BASI DI DATI II – 2 modulo
Parte I: WWW e linguaggi di mark-up

Prof. Riccardo Torlone

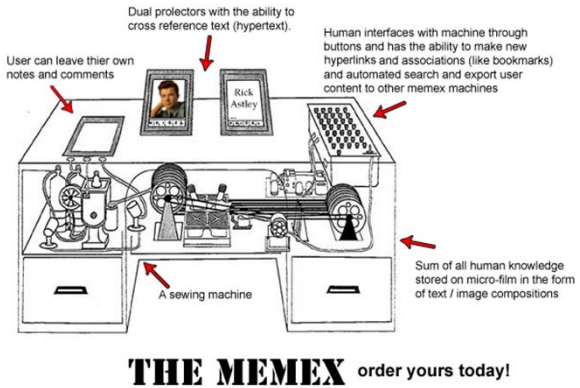
Università Roma Tre

Outline

- The history of HTML
- URLs and related schemes
- Survivor's guides to HTML and CSS
- Limitations of HTML
- The World Wide Web Consortium (W3C)

Hypertext

- Collections of document connected by hyperlinks
- Paul Otlet, philosophical treatise (1934)
- Vannevar Bush, hypothetical Memex system (1945)



- Ted Nelson introduced hypertext (1968)
- Hypermedia generalizes hypertext beyond text

Markup Languages

- Notation for adding formal structure to text
- Charles Goldfarb, the INLINE system (1970)
- Standard Generalized Markup Language, SGML (1986)
- *DTD, element, attribute, tag, entity*:

```
<!DOCTYPE greeting [
  <!ELEMENT greeting (#PCDATA)>
  <!ATTLIST greeting style (big|small) "small">
  <!ENTITY hi "Hello">
]>
<greeting style="big"> &hi; world! </greeting>
```

The Origins of the WWW

- WWW was invented by Tim Berners-Lee at CERN (1989)
- Hypertext across the Internet (replacing FTP)
- Three constituents: HTML + URL + HTTP

- HTML is an SGML language for *hypertext*
- URL is an notation for *locating files* on serves
- HTTP is a *high-level protocol* for file transfers

The Design of HTML

- HTML describes the *logical structure* of a document
- Browsers are free to *interpret tags* differently
- HTML is a *lightweight* file format
- Size of file containing just ”`Hello World!`”:

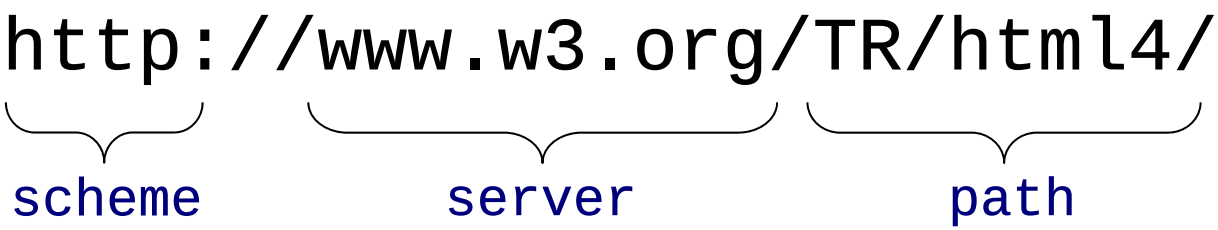
Postscript	11,274 bytes
PDF	4,915 bytes
MS Word	19,456 bytes
HTML	28 bytes

The History of HTML

- 1992: **HTML 1.0**, Tim-Berners Lee original proposal
- 1993: HTML+, some physical layout
- 1994: HTML 2.0, standard with best features
- 1995: Non-standard Netscape features
- 1996: Competing Netscape and Explorer features
- 1996: **HTML 3.2**, the Browser Wars end
- 1997: HTML 4.0, stylesheets are introduced
- 1999: **HTML 4.01**, we have a winner!
- 2000: **XHTML 1.0**, an XML version of HTML 4.01
- 2001-2010: XHTML 1.1, modularization
- 2002+: XHTML 2.0, simplified, generalized (Closed!)
- 2008-?: **HTML5**, major changes, still a working draft 

Uniform Resource Locator

- A Web resource is located by a URL



- Relative URL

  `sgml/dtd.html`

- Fragment identifier

  `http://www.w3.org/TR/HTML4/#minitoc`

URIs, URNs, and IRIs

- Uniform Resource Identifier (URI)

  `scheme:scheme-specific-part`

  Conventions about use of `/`, `#`, and `?`

- Uniform Resource Name (URN)

  `urn:isbn:0-471-94128-X`

- International Resource Identifier (IRI)

  `http://www.blåbærgrød.dk/blåbærgrød.html`

  `http://www.xn--blbrgrd-fxak7p.dk/bl%E5b%E6rgr%F8d.html`

Survivor's Guide to HTML

- Overall structure of an HTML document

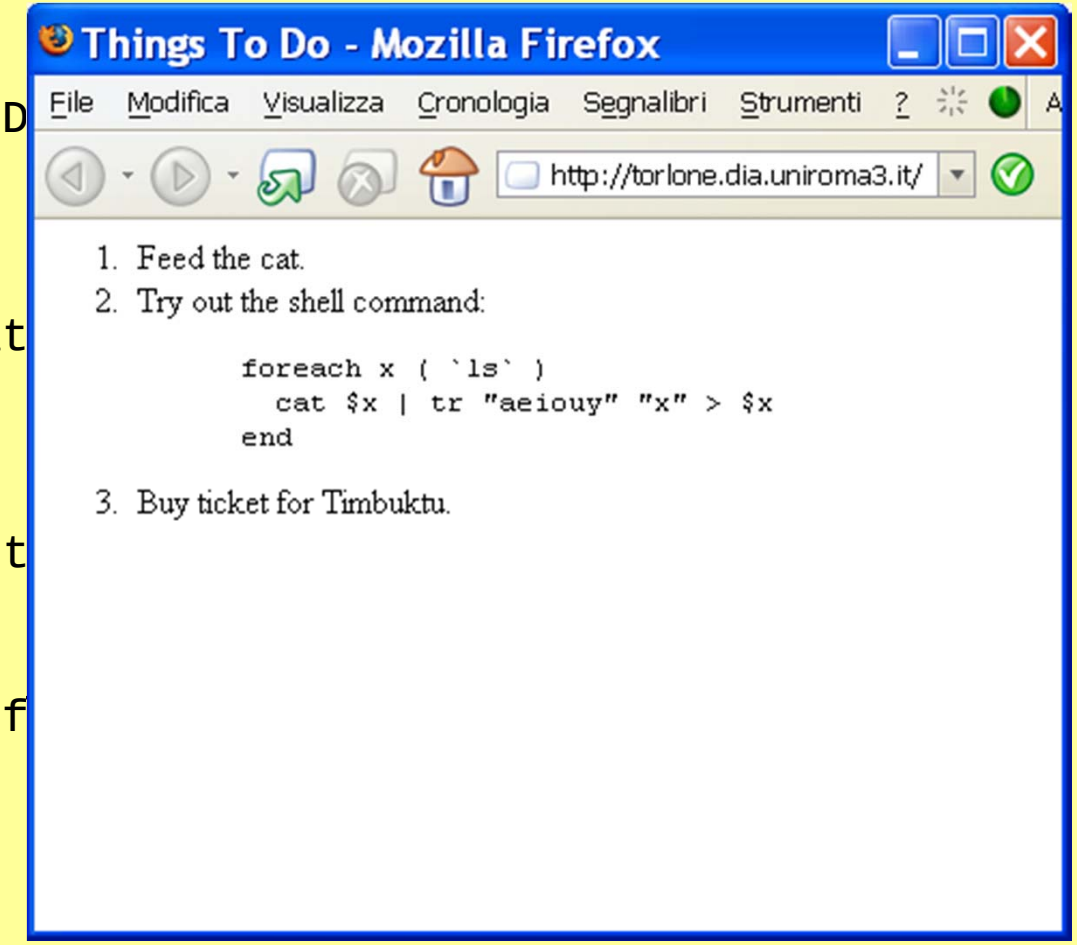
```
<html>
  <head>
    <title>The Title of the Document</title>
  </head>
  <body bgcolor="white">
  ...
  </body>
</html>
```

Simple Formatting

```
<html>
  <head>
    <title>Good Advi
  </head>
  <body>
    <h1>Good Advice
    <h2>For UNIX pro
    <b>Never</b> typ
    <p><tt>rm -rf /*
    on your computer
    <h2>For Nuclear
    <b>Never</b> pre
    <i>Big <font col
  </body>
</html>
```

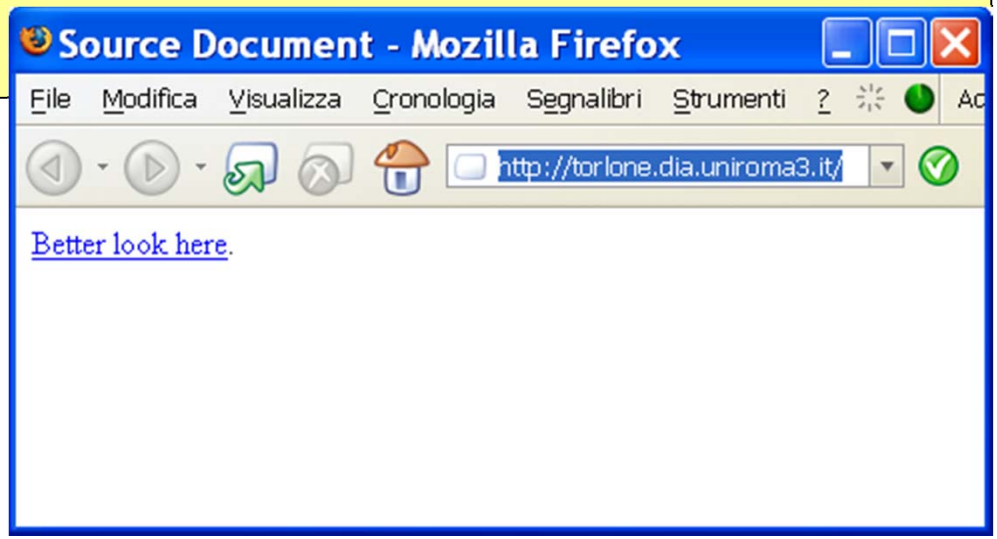
More Formatting

```
<html>
  <head>
    <title>Things To D
  </head>
  <body>
    <ol>
      <li>Feed the cat
      <li>Try out the
      <pre>
          foreach x (
            cat $x | t
          end</pre>
      </li>
      <li>Buy ticket f
    </ol>
  </body>
</html>
```



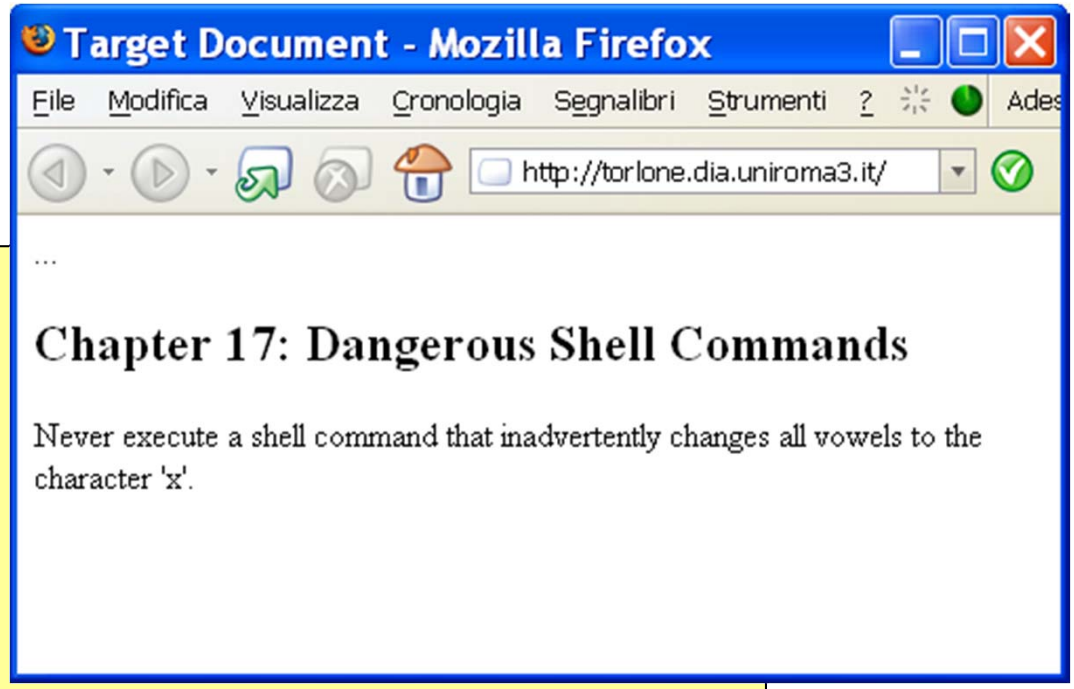
Hyperlinks: Source Document

```
<html>
  <head>
    <title>Source Document</title>
  </head>
  <body>
    <a href="target.html#danger">Better look here</a>.
  </body>
</html>
```



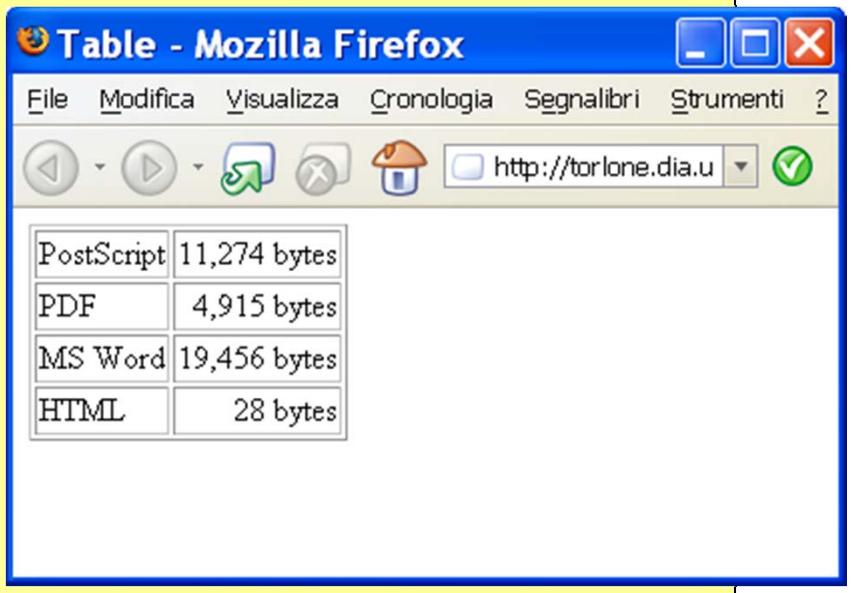
Hyperlinks: Target Document

```
<html>
  <head>
    <title>Target Document
    </title>
  </head>
  <body>
    ...
    <a name="danger"></a>
    <h2>Chapter 17: Dangerous Shell Commands</h2>
    Never execute a shell command that inadvertently
    changes all vowels to the character 'x'.
  </body>
</html>
```



Tables

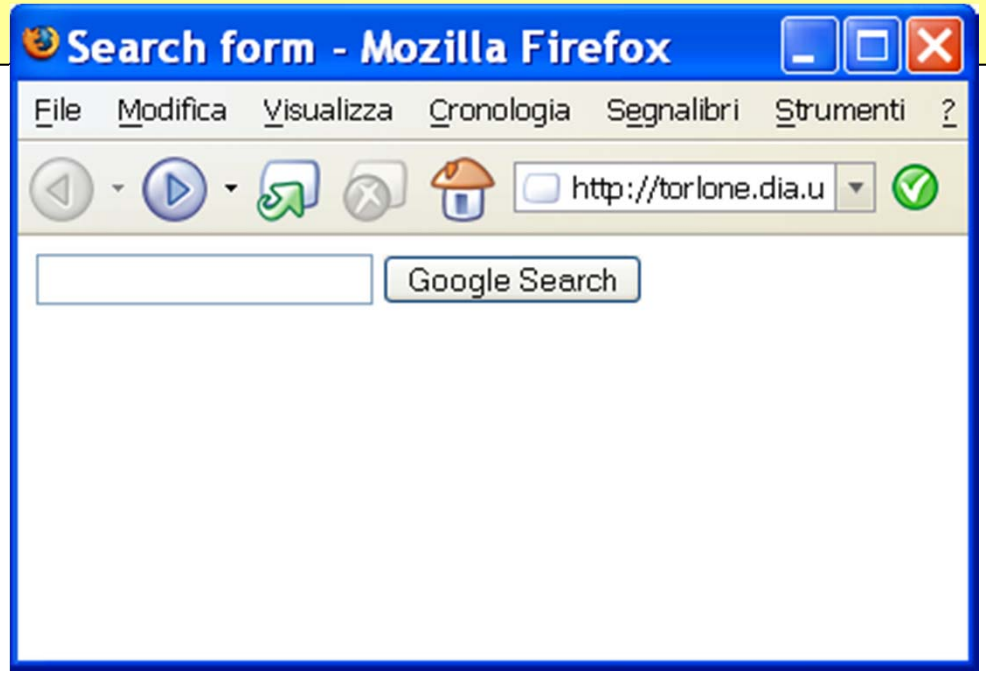
```
<table border="1">
  <tr>
    <td>PostScript</td>
    <td align="right">11,274 bytes</td>
  </tr>
  <tr>
    <td>PDF</td>
    <td align="right">4,915 bytes</td>
  </tr>
  <tr>
    <td>MS Word</td>
    <td align="right">19,456 bytes</td>
  </tr>
  <tr>
    <td>HTML</td>
    <td align="right">28 bytes</td>
  </tr>
</table>
```



Fill-Out Forms

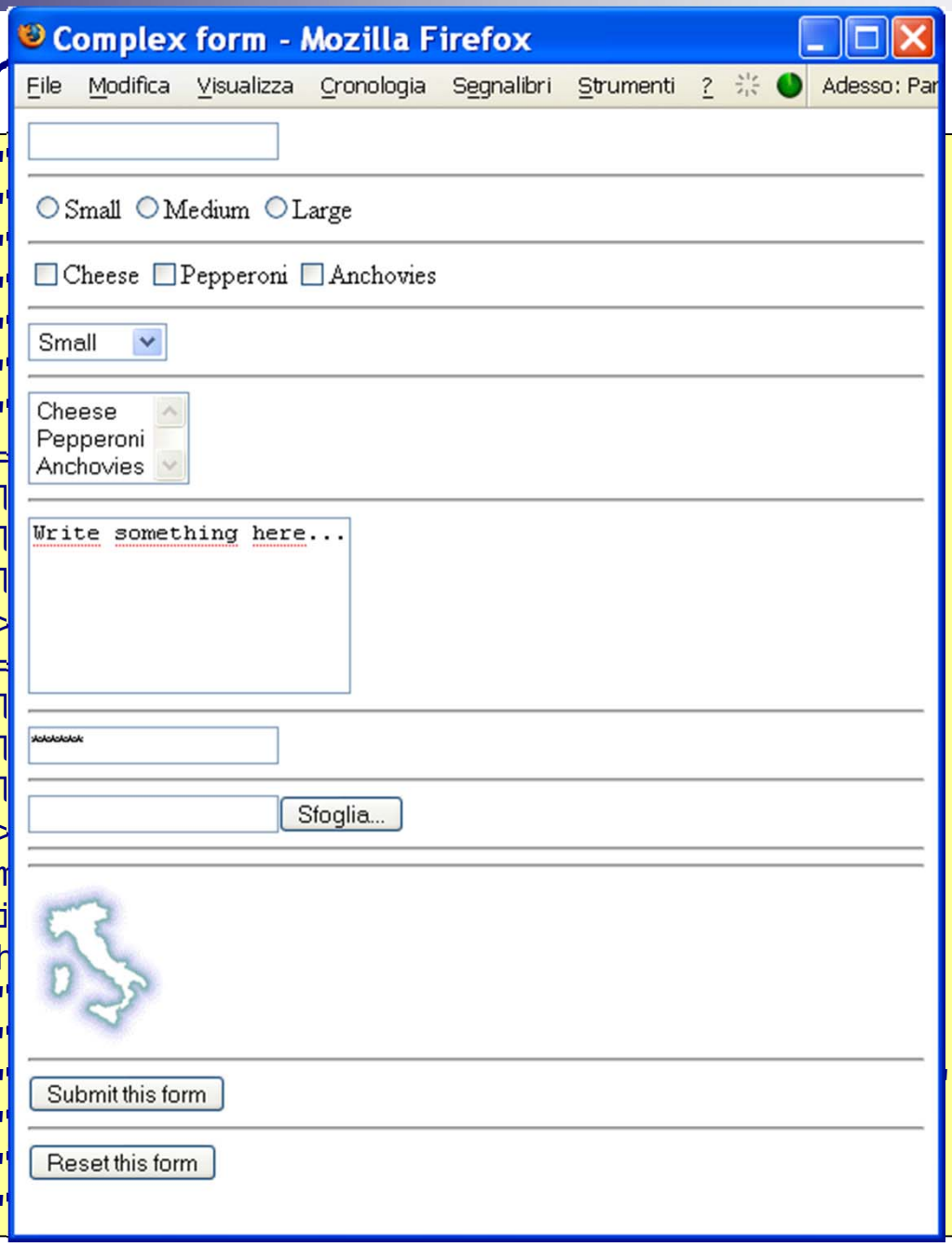
Collects named values from the client:

```
<form method="get" action="http://www.google.com/search">
  <input type="text" name="q">
  <input type="submit" name="btnG" value="Google Search">
</form>
```



GUI Elem

```
<input name="
<input name="
<input name="
<input name="
<input name="
<input name="
<input name="
<select name=
  <option val
  <option val
  <option val
</select><hr>
<select name=
  <option val
  <option val
  <option val
</select><hr>
<textarea nam
Write somethi
</textarea><h
<input name="
<input name="
<input name="
<input name="
<input type="
<input type="
```




```
></hr>
```

Logical Versus Physical

Logical structure

- the page starts with a header
- the entries are written in a list
- numbers are emphasized

Physical layout

- headers are centered, huge, and grey
- lists have square bullets
- emphasis is rendered in bold-style italics

Survivor's Guide to CSS

- Cascading Stylesheets separate structure from layout
- The essential concepts are *selectors* and *properties*
- Properties may have different *values*:

`color`	`red, yellow, rgb(212,120,20)`
`font-style`	`normal, italics, oblique`
`font-size`	`12pt, larger, 150%, 1.5em`
`text-align`	`left, right, center, justify`
`line-height`	`normal, 1.2em, 120%`
`display`	`block, inline, list-item, none`

Structure of a Stylesheet

- A selector is a *list of tag names*
- For each selector, some properties are assigned values:

```
b {color: red; font-size: 12pt}
i {color: green}
```

- Longer selectors give *context sensitivity*:

```
table b {color: red; font-size: 12pt}
form b {color: yellow; font-size: 12pt}
i {color: green}
```

- The most *specific* selector is chosen to apply

Specificity in Action

```
<head>
  <style type="text/css">
    b {color: red;}
    b b {color: blue;}
    b.foo {color: green;}
    b b.foo {color: yellow;}
    b.bar {color: maroon;}
  </style>
  <title>CSS Test</title>
</head>
```

```
<body>
  <b class=foo>Hey!</b>
  <b>Wow!
     <b>Amazing!</b>
     <b class=foo>Impressive!</b>
     <b class=bar>k00l!</b>
     <i>Fantastic!</i>
  </b>
</body>
```

Hey! Wow! Amazing! Impressive! K00l! *Fantastic!*

Applying a Stylesheet

```
h1 { color: #888; font: 50px/50px "Impact"; text-align: center; }
ul { list-style-type: square; }
em { font-style: italic; font-weight: bold; }
```

```
<html>
  <head>
    <title>Phone Numbers</title>
    <link href="style.css"
     rel="stylesheet" type="text/css">
  </head>
  <body>
    <h1>Phone Numbers</h1>
    <ul>
      <li>John Doe, <em>(202) 555-1414</em>
      <li>Jane Dow, <em>(202) 555-9132</em>
      <li>Jack Doe, <em>(212) 555-1742</em>
    </ul>
  </body>
</html>
```

HTML Validity

- HTML has a formal syntax specification
- 800 lines of DTD notation
- A *validator* gives syntax errors for invalid documents
- Most HTML documents on the Web are *invalid*:

`www.microsoft.com`	5 errors
`www.cnn.com`	121 errors
`www.ibm.com`	0 errors
`www.google.com`	35 errors
`www.oracle.com`	216 errors

- Valid documents may contain this logo: 

Validation Errors

```
Line 1, Column 1: no document type declaration; implying "<!DOCTYPE HTML SYSTEM>"
    <html>
    ^
Line 3, column 7: document type does not allow element "BODY" here.
    <body>
         ^
Line 4, column 13: document type does not allow element "B" here; assuming missing
    "CAPTION" start-tag
    <table><b>123</i></table>
             ^
Line 4, column 20: end tag for element "I" which is not open.
    <table><b>123</i></table>
                    ^
Line 4, column 28: end tag for "B" omitted, but its declaration does not permit this.
    <table><b>123</i></table>
                               ^
Line 4, column 11: start tag was here.
    <table><b>123</i></table>
           ^
Line 4, column 28: end tag for "CAPTION
    this.
    <table><b>123</i></table>
                               ^
…
```

```
<html>
  <body>
    <table><b>123</i></table>
  </body>
</html>
```

Reasons for Invalidity

- Ignorance of the HTML standard
- Lack of testing
  - ”This page is optimized for the XYZ browser”
  - ”This page is best viewed in 1024x768”
- Automatic tools generate invalid HTML output
- Forgiving browsers try to interpret invalid input

```
<h2>Lousy HTML</h1>
<li><a>This is not very</b> good.
<li><i>In fact, it is quite bad</em>
</ul>
But the browser does <a naem="goof">
something.
```

Problems with Invalidity

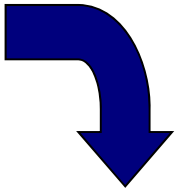
- There are several different browsers
- Each browsers has many different implementations
- Each implementation must *interpret* invalid HTML
- There are many arbitrary *choices* to make

- The HTML standard has been *undermined*
- HTML renders differently for most clients

A Standard for Invalid HTML

- The HTML Tidy tool tries to save the situation
- Invalid HTML is transformed to (almost) valid HTML
- Still many arbitrary choices, but now we agree

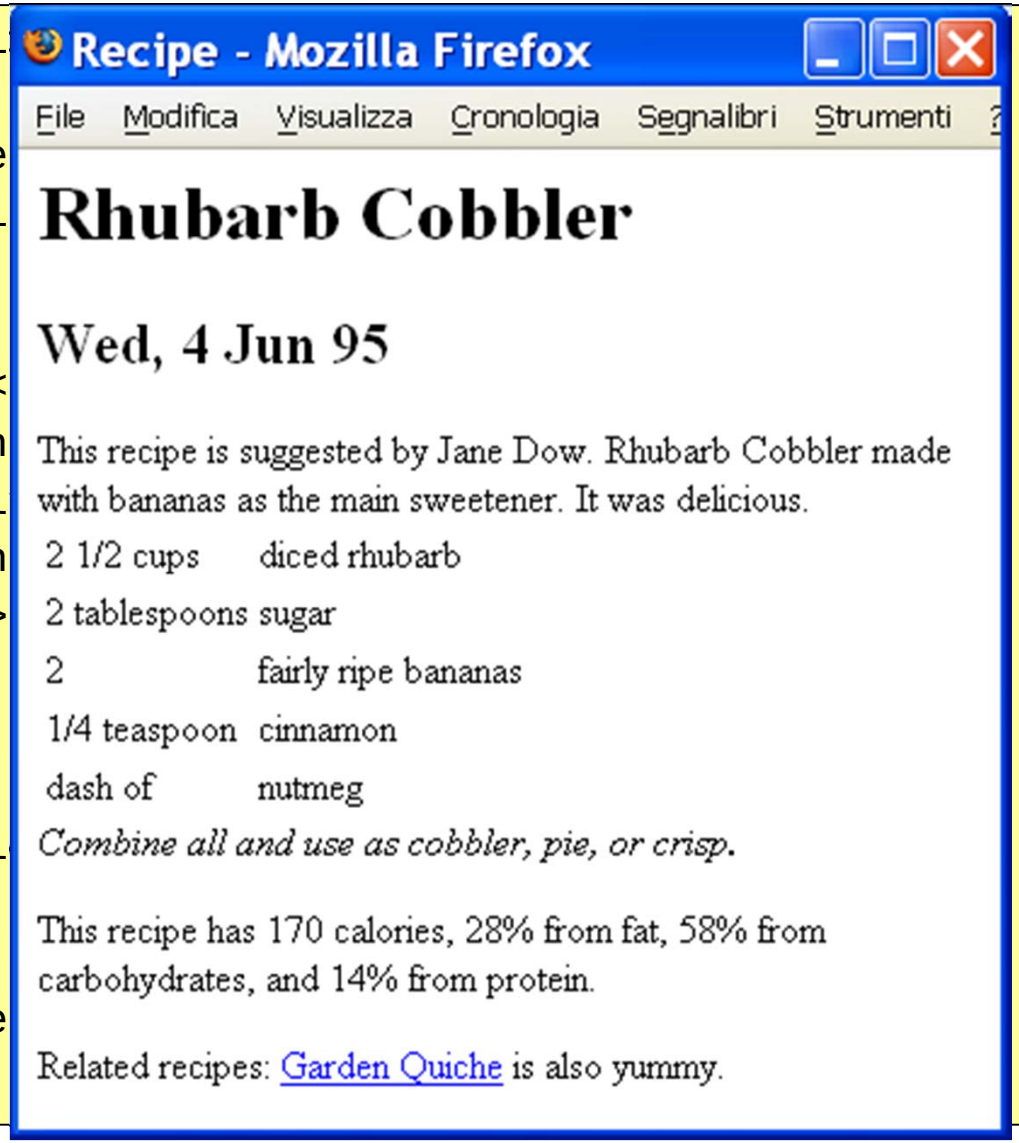
```
<h2>Lousy HTML</h1>
<li><a>This is not very</b> good.
<li><i>In fact, it is quite bad</em>
</ul>But the browser does <a naem="goof">something.
```



```
<html>
<head>
<title></title>
</head>
<body>
<h2>Lousy HTML</h2>
<ul class="noindent">
<li><a>This is not very good.</a></li>
<li><i>In fact, it is quite bad</i></li>
</ul>But the browser does <a naem="goof">something.</a>
</body>
</html>
```

HTML for Recipes

```
<h1>Rhubarb Cobbler</h1
<h2>Wed, 4 Jun 95</h2>
This recipe is suggeste
Rhubarb Cobbler made wi
It was delicious.
  <table>
  <tr><td> 2 1/2 cups <
  <tr><td> 2 tablespoon
  <tr><td> 2 <td> fairl
  <tr><td> 1/4 teaspoon
  <tr><td> dash of <td>
  </table>
<i>Combine all and use
<p>
This recipe has 170 cal
58% from carbohydrates,
<p>
Related recipes: <a hre
is also yummy.
```



Limitations of HTML

- HTML is designed for hypertext, not for recipes
- Content and presentation is intertwined
- HTML validation is less than recipe validation
- HTML standards have been undermined

- We need a special *Recipe Markup Language*!

Bytes vs. Characters

- HTML files are represented as text files
- A text file is logically a sequence of **characters**
- But physically a sequence of **bytes**
- Several mappings exist:
  - ASCII
  - EBCDIC
  - **Unicode**
- Unicode aims to cover all characters in all past or present written languages

Unicode Characters

- A character is a **symbol** that appears in a text
  - letters of the alphabet
  - pictograms (like ©)
  - accents
- Unicode characters are abstract entities:
  - **LATIN CAPITAL LETTER A**
  - **LATIN CAPITAL LETTER A WITH RING ABOVE**
  - **HIRAGANA LETTER SA**
  - **RUNIC LETTER THURISAZ THURS THORN**

Unicode Glyphs

- A **glyph** is a graphical presentation
- A typical example is: **Å**
- This may represent several characters:
  - **LATIN CAPITAL LETTER A WITH RING ABOVE**
  - **ANGSTROM SIGN**
- Or even a sequence of characters:
  - **LATIN CAPITAL LETTER A**

    COMBINING RING ABOVE
- Some characters even result in several glyphs

Unicode Code Points

- A **code point** is a unique number assigned to every Unicode character
- Code points are between 0 and 1,114,112
- Only around 100,000 are used today
- The character **`HIRAGANA LETTER SA`** is assigned the code point 12373
- Code point 0 through 127 coincide with ASCII
- Some code point are never assigned

Unicode Character Encoding

- A **character encoding** interprets a sequence of bytes as a sequence of code points
- The bytes are first parsed into **code units**
- Code units have a fixed length
- One or more code units may be required to denote a code point
- Examples are UTF-8, UTF-16, UTF-32

UTF-8

- A code unit is a single byte
- A code point is from 1 to 4 code units
- Code units between 0 and 127 directly represent the corresponding code points
- **`110XXXXX`** indicates that 2 code units are used
- **`1110XXXX`** indicates that 3 code units are used
- **`11110XXX`** indicates that 4 code units are used
- The remaining code units looks like **`10XXXXXX`**

UTF-8 Example

- 11100011 10000001 10010101
- 11100011 10000001 10010101
- 0011000001010101
- 12,373
- HIRAGANA LETTER SA

UTF-16

- A code unit consists of 2 bytes
- Code point below 65,536 are in a single code unit
- Higher code points are represented as:
  - **110110XXXXXXXXXX 110111XXXXXXXXXX**
- This makes sense because Unicode assign no code points between the numbers:
  1101100000000000 (55,296)

  and

  1101111111111111 (57,343)

Byte Order

- When reading several bytes at once, we must consider the **byte order** of the architecture
- UTF-16 starts any text with the special code point:

  `1111111011111111 (65,279)`

  called **zero-width non-breaking space**
- The dual code point

  `1111111111111110 (65,534)`

  is never assigned
- UTF-16LE and UTF-16BE may avoid this

UTF-16 Example

- 11111110 11111111 00110000 01010101
- 11111110 11111111 00110000 01010101
- 00110000 01010101
- 12,373
- HIRAGANA LETTER SA

Unicode in Java

- Java represents characters as UTF-16 code units
- Not as UTF-16 code points!
- A pragmatic choice to use only 16 bits
- The **`length`** function on strings may be wrong
- Some strings may represent illegal data

ISO-8859-1

- Another popular character encoding
- Only 256 code points
- Single byte code units
- Coincides with ASCII on code points 0-127
- Cannot represent general Unicode

- In all, there are hundreds of different encodings...

Character Encodings in HTML

- The document may declare its own encoding:

```
<meta http-equiv="Content-Type"
      content="text/html; charset=ISO-8859-1">
```

- This works if the encoding coincides with ASCII

- Unicode characters may be represented as:

  さ

World Wide Web Consortium (W3C)

- Develops HTML, CSS, and most Web technology
- Founded in 1994
- Has more than 400 companies and organizations as members
- Is directed by Tim Berners-Lee
- Located at MIT (US), Inria (France), Keiko (Japan)

W3C Players

- Members ($50,000 per year)
- Advisory board
- Technical Architecture Group
- Working Groups

W3C Documents

- Working Drafts
- Candidate Recommendations
- Proposed Recommendations
- Recommendations

- Working Group Notes
- Member Submissions
- Staff Comments
- Team Submissions

W3C Principles

- Consensus among members
- Limited intellectual property rights
- Free Web access to technical reports (unlike ISO)

WHATWG

- Web Hypertext Application Technology Working Group
- A community of people interested in evolving the Web focusing on the development of HTML and APIs needed for Web applications
- Founded by individuals of Apple, the Mozilla Foundation, and Opera Software in 2004
- Collaborates with W3C for the definition of HTML standard (HTML5 in particular)

Summary

- History and structure of HTML and CSS
- Survivor’s guides to these technologies
- Limitations of HTML for general data

Essential Online Resources

- http://www.w3.org/TR/html4/
- http://www.w3.org/Addressing/
- http://www.w3.org/Style/CSS/
- http://validator.w3.org/
- http://www.w3.org/