

Lecture 4

Representing data

CSS

How the web works - 1 TCP/IP

Representing data



bits

binary

lots of maths

Zeros and Ones

- Everything is stored in binary code
- Patterns of 1's and 0's
- A single 1 or 0 is called a **Bit**

Word, Excel	
Images	
Web pages	
Music	
Video	
Numbers	
Colours	
Alphabets	

BIT

- **binary digit**
- But ... sizes in computing use **Bytes**
- KB, MB, GB, TB

10101010100101001001010100101010010101010

8 bits is called 1 Byte

6 Bytes

- One byte can represent one letter or character

So how do we represent Numbers ?

Word, Excel	
Images	
Web pages	
Music	
Video	
Numbers	
Colours	
Alphabets	

Binary patterns can represent denary numbers

- denary = base 10
- binary = base 2
- The number system we use every day in computing
- Uses these symbols {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
- Uses these symbols {0, 1}

In base 10, each column is worth 10 times more than the previous one

12,563

10000	1000	100	10	1
1	2	5	6	3

Meaning $10000 + 2000 + 500 + 60 + 3 = 12563$

Alternatively (if you like maths)

10^4	10^3	10^2	10^1	10^0
1	2	5	6	3

Meaning $10000 + 2000 + 500 + 60 + 3 = 12563$

In base 2, each column is worth 2 times more than the previous one

The binary number 10110

16	8	4	2	1
1	0	1	1	0

Meaning

one 16 zero 8s one 4 one 2 zero 1s

$16 + 0 + 4 + 2 + 0 = 22$

Alternatively (if you like maths)

2^4	2^3	2^2	2^1	2^0
1	0	1	1	0

Meaning $16 + 0 + 4 + 2 + 0 = 22_{10}$

Tip

The base of a number is often indicated in subscript - 1078_{10} means 1078 in base 10.

To convert from **denary** to **binary**

Q. What is 1678_{10} in binary?

Step One: draw a grid doubling the column heading for as far as we need to go

Step Two: Starting from the left, add 0's and 1's to make up the number

1024	512	256	128	64	32	16	8	4	2	1

So 1678_{10} is:

To convert from **binary** to **denary**

Q. What is 11010001110_2 in denary?

Step One: draw a grid doubling the column heading for as far as we need to go....

Step Two: Place the numbers in the grid..

Step Three: Add them up

1024	512	256	128	64	32	16	8	4	2	1

So 11010001110_2 is:

So how do we represent Colours ?

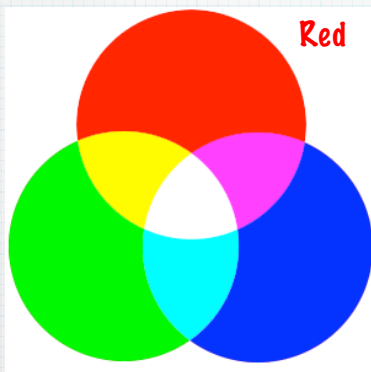
color names - 16 built in names

Color Name	BGCOLOR= "name"
Aqua	Aqua
Black	Black
Blue	Blue
Fuchsia	Fuchsia
Gray	Gray
Green	Green
Lime	Lime
Maroon	Maroon

Color Name	BGCOLOR= "name"
Navy	Navy
Olive	Olive
Purple	Purple
Red	Red
Silver	Silver
Teal	Teal
White	White
Yellow	Yellow

- Other colours can be specified by a number
- A binary number / pattern

Colours (colors) on the web

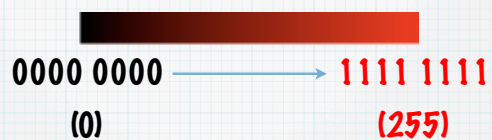


Colours made up from
amounts of red, green
and blue

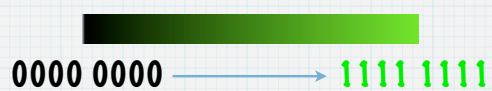
Often abbreviated to
RGB

Colours (colors) on the web

Red



Green



Blue



Colours formed by mixing 'amounts' of these

Red
00000000

Green
00000000

Blue
00000000



Red
11111111

Green
11111111

Blue
11111111

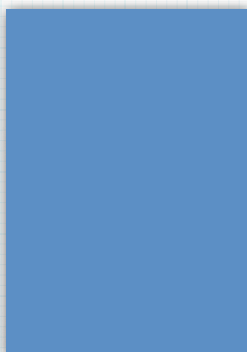


Colours formed by mixing 'amounts' of these

Red
01000000

Green
01111011

Blue
10111100



Colours formed by mixing 'amounts' of these

Write the colour down in RGB order:

01000000 01111011 10111100

Is there a shorthand way to write this...?

hexadecimal

Hexadecimal

- hexadecimal = base 16
- Used in computing as allows a shorthand for binary

Hexadecimal

- Base 2 uses 2 symbols {0, 1}
- Base 10 uses 10 symbols {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}
- Base 16 uses 16 symbols

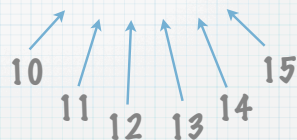
{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, ...}

Problem.. we've
run out of symbols

Hexadecimal

- Use A, B, C, D, E, F

{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F}



Example hexadecimal numbers

- 11111111
- 2456
- 3E2DD

So how is hex a shortcut?

Hexadecimal base 16

Binary pattern	Hex
0	0
1	1
10	2
11	3
100	4
101	5
110	6
111	7
1000	8

- **Shortcut table**

Binary pattern	Hex
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Example - converting from binary to hex

Split the number into blocks of four from right

0100 0000 0111 1011 1011 1100

You may need to add 0's on the left to get a block of four

Example - converting from binary to hex

Replace each 4 bit pattern with the hex digit

0100 0000 0111 1011 1011 1100
4 0 7 B B C

So 0100 0000 0111 1011 1011 1100₂

is 407BBC₁₆

407BBC_H in hexadecimal

#407BBC

Again

- Most calculators can transform from Hex to Binary (and back again)
- Find colour hex representation using on-line tools

<http://www.dhtmlgoodies.com/scripts/color-schemer/color-schemer.html>

Cascading Style Sheets

3 x 3

3 ways to attach styles

3 ways to declare styles

3 ways to attach styles

- in-line
- internal style sheet
- external style sheet

in-line

- insert the style directly into an element start tag
- use the **style** attribute

`<p>Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a markup language such as HTML. </p>`

`<h2>Common browsers</h2>`

`<p>There are a number of browsers in use (from a variety of different sources) such as IE7, Firefox and Safari.</p>`

`<p>There are other browsers as well (Opera, Konquerer).</p>`

style attribute

- Uses

style=" name-value pairs"

e.g.

style="font-size: 12pt; color: fuchsia"

in-line

- To apply this style to two of the `<p>` elements

`<p style="font-size: 12pt; color: fuchsia">Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a markup language such as HTML. </p>`

`<h2>Common browsers</h2>`

`<p style="font-size: 12pt; color: fuchsia">There are a number of browsers in use (from a variety of different sources) such as IE7, Firefox and Safari.</p>`

`<p>There are other browsers as well (Opera, Konquerer).</p>`

Advantages

- Simple to place a style/see where a style is being used
- Approach commonly seen with pre-css html editors

Disadvantages

- Lots of repetition
- No-reuse
- Mangles design in with content

internal

- insert the style into the head of the document
- use the **style** element



```
<head>
<title>Browsers</title>
</head>
```

```
<body>
<p>Web browsers allow users to ask for, receive and display pages that have been formatted
(typically) in a markup language such as HTML. </p>
```

```
<h2>Common browsers</h2>
```

```
<p>There are a number of browsers in use (from a variety of different sources) such as IE7,
Firefox and Safari.</p>
```

style element

- Uses

```
<style type="text/css">
...style information
</style>
```

e.g.

```
<style type="text/css">
p {font-size: 12pt; color: fuchsia }
body { font-family: gill, helvetica, sans-serif }
</style>
```

internal

insert the style element

```
<head>
<style type="text/css">
p {font-size: 12pt; color: fuchsia }
body { font-family: gill, helvetica, sans-serif }
</style>
<title>Browsers</title>
</head>

<body>
<p>Web browsers allow users to ask for, receive and display pages that have been formatted
(typically) in a markup language such as HTML. </p>

<h2>Common browsers</h2>

<p>There are a number of browsers in use (from a variety of different sources) such as IE7,
Firefox and Safari.</p>

<p>There are other browsers as well (Opera, Konquerer).</p>
```

Advantages

- Browser has to only get 'one' page from the web server
- Style information directly associated with page

Disadvantages

- Lots of repetition if more than one page in a site (style has to be in each page)
- Maintenance of a large number of pages costly

Tip

Use internal style sheets during the design process, or where a page has a unique style

external

- insert a link to the stylesheet in the head of the document

- use the link element

```
<head>
<link rel="stylesheet" type="text/css" href="style1.css" />
<title>Browsers</title>
</head>

<body>
<p>Web browsers allow users to ask for, receive and display pages that have been formatted
(typically) in a markup language such as HTML. </p>

<h2>Common browsers</h2>
```


Advantages

- Style separated from content
- Great for maintenance of large site designs

Disadvantages

- Two retrievals required (one for the HTML, one for the style sheet)

External style sheets are the preferred mechanism for most sites nowadays

3 ways to declare styles

- tag style
- id style
- class style

tag style

```
<html>
<head>
<link rel="stylesheet" type="text/css" href="cssforlecture1.css" />
<title>Browsers</title>
</head>

<body>
<h1>Web browsers</h1>
<h2>What they do</h2>

<p>Web browsers allow users to ask for, receive and display pages that have been formatted
(typically) in a <a href="http://www.w3.org/Markup/">markup language</a> such as
HTML.  </p>

<h2>Common browsers</h2>

<p>There are a number of browsers in use (from a variety of different sources):</p>
<ul>
<li>Microsofts Internet Explorer 7</li>
<li>Mozillas Firefox</li>
<li>Apples Safari</li>
</ul>
<p>There are other browsers as well (Opera, Konqueror).</p>
</body>
</html>
```

h2 { color: green ;
background-color: black
}

id style

- Uses the **id** attribute
- Used to assign a **unique** name to any element

```
<p id="introduction">Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a markup language such as HTML. </p>
```

```
<h2>Common browsers</h2>
```

```
<p id="explanation">There are a number of browsers in use (from a variety of different sources) such as IE7, Firefox and Safari.</p>
```

```
<p>There are other browsers as well (Opera, Konquerer).</p>
```

id style

```
#introduction {  
  color: blue;  
  background-color: yellow;  
}
```

```
#explanation {  
  color: black;  
  background-color: yellow;  
}
```

- Use the **#** symbol to indicate an **id** name in the style sheet

Watch-out

ids in a single document **MUST** be unique; try to use single short words - no spaces are allowed

id style

- Watch out for **id** mania

- Far too many **ids**

```
<html>  
<head>  
<title>Browsers</title>  
</head>
```

```
<body>  
<h1 id="title">Web browsers</h1>  
<h2 id="subtitle">What they do</h2>
```

```
<p id="myfirstparagraph">Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a <a href="http://www.w3.org/Markup/">markup language</a> such as HTML.  </p>
```

```
<h2 id="anothersubtitle">Common browsers</h2>
```

```
<p id="mythirdparagraph">There are a number of browsers in use (from a variety of different sources).</p>
```

```
<ul id="myorderedlist">  
<li>Microsofts Internet Explorer 7</li>  
<li>Mozillas Firefox</li>  
<li>Apples Safari</li>  
</ul>
```

```
<p id="myforthparagraph">There are other browsers as well (Opera, Konquerer).</p>  
</body>
```

- Poorly chosen names as well - try to avoid designed names - focus on content context

- a **class** is a group of elements that will share a common style

class style

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a

markup language such as HTML.



Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsoft's Internet Explorer 7
- Mozilla's Firefox
- Apple's Safari

There are other browsers as well (Opera, Konqueror).

We want this `<h2>` element to be blue

We also want this `<p>` element to have the same style

- Uses the **class** attribute
- Used to assign a **class** name to any element

class style

```
<h2 class="bluestyle" >What they do</h2>
```

```
<p class="bluestyle" >Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a markup language such as HTML. </p>
```

```
<h2>Common browsers</h2>
```

```
<p>There are a number of browsers in use (from a variety of different sources) such as ...
```

class style

```
.bluestyle {
  color: blue;
}
```

```
h3.bluestyle {
  color: blue;
  size: 120%;
}
```

- Use the **.** symbol to indicate a **class** name in the style sheet

Cascading Style Sheets



Boxes

Start with some HTML in a browser

Web browsers ← **h1**

What they do ← **h2**

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in

anchor (hyperlink) ← **img**

↓

a markup language such as HTML.

Common browsers ← **h2**

There are a number of browsers in use (from a variety of different sources):


- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).

p

p

p



```
<html>
<head>
<title>Browsers</title>
</head>
```

```
<body>
<h1>Web browsers</h1>
<h2>What they do</h2>
```

```
<p>Web browsers allow users to ask for, receive and display pages that have been formatted
(typically) in a <a href="http://www3.org/Markup/">markup language</a> such as
HTML.  </p>
```

```
<h2>Common browsers</h2>
```

```
<p>There are a number of browsers in use (from a variety of different sources):</p>
<ul>
```

```
<li>Microsofts Internet Explorer 7</li>
<li>Mozillas Firefox</li>
<li>Apples Safari</li>
</ul>
```

```
<p>There are other browsers as well (Opera, Konquerer).</p>
</body>
</html>
```

Source

Blocks

- The placement of elements creates a logical structure in the document
- Elements cause the document to be subdivided into blocks

```
<html>
<head>
<title>Browsers</title>
</head>
```

Initial containing block

```
<body>
<h1>Web browsers</h1>
<h2>What they do</h2>
```

```
<p>Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a <a href="http://www.w3.org/Markup/">markup language</a> such as HTML.  </p>
```

```
<h2>Common browsers</h2>
```

```
<p>There are a number of browsers in use (from a variety of different sources):</p>
```

```
<ul>
<li>Microsofts Internet Explorer 7</li>
<li>Mozillas Firefox</li>
<li>Apples Safarik</li>
</ul>
```

```
<p>There are other browsers as well (Opera, Konquerer).</p>
```

```
</body>
</html>
```

```
<html>
<head>
<title>Browsers</title>
</head>
```

body block 'inside' the outer block

```
<body>
<h1>Web browsers</h1>
<h2>What they do</h2>
```

```
<p>Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a <a href="http://www.w3.org/Markup/">markup language</a> such as HTML.  </p>
```

```
<h2>Common browsers</h2>
```

```
<p>There are a number of browsers in use (from a variety of different sources):</p>
```

```
<ul>
<li>Microsofts Internet Explorer 7</li>
<li>Mozillas Firefox</li>
<li>Apples Safarik</li>
</ul>
```

```
<p>There are other browsers as well (Opera, Konquerer).</p>
```

```
</body>
</html>
```

```
<html>
<head>
<title>Browsers</title>
</head>
```

Blocks within blocks

```
<body>
<h1>Web browsers</h1>
<h2>What they do</h2>
```

```
<p>Web browsers allow users to ask for, receive and display pages that have been formatted
(typically) in a <a href="http://www.w3.org/MarkUp/">markup language</a> such as
HTML. </p>
```

```
<h2>Common browsers</h2>
```

```
<p>There are a number of browsers in use (from a variety of different sources):</p>
```

```
<ul>
```

```
<li>Microsofts Internet Explorer 7</li>
```

```
<li>Mozillas Firefox</li>
```

```
<li>Apples Safari</li>
```

```
</ul>
```

```
<p>There are other browsers as well (Opera, Konqueror).</p>
```

```
</body>
```

```
</html>
```

Blocks within blocks

Blocks

- Two common types of blocks

Block level elements

In-line block elements

So what's the difference?

Block level elements

- Are laid out vertically inside the containing block

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in

a markup language such as HTML

Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).

h1
h2

p

h2

p

in-line elements

- are laid out horizontally in the containing block

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in

a markup language such as HTML

Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).

anchor

img

Defaults

Block level elements

p
h2
ol
li
h1
h3 ...
ul ...

In-line elements

img
strong
a
emph

Note

Lists / List items use a different display style for its elements, called list-item. For the moment, think of ol/ul/li as being block

So what can we do with blocks?

- Change the blocks nature **display property**
- Float them **float property**
- Clear space next to them **clear property**
- Treat them as boxes and change the visual aspects

the CSS box model

display property

This property can be used to change how an element block is situated

value	inline or block or none or inherit*
initial value	element specific / inline
applies to	all elements
inherited	no (unless value indicates it)

***Other values are available**

Demo

Empty stylesheet

```
h1 {  
}  
img {  
}  
a {  
}
```

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in

a markup language such as HTML.



Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konqueror).

Demo - change h1 to none

stylesheet

```
h1 {  
  display: none;  
}  
  
img {  
  
}  
  
a {  
  
}
```

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a

[markup language](#) such as HTML.



Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).

Demo - change img to none

stylesheet

```
h1 {  
  display: none;  
}  
  
img {  
  display: none;  
}  
  
a {  
  
}
```

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a [markup language](#) such as HTML.

Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).

- Apples Safari

There are other browsers as well (Opera, Konquerer).

Demo - change a to block

stylesheet

```
h1 {  
  display: none;  
}  
  
img {  
  display: none;  
}  
  
a {  
  display: block;  
}
```

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a [markup language](#) such as HTML.

Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).

float property

- This property 'floats' a block **left or right**
- The block floats to the side until its edge touches another block

float property

Any in-line element floated becomes a block style element

value	left or right or none or inherit
initial value	none
applies to	all but positioned elements
inherited	no (unless value indicates it)

Demo - floating to the right

stylesheet

```
h1 {  
}  
img {  
  float: right;  
}  
a {  
}
```

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a [markup language](#) such as HTML.

Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsoft's Internet Explorer 7
- Mozilla's Firefox
- Apple's Safari

There are other browsers as well (Opera, Konqueror).



Demo - floating to the left

stylesheet

```
h1 {  
}  
  
img {  
  float: left;  
}  
  
a {  
}
```

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a [markup language](#) such as HTML.



Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).

clear property

- This property clears space on a blocks **left or right**

value	left or right or none or inherit or both
initial value	none
applies to	block-level elements
inherited	no (unless value indicates it)

Demo

Empty stylesheet

```
h1 {  
}  
  
img {  
}  
  
a {  
}
```

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in

a [markup language](#) such as HTML.



Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).

Demo - floating the image to the right

stylesheet

```
h1 {  
}  
  
img {  
  float: right;  
}  
  
h2 {  
}
```

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a [markup language](#) such as HTML.

Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).



Demo - now to clear the h2 heading

stylesheet

```
h1 {  
}  
  
img {  
  float: right;  
}  
  
h2 {  
  clear: right;  
}
```

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in a [markup language](#) such as HTML.

Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).



CSS box model

- Blocks can be styled as boxes
- Boxes have properties such as

border height width margin padding

CSS box model



border

- Can set the border-style

none
hidden
dotted
dashed
solid
double
groove
ridge
inset
outset

- Can set the border-width

px
pt
em

1pt=1/72inch
em=current font
size of current
element

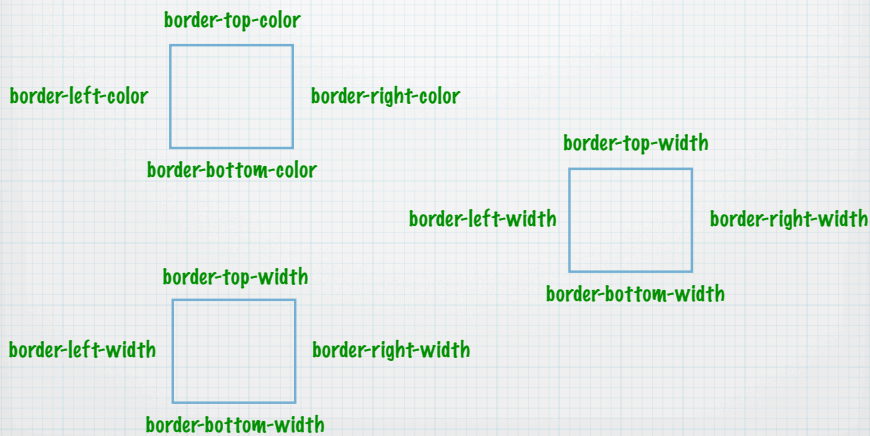
border

- Can set the border-color

Standard colour
technique using 24bit
palette

border

- Can set the values individually for the 4 sides



Demo

stylesheet

```
h1 {  
}  
h2 {  
border-style: solid;  
}  
a {  
}
```

Web browsers

What they do

Web browsers allow users to ask for, receive and display pages that have been formatted (typically) in

a [markup language](#) such as HTML.



Common browsers

There are a number of browsers in use (from a variety of different sources):

- Microsofts Internet Explorer 7
- Mozilla's Firefox
- Apples Safari

There are other browsers as well (Opera, Konquerer).

Demo

stylesheet

```
h1 {  
}  
h2 {  
border-style: dotted;  
}  
a {  
}
```

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Demo

stylesheet

```
h1 {  
}  
  
h2 {  
border-style: dashed;  
}  
  
a {  
}
```

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Demo

stylesheet

```
h1 {  
}  
  
h2 {  
border-style: solid;  
border-color:red;  
}  
  
a {  
}
```

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Demo

stylesheet

```
h1 {  
}  
  
h2 {  
border-style: solid;  
border-color:red;  
border-width:10px;  
}  
  
a {  
}
```

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width

1px=1 pixel

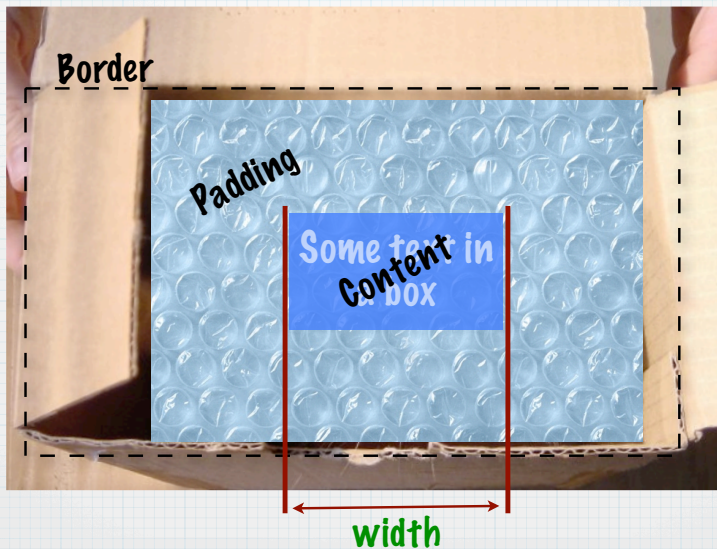
1pt=1/72inch

- Can set the element **width**

em=current font size of current element - used to be based on the width of the letter 'M'

% as a percentage of the containing block

CSS box model



Demo

stylesheet

```
h1 {  
}  
  
h2 {  
  border-style: solid;  
  width: 50%;  
}  
  
a {  
}
```

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Common browsers

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padding

1px=1 pixel

1pt=1/72inch

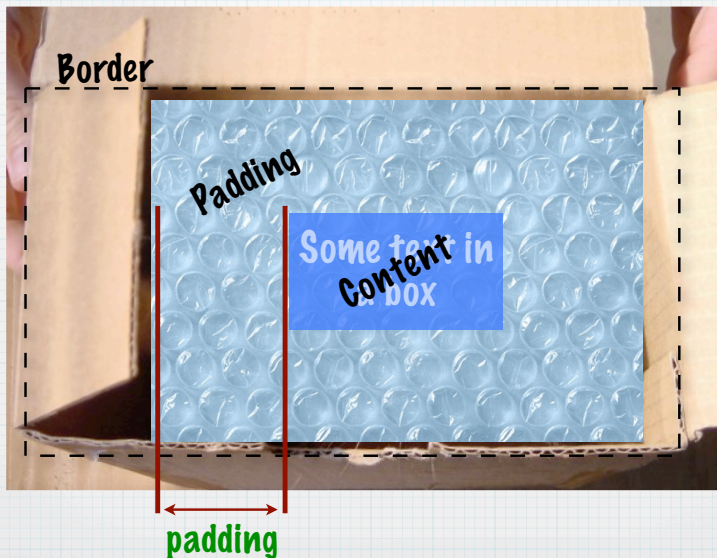
- Can set the elements padding size

em=current font size of current element - used to be based on the width of the letter 'M'

% as a percentage of the containing block

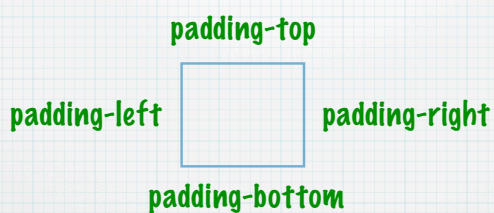
- Padding sits between the content and the border

CSS box model



padding

- Can set the padding individually for the 4 sides



Demo

stylesheet

```
h1 {
```

```
}
```

```
h2 {
```

```
border-style: solid;
```

```
width: 50%;
```

```
padding: 10px;
```

```
}
```

```
a {
```

```
}
```

Web browsers

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Common browsers

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margin

- Can set the size of the space around an element

1px = 1 pixel

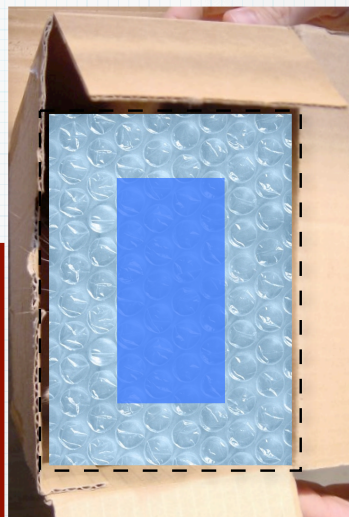
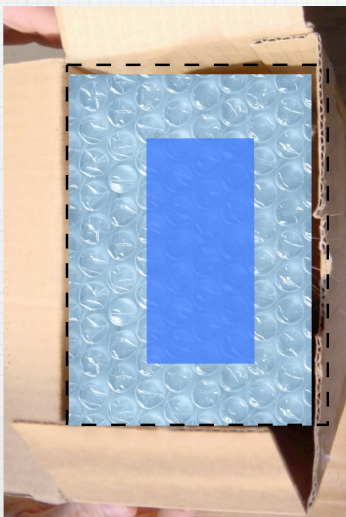
1pt = 1/72 inch

em = current font size of current element - used to be based on the width of the letter 'M'

% as a percentage of the containing block

- Special rules are used to calculate the gap between two horizontal elements with margins

CSS box model



margin

Demo stylesheet

```
h1 {  
}  
  
h2 {  
border-style: solid;  
width: 50%;  
padding: 10px;  
margin: 20px;  
}  
  
a {  
}
```

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How the web works - 1

Transmission Control Protocol / Internet protocol Domain Name System

- An understanding of these two is required to understand the limitations of Web based systems

TCP/IP

- Provides an addressing mechanism for each machine – an IP address
- Provides a way to transmit a message to an address



History

- Originally funded by American department of Defence - connecting UNIX style mainframes
- Designed to be robust (to recover from military attack)
- Grew from connecting Universities and research groups into the standard networking protocol for the Internet









IP numbers

- To uniquely identify each machine, assign each one a unique IP number or IP address
- No other computer should have this number (in practice this is not quite true)
- A 32 bit code

10010101 01001100 00001100 00000100

Zeros and Ones

- Everything is stored in binary code
- Patterns of 1's and 0's
- A single 1 or 0 is called a **Bit**

Word, Excel	
Images	
Web pages	
Music	
Video	
Numbers	
Colours	
Alphabets	
Addresses	

IP numbers usually written using a special notation

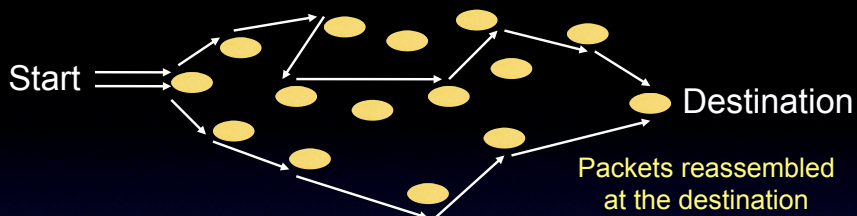
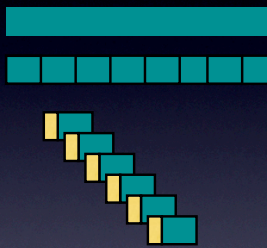
- Dotted quad notation – each 8 bit pattern written as a denary number

10010101 01001100 00001100 00000100

149.76.12.4

So how does a transmission occur? (An abstract!)

- Take the message and divide into smaller packets
- Label each one with the destination address
- Packets are then sent out onto the network



- No guarantee that packets travel the same route
- Redundancy and error checking built into the protocol
- Broken nodes don't stop the transmission

No guaranteed 'time' for transmission

- Issue for real time applications
- Video streams - YouTube
- Uses buffering
- Uses high compression to reduce file size / bandwidth



One central organisation required to administer the IP addresses



- IANA *Internet assigned numbers authority*
- An American controlled and funded organisation

Users work through intermediate regional or organisational bodies

- UK Universities work through JANET
- Companies can work through ISPs who block book IP numbers

IP numbers classified into groups

Class A 1.0.0.0 to 127.0.0.0

- Allows 1 million hosts
- Rare
- Large organisations

Class B 128.0.0.0 to 191.255.0.0

- More common than Class A
- 16320 nets with 65024 hosts each

...

Class C 192.0.0.0 to 255.255.255.0

- Allows 2 million networks with 254 hosts
- More common than B

Class D, E, F

- Experimental
- Reserved for future use

In reality much more complex:

Subnets, port numbers, IP routing

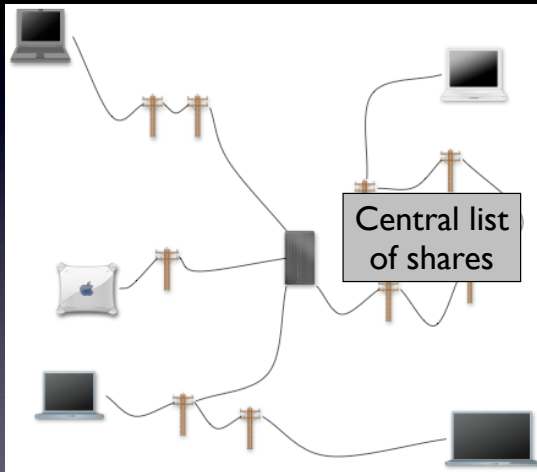
- Allows the number of sub networks to be much larger
- Allows the number of connected machines to be much larger

Peer 2 Peer networks

Freds machine
sharing music

Toms machine
sharing music

Emmas machine
sharing music



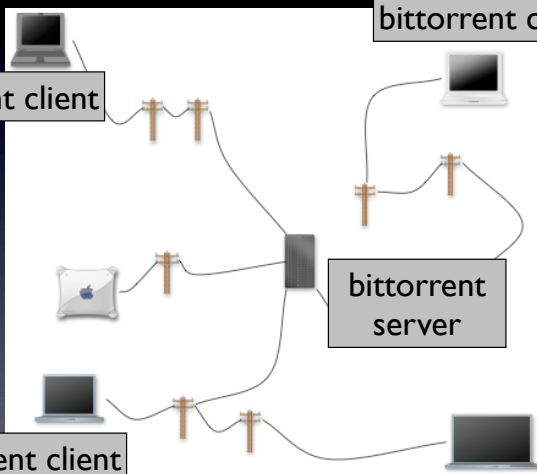
Peer 2 Peer networks

bittorrent client

bittorrent client

bittorrent
server

bittorrent client

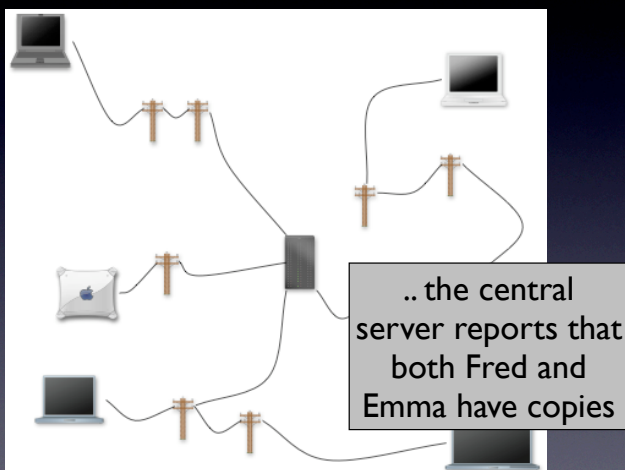


Peer 2 Peer networks

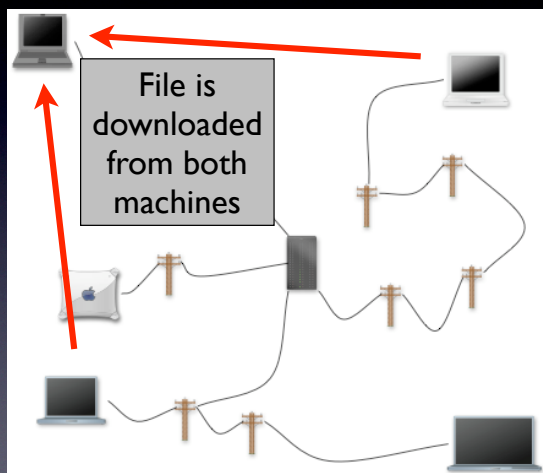
Freds machine
sharing music

Tom searches
for some
music ...

Emmas machine
sharing music



Peer 2 Peer networks



So how does the RIAA/ BPI know who you are?

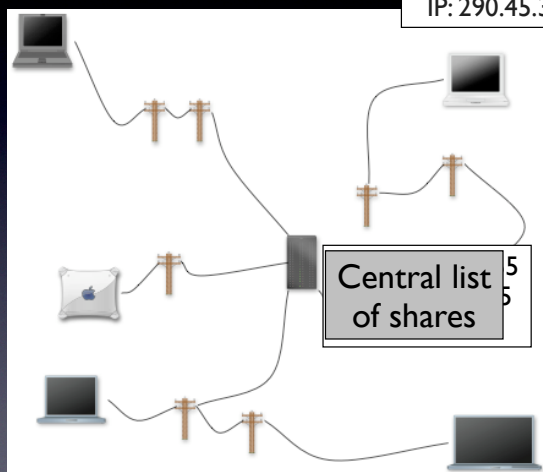
- By looking for your IP number

IP Number fingerprint

Toms machine
sharing music
IP: 201.13.48.255

Freds machine
sharing music
IP: 290.45.3.23

Emmas machine
sharing music
IP: 178.3.56.255



Scenario: A business wishing to allocate IP numbers to machines

Solution One

- Use an ISP to block book a range of IP numbers
- Assign one to each machine using the TCP/IP settings - *a fixed IP address scheme*

Advantage

- A particular machine can host a particular service
- Web server, Mail server etc.

Disadvantage

- Expensive (in terms of cost and resources)
- Doesn't match modern working practices

Laptops only occasionally connected to the network still need an IP address

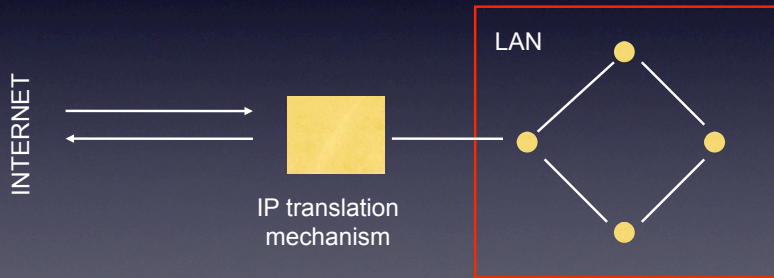
Scenario: A business wishing to allocate IP numbers to machines

Solution Two

- The company uses IP numbers that are specifically for LAN use only
- Some ranges of IP numbers are not forwarded over the Internet
- These can be safely used for machines on the LAN

A small number of 'real' addresses are required for

- Hosted services required on the Internet
- Packets originating on the LAN to be sent out to the Internet



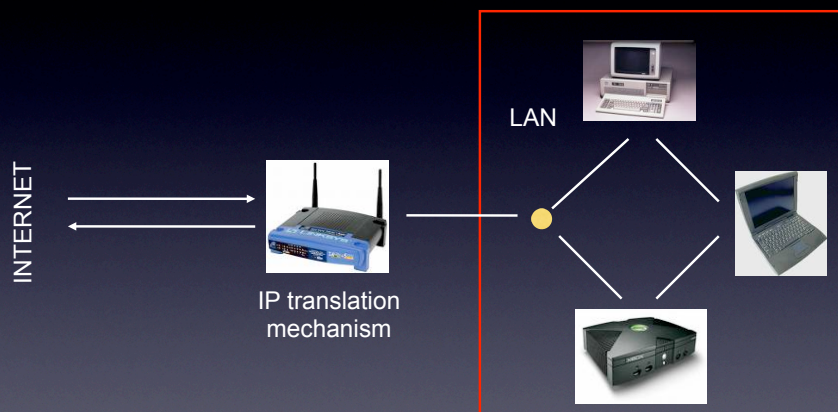
Advantage

- Smaller number of real addresses required
- Don't have to apply for large blocks of real numbers

Disadvantage

- Still using a fixed IP address scheme

You may have a router at home



Scenario: A business wishing to allocate IP numbers to machines

Solution Three

- The company uses a dynamic IP address scheme
- Machines acquire one IP address when connected
- IP address is released when the PC is disconnected

Most home ISPs use this system to allocate IP addresses

Most organisations use DHCP

A DHCP server machine hosts a repository of IP numbers

- When a machine is connected it requests (leases) an IP address from the set available
- Statistics can be used to determine the optimal number of IP addresses required
- Granting an IP number can be done after 'authenticating'

Kingston University

Uses the MAC address from your machine

- Every Network card (NIC or Network Interface controller) has a unique number
- Media Access Control address (MAC address)
- Only machines with a recognised MAC address can get an IP number



Finally:

Despite all of these techniques, still running out of IP numbers, so ...

- IPv6 new addressing scheme to be phased in
- 128 bit addresses (as opposed to 32 bits)