a client-side store. The data items stored using these interfaces are accessible only by pages in the same domain. In chapter 5 you'll build the application shown in figure 1.13, which stores user settings and preferences in local storage.

Although the Web Storage API can store megabytes of data (5 megabytes is the limit imposed by most browsers), it's not ideal for storing complex data structures that would typically be stored in a database. Later in this chapter, you'll learn about IndexedDB, which defines a full indexed database API for storing data locally on the client.



Your Name: Ash Blue
Color Scheme: Green

Figure 1.13 In chapter 5, you'll learn how to use the `localStorage` interface to persist user settings in a mobile task-management application.

1.3.7 *Offline web applications*

These days, it seems we're permanently online—our internet connections are always on, our mobile devices have data plans that work over cellular data networks, and now we can even get connected as we travel by air. That said, we may still have times when we need to make do with working offline. Maybe your network connection is down, or you're abroad and don't want to pay exorbitant data roaming fees. Or you're using one of the few devices that doesn't have a wireless data connection.

Solutions have long existed for saving HTML documents for offline use. As useful as these are for reading static content like news articles, they're useless when it comes to web applications. HTML5 goes a step beyond saving documents, by providing developers the ability to define a cache manifest file that defines how their applications' files should be cached for offline use.

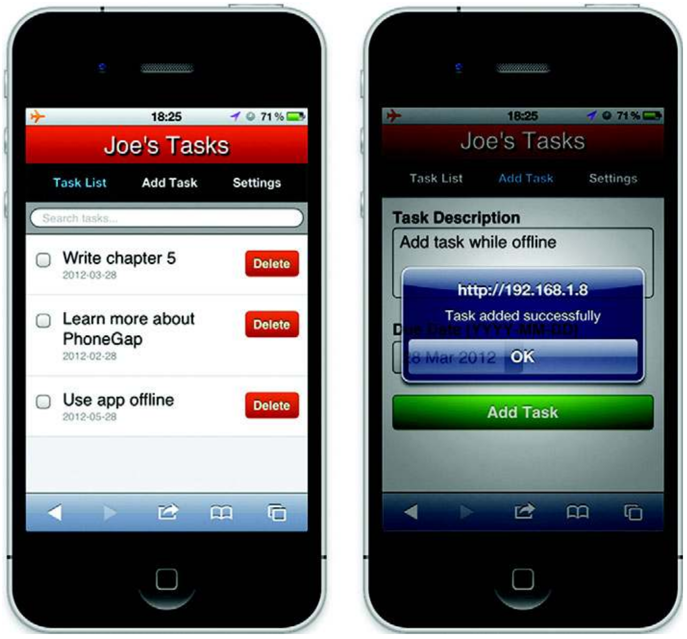
The cache manifest file can also define those files that shouldn't be cached for offline use. In this case, a fallback can be provided that will be loaded by the browser when the user is offline. This enables you to provide separate files for online and offline use.

An example use case might be where your application saves data to a database on a server. When online, the application may perform AJAX requests to retrieve and update data on this database. In the background, the application may be storing data locally in an IndexedDB database, which we'll talk more about in an upcoming section. Now, when the user is offline, the application could load a JavaScript file specifically designed for use in offline mode. Instead of firing AJAX requests to the server, it would retrieve and modify the data in the local IndexedDB database. The next time the user connects to the network, the application can then submit the data from the local database to the server-side database.

You'll learn how to develop the offline-capable web application shown in figure 1.14 in chapter 5.

1.4 Additional APIs and specifications

As you learned earlier, the HTML5 family doesn't stop at the HTML5 specification itself. A host of other technologies and specifications exist that define new functionality,



Write chapter 5
2012-03-28
Learn more about PhoneGap
2012-02-28
Use app offline
2012-05-28

Add task while offline
http://192.168.1.8
Task added successfully
28 Mar 2012

Figure 1.14 A screenshot of the mobile application with offline capabilities that you'll create in chapter 5

which modern browser vendors are steadily including in their latest offerings, such as the Geolocation API; the IndexedDB API; the File Reader, File Writer, and File System APIs; and SVG and WebGL.

In this section, you'll learn

- The Geolocation API and how you can use it to determine a user's geographic location
- The IndexedDB API and how it allows you to store an entire database on the client side
- File-oriented specifications and how you can use them to work with and store files locally on the user's filesystem
- SVG and WebGL and how they're enabling developers to produce impressive high-quality vector graphics and 3D animations on the web

We'll talk about each ancillary yet important specification, starting with Geolocation.

1.4.1 Geolocation API

As mobile device usage has surged in recent years, so has the use of location-aware applications. The Global Positioning System (GPS) sensors found on modern smartphones enable applications to locate users to a high degree of accuracy. If GPS isn't available (if the device doesn't have a sensor, or if the user is out of satellite line of sight), devices can fall back to other means of tracking location, using information such as your cellular network, Wi-Fi network, or IP address.

The Geolocation API defines methods that allow web applications to find a user's location. When these methods are called, the browser will notify the user that the application is requesting access to their location. The user can then choose to accept or reject this request, ensuring that applications don't track user location without their express prior permission. If the user accepts the request, the API then provides the application with a series of data about the user's location including coordinates (latitude and longitude), altitude, heading, and speed, as well as the level of accuracy of the result.

You'll learn how to use geolocation in chapter 3, where you'll use it to get the user's current location and include a map of that location in an HTML document (figure 1.15).

1.4.2 Indexed database (IndexedDB API)

The IndexedDB API provides developers with a means of storing complex data structures in a full client-side database. The main advantage of the IndexedDB API over the Web Storage API is that in Web Storage the only index is the key of the key/value pair, whereas in IndexedDB the values are fully indexable too, making it a more viable solution for any application where you need to search or filter data. The trade-off is that the API for IndexedDB is much more complex, and it can be difficult to get to grips with initially.

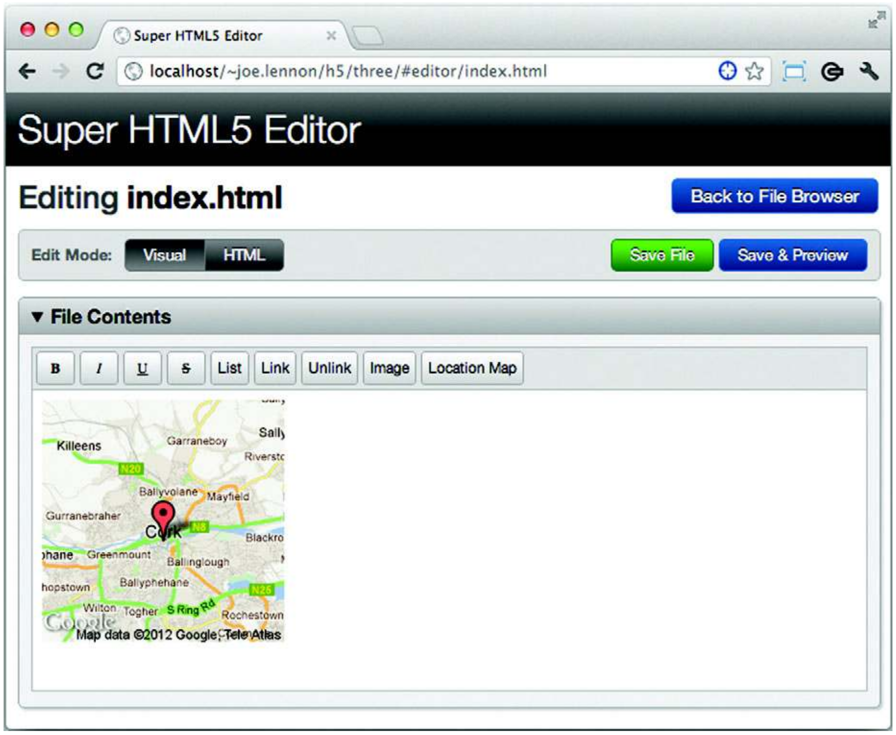


Figure 1.15 Adding maps showing your current location in the chapter 3 application

IndexedDB is a relative newcomer to the HTML5 specification family. There had been a different proposed solution, Web SQL (Structured Query Language), a specification that defined a relational client-side database that used SQL statements for query and data manipulation. In the end, it was dropped because all the browsers that had adopted it were using the same implementation (an SQLite database) so it could never meet the WHATWG's and W3C's standardization criteria of having "two independent, interoperable implementations of each feature." When it was dropped, support had already been included in several browsers, including mobile browsers like Mobile Safari and Android. Browser support for IndexedDB has been slow-moving, and as a result, most applications that use IndexedDB also use Web SQL as a fallback.

In chapter 5, you'll learn how to use IndexedDB (with a Web SQL fallback) to store task data in a mobile task-management application, as illustrated in figure 1.16.

1.4.3 File, File Reader, File Writer, and File System APIs

Working with files in web applications has traditionally been a pain. The only native means of allowing users to select files from their computers was to use the file input type, which is well known for being cumbersome, particularly when it comes to styling the UI of the widget. When the user selected the file, the application would have to upload the entire file to the server in order to do anything with it. Although Flash- and Java-based offerings are available that provide improved functionality, these aren't ideal given that they require a third-party plug-in.

The HTML5 family includes a number of related file-based specifications that promise to make working with files in web applications much easier. The File API allows developers to get a reference to a file object in JavaScript, reading properties such as its name, size, and MIME type. You can use the File Reader API to read a file object, either in its entirety or partially in chunks. Similarly, you can use the File Writer API to output data to a file. The File System API allows developers to manipulate file objects in a sandboxed local filesystem on the client. This enables you to perform much of the file interaction on the client, significantly saving the load on the server. No longer do you have to upload the entire file to the server, only to discover it's of the wrong MIME type, and then have to tell the user that the file wasn't of the correct type. You can imagine how annoying this would be to users after they've uploaded a large file.

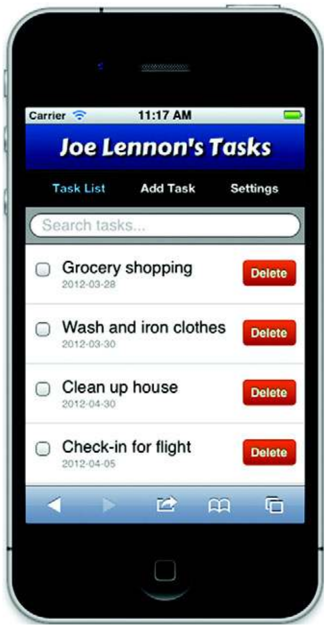


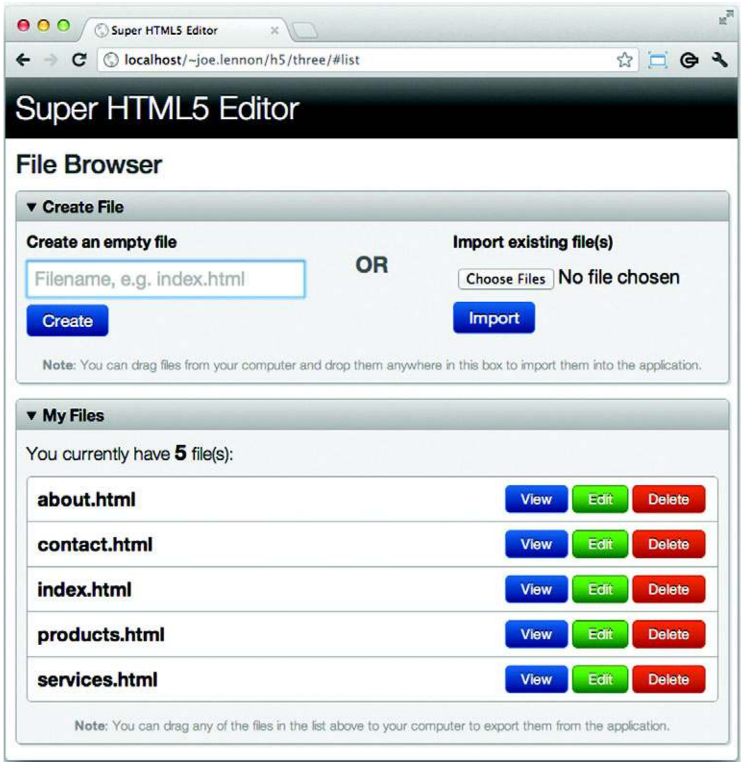
Figure 1.16 The chapter 5 application will use IndexedDB to store a list of tasks and allow fast sorting and searching.

You'll use all of these APIs to provide a full local filesystem, and we'll cover where HTML files will be stored in chapter 3. A screenshot of how you can use some of this functionality is illustrated in figure 1.17.

1.4.4 Scalable Vector Graphics

Scalable Vector Graphics (SVG) is an XML language that allows you to create impressive vector graphics using markup that can be styled using CSS and interacted with via the DOM using JavaScript. One of the primary issues with bitmap graphics is that as you scale their dimensions up, the quality of the graphic degrades and produces a "pixelated" result. Vector graphics are constructed using math equations rather than pixels, and as a result they can scale up to look impressive even at large sizes.

In chapter 7, you'll learn how to use SVG as you build the app SVG Aliens (figure 1.18), an exercise that illustrates how to create shapes and complex objects using SVG, implement collision detection, and understand the pros and cons of using SVG rather than the `<canvas>` element.



Super HTML5 Editor

localhost/~joe.lennon/h5/three/#list

Super HTML5 Editor

File Browser

▼ Create File

Create an empty file

Filename, e.g. index.html

Create

OR

Import existing file(s)

Choose Files No file chosen

Import

Note: You can drag files from your computer and drop them anywhere in this box to import them into the application.

▼ My Files

You currently have **5** file(s):

about.html	View	Edit	Delete
contact.html	View	Edit	Delete
index.html	View	Edit	Delete
products.html	View	Edit	Delete
services.html	View	Edit	Delete

Note: You can drag any of the files in the list above to your computer to export them from the application.

Figure 1.17 The Super HTML5 Editor you'll build in chapter 3 will allow you to perform file operations such as creating a new blank file and importing an existing file either by selecting it or dragging it into the application. It'll store these files in a sandboxed local filesystem, from which you can view, edit, and delete the files or export them to your computer by dragging them out of the application.

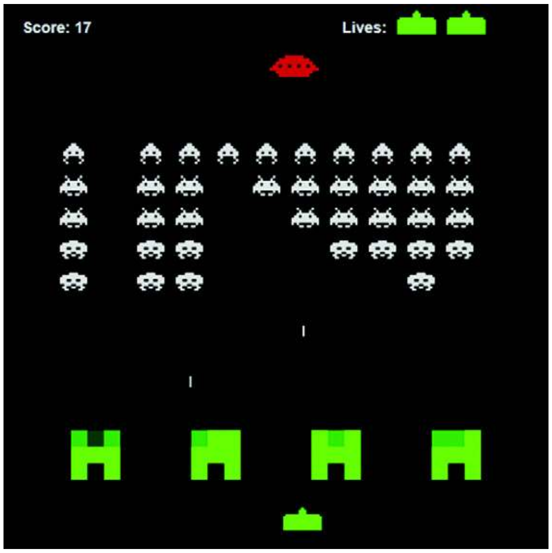


Figure 1.18 The SVG Aliens game in action. You'll learn to build this game in its entirety later in this book.

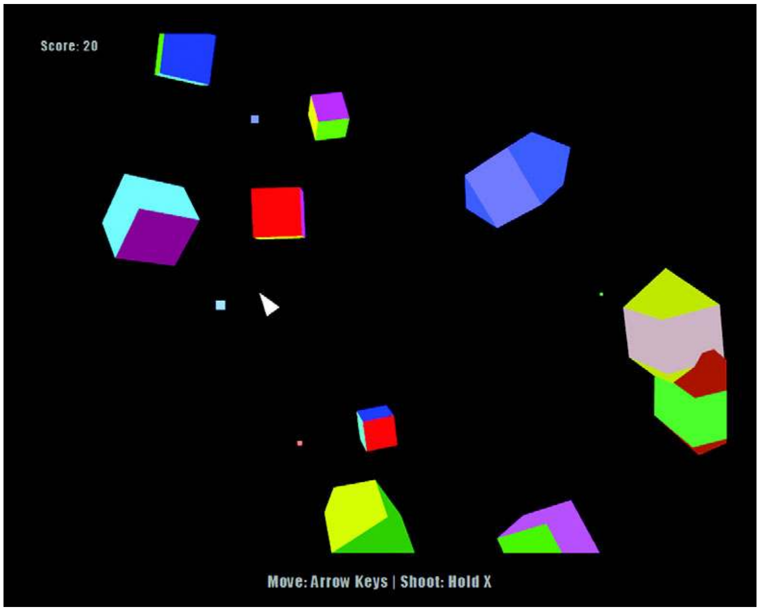


Figure 1.19 The 3D Geometry Destroyer game in all its glory. Building this game is covered in chapter 9.

1.4.5 Web Graphics Library

Last but not least is the Web Graphics Library (WebGL), a JavaScript API for creating 3D graphics using the `<canvas>` element. WebGL is based on the Open Graphics Library for Embedded Systems (OpenGL ES) standard, which was designed for implementing 3D on embedded devices including mobile phones. It provides developers with an API that allows them to control graphics hardware at a low level using shader, buffer, and drawing methods.

In chapter 9, you'll learn not only about the WebGL API but also about 3D graphics programming in general, including how to create shaders, work with data using buffers, assemble 3D data onto the screen using matrix manipulation, and more. You'll do these tasks through the lens of our sample application, which has you building an entire 3D game, Geometry Destroyer, a screenshot of which you can see in figure 1.19.

1.5 Summary

HTML5 is the most important revision of HTML since its inception in 1991. Although HTML began as a relatively straightforward markup language, it has since become a platform for complex web page design and web application development, particularly when coupled with its close relations CSS and JavaScript. HTML5 is the first version of the language to acknowledge this significance and include a number of application-oriented JavaScript APIs within the specification.

Over the course of the next eight chapters, you'll learn how to build eight separate applications, everything from mobile applications that work offline to 3D games. In the next chapter, you move away from introductory concepts and delve deep into the vast improvements in web forms that HTML5 has to offer, including the new input types that allow guided entry of a much wider variety of data types, new attributes such as `autofocus` and `placeholder`, and the out-of-the-box features that simplify client-side validation.