

# ECS417U - Fundamentals of Web Technology

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*Lecture 1, Tuesday 10/01/17*

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## General Information

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# Course objectives

- The course is to help you
  - Understand the basics of Internet, WWW, and client side and server side web programming
  - Understand the concept of markup language and be able to design webpages using
    - XHTML/HTML5
    - Cascading Style Sheet (CSS)
  - Understand the concept of Scripting Languages and Event-Driven Programming and be able to write programs on
    - Client-side: JavaScript
    - Server-side: PHP

# Course objectives

- The course is NOT a web-design course
  - Website design will be taught systematically in a 2<sup>nd</sup> year module: ECS507U Website Design and Authoring
- It DOES NOT has the scope to cover advanced web programming topics
  - Those topics will be covered in a 3<sup>rd</sup> year module: ECS639U Web Programming, including
    - Python, Django, Javascript, jQuery and HTML
- So don't expect that it will cover everything and to the most advanced level
- It is designed to cover as broad as possible but at the minimum depth

# Why ECS417U

- The World Wide Web (WWW) is one of most significant inventions in human history
- An EECS graduate should and must know how it works and how to program it
- What you will learn from this course alone (plus ECS507U and ECS639U) may land you a job in the future
- Or at least a TA job for this module next year and the year after

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# Course structure

- Week 1: Web fundamentals and XHTML I
- Week 2: Practical server basics
- Week 3: XHTML II + HTML5
- Week 4, 5: CSS
- Week 6, 8, 9: PHP
- Week 10, 11, 12: JavaScript

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## Course resources

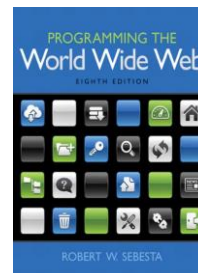
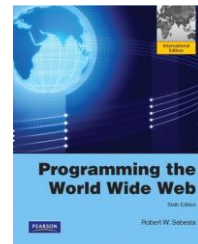
- **Lectures:**
  - 10am-12pm, Tuesdays (Weeks 1-6, 8-12), Great Hall
  - 5-6pm, Tuesdays (**Weeks 6, 8-12 only**), Arts Two LT
- **Labs:** 3 two-hour sessions each week on Fridays:
  - Each of you has been assigned to one of the three sessions/groups
    - 9am-11am (ITL ground floor)
    - 11am-1pm (ITL ground floor)
    - 2pm-4pm (ITL ground floor)
  - Starting from week 2 (Friday 20th Jan 2017)
  - No lab in Week 7 (Reading Week)
  - Lab sheets can be found at the course website

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## Course resources

- **Textbook:** Programming the World Wide Web (Sixth Edition), by Robert W. Sebesta, Pearson International Edition, ISBN-10:0-13-705383-5.
  - You can buy it at the on-campus bookshop; alternatively, there are one copy at the Short Loan Collection and 6 more at One Week Loans in the College Main Library
  - You can also buy the latest edition (eighth) online
- **Course website:**  
<http://qmplus.qmul.ac.uk/course/view.php?id=2319>
- **Forum:** follow the link on the course website
- **Method of communication:**
  - Forum
  - Email me/TAs directly
  - Talk to me during break, after lecture and my office hour



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## Teaching team

- **Tao Xiang:** Lectures & overall management
  - Office: CS/324
  - Office hour: Fridays 2-3pm
  - Email: [t.xiang@qmul.ac.uk](mailto:t.xiang@qmul.ac.uk)
- Lab Demonstrators (TAs): ~20 TAs whose emails can be found on the course website

## Assessments

- Final exam in May: 70%
- A sequence of lab based exercises including a mini-project: 30% in total and consist of:
  - 10% for practical exercises (lab sheets for weeks 2-10) assessed during the lab session in the ITL in week 11 (Friday 24 March)
  - 20% for an individual mini-project assessed during the lab session in the ITL in week 12 (Friday 31 March)

## Important notes

- Attend lectures
- Attend labs and also spend extra time on reading materials and practice
- Not all slides will be covered during lectures
- Ask questions
- Visit the course website and discussion forum regularly
- **Plagiarism** cases will be handled seriously

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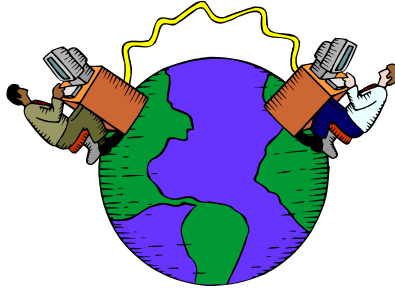
## Important notes

- **Disruptive  
behaviour is NOT  
tolerated**

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# Introduction to Internet

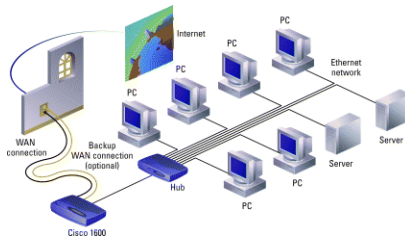


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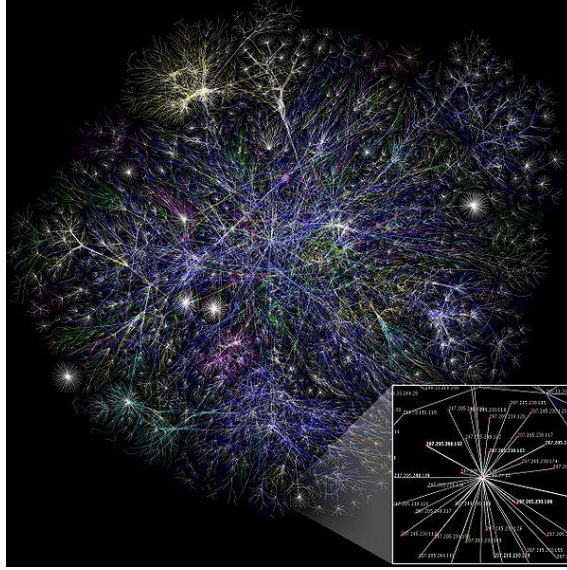
## What is the Internet?

- The Internet is a huge collection of computers connected in a communication network
  - Global
  - Networks of networks



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Tree of routing paths through a portion of the Internet as visualized by the [Opte Project](#)

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## History of Internet

- Began in the 1950s with the concept of packet networking
- The first node of ARPAnet was established at UCLA in 1969.
- In the late 1970s and 1980s, many networks were developed (e.g. BITNET, CSNET, NSFnet) locally.
- In 1995, private firms took over the responsibilities of managing the backbone from NSF.



Larry Roberts, the principal architect of the ARPANET



Vint Cerf, the founding father of Internet

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# Internet protocols



- It is a special set of rules that end points in a telecommunication connection use when they communicate.
- **Internet Protocol (IP)** – To send and receive messages at the Internet address level.
- **Transmission Control Protocol (TCP)** – on top of IP, to exchange messages with other Internet points at the information packet level.
- On top of TCP/IP, a variety of higher level protocols exist, among which the most important one is **Hypertext Transfer Protocol (HTTP)** for delivering HTML, sound, audio files on the World Wide Web.

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# Internet protocols



## The Internet Protocol Suite

### Application Layer

BGP • DHCP • DNS • FTP • GTP • HTTP •  
IMAP • IRC • Megaco • MGCP • NNTP • NTP •  
POP • RIP • RPC • RTP • RTSP • SDP • SIP •  
SMTP • SNMP • SOAP • SSH • Telnet •  
TLS/SSL • XMPP • (more)

### Transport Layer

TCP • UDP • DCCP • SCTP • RSVP • ECN •  
(more)

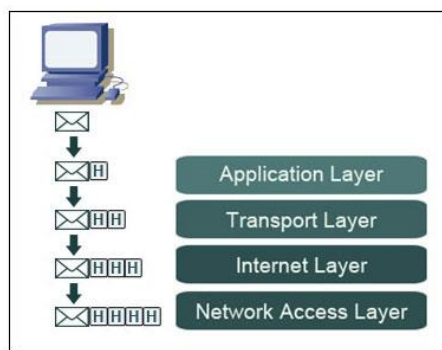
### Internet Layer

IP (IPv4, IPv6) • ICMP • ICMPv6 • IGMP •  
IPsec • (more)

### Link Layer

ARP/InARP • NDP • OSPF • Tunnels (L2TP) •  
PPP • Media Access Control (Ethernet, DSL,  
ISDN, FDDI) • (more)

This box: [view](#) • [talk](#) • [edit](#)



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## IP address

- The Internet devices are identified by
  - Device names for people to remember
  - Numeric addresses (IP) for computers
- An IP address is a unique 32-bit number (as in IPv4)
  - Divided into 4 parts (1 byte each)
  - For example: 191.57.126.0
- Next generation : IPv6 – 128-bit

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## Domain names

- People have difficulties dealing with and remembering numbers; fortunately devices on the Internet also have textual names
  - [www.eecs.qmul.ac.uk](http://www.eecs.qmul.ac.uk) (numeric address: 138.37.95.150)
  - It corresponds to the computer providing web services on the eecs@qmul domain
- There are **name servers** on the Internet that implement the Domain Name System (DNS)

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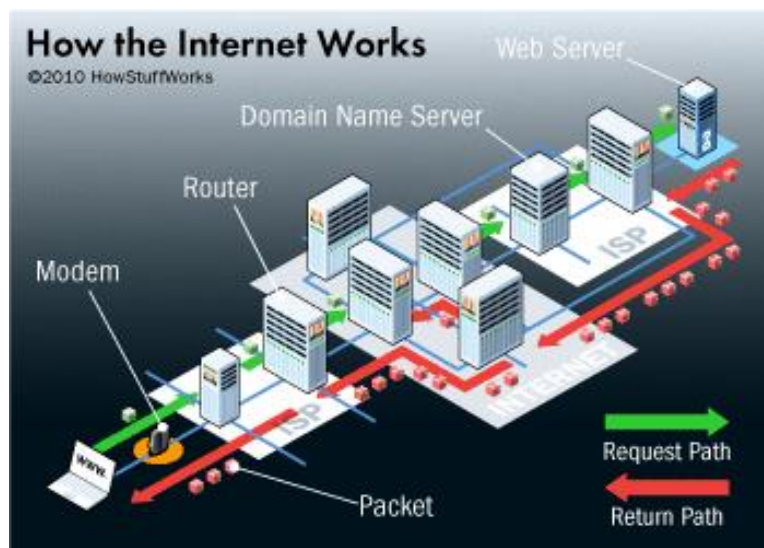
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# Analogy to Telephone Network

- IP ~ the telephone network
- TCP ~ calling someone, having a conversation, and hanging up
- DNS ~ directory assistance (e.g. 118118) which helps convert the name of the person/company you call to a telephone number

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# Introduction to World Wide Web

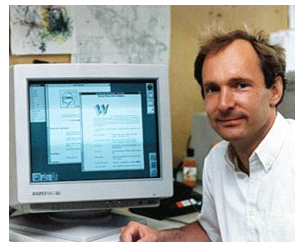


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## What is the WWW

- It is one way of making use of the Internet
- It is a collection of software and protocols that has been installed on most computers on the Internet, together with the information being shared
- Affectionately called “**The Web**”
- Proposed by Sir Tim Berners-Lee at CERN (www.cern.ch) in 1989

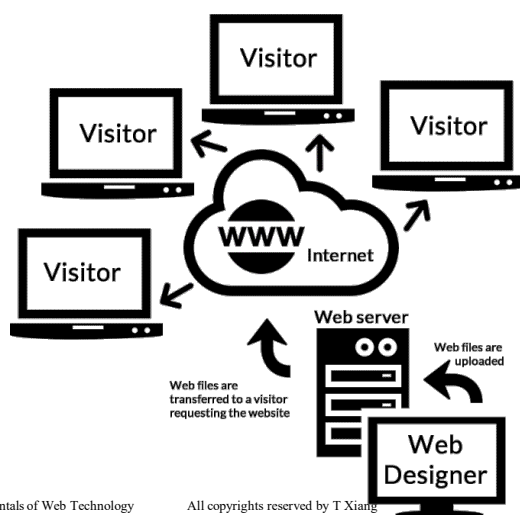


Sir Tim, the inventor of the Web

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## How does the Web work?



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## How does the Web work?

- Web information is stored in the form of web pages
- Web pages are stored in the computers called **Web servers**.
- The computers reading the pages are called **Web clients**.
- A **Web browser** is software used by an end user to access the Web.
- The web server waits for the request from the web clients over the Internet.
  - Communication is via **Hypertext Transport Protocol (HTTP)**
  - Document representation using **Hypertext Markup Language (HTML)**

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# Web terminology

- Client
  - Any computer on the network that requests services from another computer on the network.
- Server
  - Any computer that receives requests from client computers, processes and sends the output.
- Web Page
  - Any page that is hosted on the Internet.
- Web Development (what this course is about)
  - The process of creating and modifying web pages.

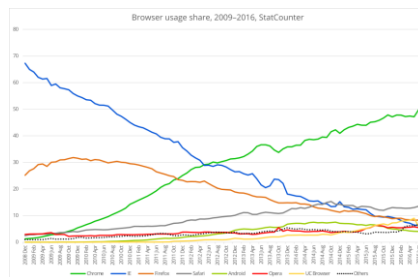
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# Web browser



- It is a **program** that retrieves information from the Web.
  - Netscape, Mosaic
    - Dead
  - Microsoft Internet Explorer
    - Notorious and being replaced by Edge...
  - Mozilla/Firefox
    - Past it?
  - Safari
    - If you are an Apple fan...
  - Chrome
    - Getting dominant and faster?
  - Mobile
    - Rising fast



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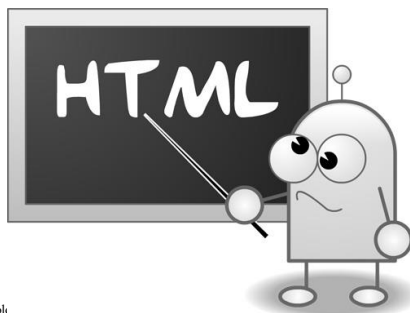
# Web server

- It is a program that waits for requests from the web browser (in the previous context, it referred to the computer that hosts the server program).
- It provides four major functions
  - Serving web pages
  - Running gateway programs (e.g. CGI) and returning output
  - Controlling access to the server
  - Monitoring and logging all access
- E.g. Apache, IIS, ...
- More on this topic next week

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# XHTML I



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# Outline

- Markup language
- A brief history of XHTML
- Basic XHTML syntax
- Formatting text content
- XHTML validation

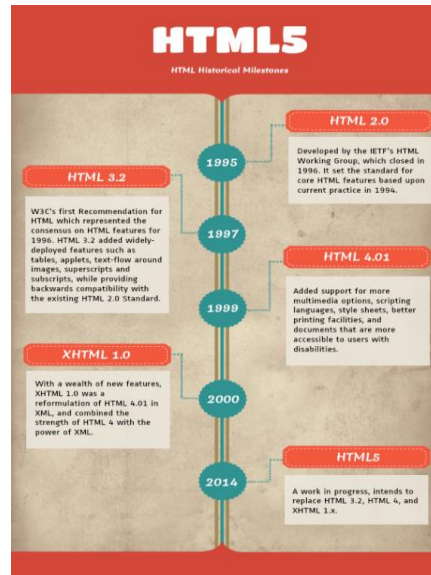


## The concept of markup language

- A Markup language
  - combines text and extra information about the text. The extra information, for example about the text's structure or presentation, is expressed using **markup**
  - originated from the book publishing industry.
  - allows us to embed formatting instructions in the document.



# Evolution of web markup languages



## HTML vs. XHTML

- XHTML 1.0 is a reformulation of HTML 4.01 as an XML markup language
- Controlled by World Wide Web Consortium (W3C)
- Why XHTML
  - HTML has few syntax rules, leading to sloppy and sometime ambiguous documents
  - HTML processors do not even enforce the few syntax rule that do exist in HTML
  - XHTML syntax is much more strict, leading to clean and clear documents in a standard form
  - The syntactic correctness of XHTML documents can be validated
  - But, we are seeing the resurrection of **HTML5** from 2014



# Hello world!

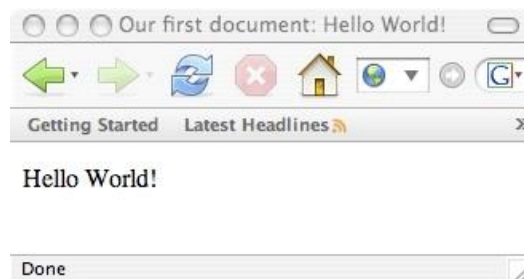
Document  
Type  
Declaration

```
<?xml version = "1.0" encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
```

Document  
Instance

```
<!-- helloworld.html
      A trivial document
-->
<html xmlns = "http://www.w3.org/1999/xhtml">
<head> <title> Our first document: Hello World!
</title>
</head>
<body>
  <p>
    Hello World!
  </p>
</body>
</html>
```

# Hello world!



## Basic syntax

- Elements are defined by tags (markers)
  - Tags format
    - Opening tag: `<name>`
    - Closing tag: `</name>`
- The opening tag and its closing tag together specify a container for the *content* they enclose

`<p align="right">     </p>`

Element name     Attribute name     Attribute value

- Not all tags have content
  - If a tag has no content, its form is `<name />`

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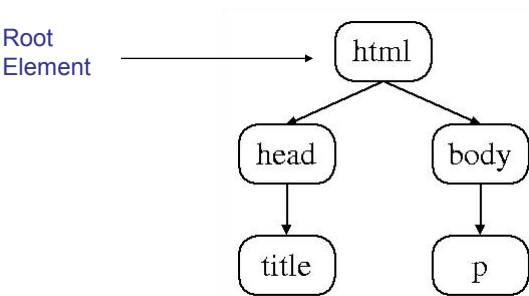
## Basic syntax

- The container and its content together are called an *element*
- If a tag has **attributes**, they appear between its name and the right bracket of the opening tag
- Comment form: `<!-- ... -->`
- Browsers ignore comments, unrecognizable tags, line breaks, multiple spaces, and tabs
- Tags are suggestions to the browser; they can be ignored by a browser even if they are recognized

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# HTML Element Tree



A simplest example

# Hello world!

Document Type Declaration

Document Instance

```
<?xml version = "1.0" encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<!-- helloworld.html
      A trivial document
-->
<html xmlns = "http://www.w3.org/1999/xhtml">
  <head> <title> Our first document: Hello World!
</title>
</head>
<body>
  <p>
    Hello World!
  </p>
</body>
</html>
```

## HTML Root Element

- Document type declaration specifies name of root element:  
`<!DOCTYPE html`
- Root of HTML document must be `html`
- XHTML 1.0 ( the standard we will follow) requires that this element contain `xmlns` **attribute specification** (name/value pair)



```
<html xmlns="http://www.w3.org/1999/xhtml">
```

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## HTML head and body Elements

- The **body** element contains information displayed in the browser client area
- The **head** element contains information used for other purposes by the browser:
  - **title** (shown in title bar of browser window)
  - **scripts** (client-side programs)
  - **style** (display) information, e.g. CSS
  - etc.

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# XHTML document structure

- Every XHTML document must begin with:

```
<?xml version = "1.0" encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
```

- <html>, <head>, <title>, and <body> are required in every document
- The whole document must have <html> as its root
- html must have the xmlns attribute:

```
<html xmlns="http://www.w3.org/1999/xhtml">
```

- A document consists of one head and one body
  - The <title> tag is used to give the document a title, which is normally displayed in the browser's window title bar (at the top of the display)

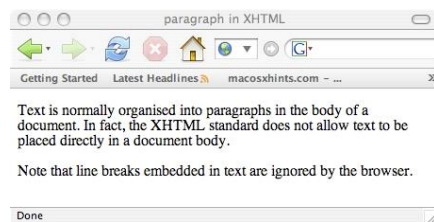
## Paragraphs

- Text is normally placed in paragraph elements
  - The <p> tag breaks the current line and inserts a blank line - the new line gets the beginning of the content of the paragraph
  - The browser puts as many words of the paragraph's content as will fit in each line

# Paragraphs

```
<p>
  Text is normally organised into
  paragraphs in the body of a document.
  In fact,

  the XHTML standard does not allow text
  to be placed directly in a document
  body.
</p>
<p>
  Note that line breaks embedded
  in text are ignored by the browser.
</p>
```



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# Line breaks

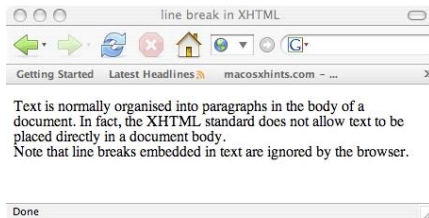
- Line breaks
  - The effect of the `<br />` tag is the same as that of `<p>`, except for the blank line
  - No closing tag needed!
  - Note the space before “/”
- `<br />` is example of an **empty element**, i.e., element that is not allowed to have content
- XML allows two syntactic representations of empty elements
  - **Empty tag** syntax `<br />` is recommended for browser compatibility
  - XML parsers also recognize syntax `<br></br>` (start tag followed immediately by end tag), but many browsers do not understand this for empty elements

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# Line breaks

```
<p>
  Text is normally organised into
  paragraphs in the body of a document.
  In fact, the XHTML standard does not
  allow text to be placed directly in a
  document body.
  <br />
  Note that line breaks embedded
  in text are ignored by the browser.
</p>
```



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# Preserving Whitespace

- Use **pre** to **preserve whitespace** in text and display using monospace font:

```
<pre>
  Use pre (for "preformatted") to
  preserve white space and use
  monospace type.
  (But note that tags such as<br />still work!)
</pre>
```

- Note that any embedded markup (such as **<br />**) is still treated as markup!
- Show [pre.html](#)

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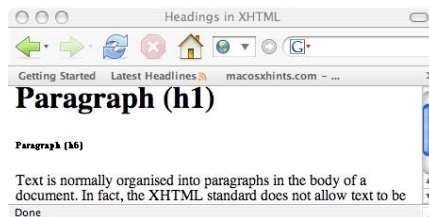
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# Headings

- Six sizes, 1 - 6, specified with `<h1>` to `<h6>`
- 1, 2, and 3 use font sizes that are larger than the default font size
- 4 uses the default size
- 5 and 6 use smaller font sizes

```
<h1> Paragraph (h1) </h1>
<h6> Paragraph (h6) </h6>
<p>
    Text is normally organised into
    paragraphs in the body of a document.
    In fact, the XHTML standard does not
    allow text to be placed directly in a
    document body.
</p>
```



# Font style and sizes

- Font styles:
  - emphasis: `<em>` `</em>`
    - Most browsers use italics for such content
  - strong: `<strong>` `</strong>`
    - Most browsers use italics for such content
- Font Size:
  - Larger: `<big>` `</big>`
  - Smaller: `<small>` `</small>`

# Font

```
<p>
  <strong>The</strong>
  <em>font</em> tags in XHTML really can
  <big>only</big> do <small>that</small>
  much.
</p>
<p>
  <strong>The</strong>
  </em>font</em> tags in XHTML really can
  <big><big><big>only</big> do
  <small>that</small> much</big></big>.
</p>
```



## Inline and block elements

- The **inline** elements
  - appear in the current line (except <br />)
  - Can't be nested directly in <body> or <form>
  - E.g. <em>, <img>, <span>
- The **block** elements
  - Break the current line
  - Can't be the content of inline elements
  - E.g. <p>, <form>, <h1>, <div>

# Character entities

Special characters that can't be typed as themselves:

Character	Entity	Meaning
&	<code>&amp;amp;</code>	Ampersand
<	<code>&amp;lt;</code>	Less than
>	<code>&amp;gt;</code>	Greater than
"	<code>&amp;quot;</code>	Double quote
'	<code>&amp;apos;</code>	Single quote (apostrophe)
$\frac{1}{4}$	<code>&amp;frac14;</code>	One quarter
$\frac{1}{2}$	<code>&amp;frac12;</code>	One half
$\frac{3}{4}$	<code>&amp;frac34;</code>	Three quarters
°	<code>&amp;deg;</code>	Degree
(space)	<code>&amp;nbsp;</code>	Nonbreaking space

Check: <http://www.digitalmediaminute.com/reference/entity/index.php>

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# Hypertext links

- A Hypertext link is a pointer to a place in a Web resource (in the same website or anywhere on the Web) – e.g.: [a wikipedia page](#)
- A link is specified with the **href** (hypertext reference) attribute of `<a>` (the anchor tag)
- The content of `<a>` is the visual link in the document (e.g. text or image)
- A document that includes an anchor tag that specifies a link is called the source of the link
- A document whose address is specified in that link is called the target of the link
- The source and target of the link can be the same document!

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# Hypertext links

- A link points to some sources. Possible sources are:
  - An XHTML document anywhere on the Web
    - e.g. `<a href = "http://www.bbc.co.uk">BBC </a>`
  - An local file of any type
    - e.g. `<a href = "paragraph.html">Paragraphs</a>`
  - A specific place in the current document
    - e.g. `<h3 id = "other activities"> Other Activities </h3>`  
`<a href = "#other activities">here </a>`

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## An example of links

```
<p>
  What we have learned so far
are: "<a href =
"paragraph.html">Paragraphs</a>", "<a
href = "headings.html">Headings</a>",
and "<a href = "font.html">Fonts</a>"
in XHTML.
</p>
<p>
  Apart from programming in XHTML,
I also enjoy some other activities.
To find out more, go <a href =
"#other activities">here </a>.
</p>
<h3 id = "other activities"> Other
Activities </h3>
<p>
  Reading news from <a href =
"http://www.bbc.co.uk">BBC </a>
website.
</p>
```



[Links.html](#)

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# Unrecognized HTML Elements

Misspelled  
element name →

```
<?xml version = "1.0" encoding = "utf-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<!-- helloworld.html
    A trivial document
-->
<html xmlns = "http://www.w3.org/1999/xhtml">
  <head>
    <titl> Hello WorldBadElt.html
  </title>
  </head>
  <body>
    <p>
      Hello World!
    </p>
  </body>
</html>
```

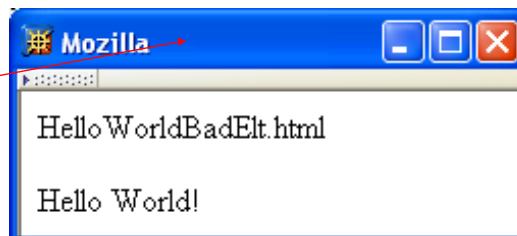
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# Unrecognized HTML Elements

title character  
data

Belongs  
here →



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# Unrecognized HTML Elements



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# Unrecognized HTML Elements

- Browsers ignore tags with unrecognized element names, attribute specifications with unrecognized attribute names
  - Allows evolution of HTML while older browsers are still in use
- Implication: an HTML document may have errors even if it displays properly
- Should use an [HTML validator](#) to check syntax

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# Validation

Check the syntax using a formal HTML validator

■ <http://validator.w3.org/file-upload.html>

■ <http://www.htmlhelp.com/tools/validator/> (faster!)

W3C Markup Validation Service: Upload Files - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://validator.w3.org/file-upload.html

Firefox Help Firefox Support Plug-in FAQ https://intranet.dcs.qm...

W3C Markup Validation Service v0.7.3

Home About News Docs Help & FAQ Feedback

This form allows you to upload files from your computer and have them validated.

Validate Uploaded File

Validate by File Upload

File: C:\teachingweb\technologies\DCS151\lecture\_notes\1 Browse...

Encoding: (detect automatically) Use FallBack instead of Override

Doctype: (detect automatically) Use FallBack instead of Override

☐ Show Source ☒ Verbose Output

Options (Help): ☐ Validate error pages

Validate this file

Note: file upload may not work with Internet Explorer on some versions of Windows XP Service Pack 2, see our information page on the W3C QA Website.

If your document is on the Web, you can validate it with the same advanced options by entering its address instead.

W3C XHTML 1.0 Feedback: The W3C Validator Team  
Date: 20050209 08:42:49

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Done

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## An example of validation

```
<?xml version = "1.0" encoding
= "utf-8"?>
<!DOCTYPE html PUBLIC "-
//W3C//DTD XHTML 1.0
Strict//EN"

"http://www.w3.org/TR/xhtml1/D
TD/xhtml1-strict.dtd">
<html
xmlns="http://www.w3.org/1999/x
html" xml:lang="en" lang="en">
<!-- helloworld.html
A trivial document
-->
<head> <title> Our first
document: Hello World! </title>
</head>
<body>
<p>
Hello World! my GOD!
error!

</body>
</html>
```

Result for validation\_example.html - W3C Markup Validator - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://validator.w3.org/check

Firefox Help Firefox Support Plug-in FAQ https://intranet.dcs.qm...

W3C Markup Validation Service v0.7.3

Home About News Docs Help & FAQ Feedback

Jump To: Results Source Listing

Result: Failed validation, 1 error

File: validation\_example.html

Modified: (undefined)

Server: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-GB; rv:1.8.0.2) Gecko/20060308 Firefox/1.5.0.2

Size: (undefined)

Content-Type: text/html

Encoding: utf-8

Doctype: XHTML 1.0 Strict

Root Namespace: http://www.w3.org/1999/xhtml

Note: The Validator XML support has some limitations.

This page is **not Valid XHTML 1.0 Strict!**

Below are the results of checking this document for XML well-formedness and validity.

1. Line 14, column 8: end tag for "p" omitted, but OMITTAG NO was specified

You may have neglected to close an element, or perhaps you meant to "self-close" an element, that is, ending it with ">" instead of ">".

2. Line 11, column 4: start tag was here.

Done

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## XHTML editor

- Can be edited using any text editor (e.g. Notepad)
- Helpful to use one with certain HTML/XML-specific features such as tag highlighting
  - Notepad++
  - gedit
  - jEdit (<http://www.jedit.org/>)
- Higher level tools (WYSIWYG ) – not recommended for this course:
  - Microsoft Frontpage
  - Macromedia Dreamweaver
  - KompoZer

## What you have learned today

- How important this course is
- Basics of Internet
- Basics of WWW
- Concept of Markup Language
- Basic syntax of XHTML
- XHTML text formatting