## Module Overview

- **Web Technologies (CS7062)**
  1) Intro to the Web  
  2) HTML and CSS  
  3) HTML and CSS  
  4) Intro to Databases  
  5) Intro to Databases  
  6) PHP and MySQL  
  7) Reading Week  
  8) PHP and MySQL  
  9) PHP and XML  
  10) CMS  
  11) Analytics  
  12) Visualisations  

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**Background to the Web, terminology etc. (Owen Conlan) (3 Lecture)**

**Static Web Design (Séamus Lawless) (1 Lecture, 2 Lab)**

**Intro and Lab Interaction (Séamus Lawless) (1 Lecture, 2 Lab)**

**Intro and Lab Interaction (Séamus Lawless) (1 Lecture, 2 Lab)**

**Intro and Lab - Web Form (Alex O'Connor) (1 Lecture, 2 Lab)**

**Intro and Lab - Web Form (Alex O'Connor) (1 Lecture, 2 Lab)**

**Intro to XML and Lab - Render Data from XML (Alex O'Connor) (1 Lecture, 2 Lab)**

**Intro to the Various Types and Install (Shawn Day) (1 Lecture, 2 Lab)**

**Intro and some practical examples (Shawn Day) (1 Lecture, 2 Lab)**

**Intro and some practical examples (Shawn Day) (1 Lecture, 2 Lab)**

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*Dr. Owen Conlan, Introduction to Web Technologies*
Learning Objectives

- Today
  - The Internet and the World Wide Web
  - History of the Internet and the WWW
  - Transmission Across the Internet
  - TCP/IP and Domain Names
  - Basic Services from FTP to the WWW
  - Uniform Resource Locators (URLs)
  - Intranets and Extranets

Internet or World Wide Web

- Is there a difference? What is it?

The InterNet is short for...

- INTERconnected NETwork
How do we use the Internet?

- Email
- WWW, hypertext, browsers
- RSS
- FTP, P2P file distribution
- Mobile Internet
- IM, IRC, Skype
- Blogging, microblogging
- Gaming
- Learning
- Video Conferencing
- Remote Backup
- Streaming video and audio
- Collaboration-Participation (Wiki)
- Collaborative tagging
- Software over the web
- Rich User Experiences
- Social networks
- Business and finance
- ...
The Internet

- The Internet is a giant network of networks
- A network may include PCs, and other devices like servers or printers
- A network is connected through a communication channel
- Early research was performed by the US Department of Defense in 1962. This research group established ARPAnet (Advanced Research Project Agency) in order to connect the US Defense Department network.

What did the Internet come from?

- Original aim was to create a network that would allow users of a research computer at one university to be able to ‘talk to’ research computers at other universities.
- A side benefit of ARPAnet’s design was that, because messages could be routed or rerouted in more than one direction, the network could continue to function even if parts of it were destroyed in the event of a military attack or other disaster.
- The users of the Internet took a direction of their own.

History of the Internet

- The first long distance communication took place in 1965 between a computer in MIT and California.
- In 1969, four computers clients were connected together via ARPAnet.
  - How old is the Internet?
- Leonard Kleinrock is accredited with the idea of packet switching, which describes how data can be sent across a network.
History of the Internet

- The **ethernet** was developed by Xerox during this period. This was inspired by Robert Metcalfe's PhD on 'packet networks'.
- An ethernet is a protocol for describing how computers can be connected in a LAN (Local Area Network).
- Through the use of Ethernet and ARPAnet the US were able to develop a working network.
- In the late 1970s and early 1980s other networks were developed, e.g. CSNET, USNET and BITNET.

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History of the Internet

- In 1973 Vint Cerf and Bob Kahn created the TCP/IP communication protocols.
- TCP/IP: Transfer Control Protocol/Internet Protocol is a set of rules that describe how computers can communicate over a network.
- To send information over the Internet, a computer packs data into **Internet Protocol (IP)** packets and labels them with the correct address. They are then sent across a packet switched interconnected network.

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**ARPAnet**

ARPANET GEOGRAPHIC MAP, OCTOBER 1980

[Map of ARPAnet showing geographic connections and nodes]
**Minitel**

- Videotext online service accessible through the telephone lines (1982)
- One of the world’s most successful pre-World Wide Web online services
- Development between France Télécom & British Telecom.
  - phone directory (free)
  - mail-order retail companies
  - airline or train ticket purchases
  - information services
  - IM
  - message boards

**Email**

- Email 1965, Internet Email 1969, Mailing List 1975

There is a distributed network teleconferencing facility oriented to networks experimentally available called TCTALK. It was the result of a thesis of Jim Calvin at OGS. It can be accessed at the IS1 site via <network-help>TCTALK. Questions relative to it can be answered by Calvin or Geoff at BRI-AI. I would recommend that you try it if you have not. Improvements are being made on a time available basis by Calvin.

The full description of TCTALK is available via the net and is in essence Calvin's CASE thesis. Contact Calvin for that.

Dave
10-KAS-78 22:09:57-PDT, 2463;00000000000
Mail-from: UGC-181 sendt at 7-JUN-75 2024-PDT
Date: 7 JUN 1975 2024-PDT
From: WALKER at UGC-181
Subject: HBGROUP# 002 Message Group Status
To: MessageGroup:

First let me apologize for not being very responsive to many of you. As you may have guessed we have been quite busy of late defending this wonderful network that we are responsible for; as "Net Manager" a hefty portion of all this has fallen upon me. My concern here is that it will no doubt get worse before it gets better, so let me also apologize in advance.

**USENET**

Google Groups
MUDs to MMORPGs -)

- First Internet emoticon -) tongue-in-cheek (Mackenzie, K., 1979)

Welcome! By what name shall I call you?
> Ludwig
This persona already exists - what's the password?
> *
Yes!
Hello, Ludwig!

Elizabethan surname.
This cozy, Tudor room is where all British legends exposed oak beams and soft, velvet-covered furnishings lend atmosphere in which to relax before venturing timeless maze. A sense of decorum and decorum prevail.

North
Dense forest.
You are standing in some dense forest, which slopes
North
The forest becomes too dense to go any farther. You

MUD: Multi-User Dungeon

http://www.ishar.com/

MMORPG: Massive Multiplayer Online Role-Playing Game

Some online game data
- from: http://www.onlinemba.com/blog/online-gaming-statistics/
- Note! onlinemba gathered their info from other blogs, so these are not exact stats.

ONLINE GAMING STATS

The online gaming market is worth more than $15 BILLION

20 million players have spent 17 billion hours on Xbox Live

24 hours = 1 billion

There are 40 million registered PlayStation Network accounts

AVERAGE TIME SPENT PLAYING (in the U.S. for 2009)
by XBOX gamers: 7.3 hrs/week
by PC gamers: 6.6 hrs/week
by PS3 gamers: 5.8 hrs/week
How Big is the Internet?

### WORLD INTERNET USAGE AND POPULATION STATISTICS

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>1,237,542,968</td>
<td>4,514,400</td>
<td>158,699,620</td>
<td>11.4 %</td>
<td>2,527.4 %</td>
<td>5.7 %</td>
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<tr>
<td>Asia</td>
<td>3,879,740,877</td>
<td>114,304,000</td>
<td>922,329,554</td>
<td>23.8 %</td>
<td>706.0 %</td>
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<td>Europe</td>
<td>816,426,916</td>
<td>105,096,003</td>
<td>476,213,935</td>
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<td>351.1 %</td>
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<tr>
<td>Middle East</td>
<td>216,258,843</td>
<td>3,284,800</td>
<td>68,553,666</td>
<td>31.7 %</td>
<td>1,987.0 %</td>
<td>3.3 %</td>
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<tr>
<td>North America</td>
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<td>150,596,600</td>
<td>272,066,000</td>
<td>78.3 %</td>
<td>151.7 %</td>
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<tr>
<td>Latin America / Carib.</td>
<td>567,265,165</td>
<td>10,091,009</td>
<td>215,020,460</td>
<td>36.2 %</td>
<td>1,031.4 %</td>
<td>10.3 %</td>
</tr>
<tr>
<td>Oceania / Australia</td>
<td>36,426,905</td>
<td>7,623,460</td>
<td>21,293,830</td>
<td>60.1 %</td>
<td>171.4 %</td>
<td>1.0 %</td>
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<tr>
<td>WORLD TOTAL</td>
<td>6,930,955,114</td>
<td>360,895,462</td>
<td>2,095,066,065</td>
<td>30.2 %</td>
<td>480.6 %</td>
<td>100.0 %</td>
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</table>

### Internet and Facebook Usage in Europe

<table>
<thead>
<tr>
<th>EUROPE</th>
<th>Population (2011 Est.)</th>
<th>Internet Users, Latest Data</th>
<th>Penetration (% Population)</th>
<th>Users % in Europe</th>
<th>Facebook Subscribers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ireland</td>
<td>4,970,976</td>
<td>3,042,600</td>
<td>65.1 %</td>
<td>0.8 %</td>
<td>2,004,740</td>
</tr>
</tbody>
</table>

- 1 in every four person has Internet access
Browsers

- An application that provides a way to look at and interact with the information on the World Wide Web
- It retrieves, presents, and traverses information resources
- These include web pages, images, video, and other multimedia content

Which do you use?
### Browsers 2009

<table>
<thead>
<tr>
<th></th>
<th>Internet Explorer</th>
<th>Firefox</th>
<th>Chrome</th>
<th>Safari</th>
<th>Opera</th>
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<tbody>
<tr>
<td>December</td>
<td>37.2 %</td>
<td>46.4 %</td>
<td>9.8 %</td>
<td>3.6 %</td>
<td>2.3 %</td>
</tr>
<tr>
<td>November</td>
<td>37.7 %</td>
<td>47.0 %</td>
<td>8.5 %</td>
<td>3.8 %</td>
<td>2.3 %</td>
</tr>
<tr>
<td>October</td>
<td>37.5 %</td>
<td>47.5 %</td>
<td>8.0 %</td>
<td>3.8 %</td>
<td>2.3 %</td>
</tr>
<tr>
<td>September</td>
<td>39.6 %</td>
<td>46.6 %</td>
<td>7.1 %</td>
<td>3.6 %</td>
<td>2.2 %</td>
</tr>
<tr>
<td>August</td>
<td>39.3 %</td>
<td>47.4 %</td>
<td>7.0 %</td>
<td>3.3 %</td>
<td>2.1 %</td>
</tr>
<tr>
<td>July</td>
<td>39.4 %</td>
<td>47.0 %</td>
<td>6.5 %</td>
<td>3.3 %</td>
<td>2.1 %</td>
</tr>
<tr>
<td>June</td>
<td>40.7 %</td>
<td>47.3 %</td>
<td>6.0 %</td>
<td>3.1 %</td>
<td>2.1 %</td>
</tr>
<tr>
<td>May</td>
<td>41.0 %</td>
<td>47.7 %</td>
<td>5.5 %</td>
<td>3.0 %</td>
<td>2.2 %</td>
</tr>
<tr>
<td>April</td>
<td>42.1 %</td>
<td>47.1 %</td>
<td>4.9 %</td>
<td>3.0 %</td>
<td>2.2 %</td>
</tr>
<tr>
<td>March</td>
<td>43.3 %</td>
<td>46.5 %</td>
<td>4.2 %</td>
<td>3.1 %</td>
<td>2.3 %</td>
</tr>
<tr>
<td>February</td>
<td>43.6 %</td>
<td>46.4 %</td>
<td>4.0 %</td>
<td>3.0 %</td>
<td>2.2 %</td>
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<tr>
<td>January</td>
<td>44.8 %</td>
<td>45.5 %</td>
<td>3.9 %</td>
<td>3.0 %</td>
<td>2.3 %</td>
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### Browsers 2010

<table>
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<tr>
<th></th>
<th>Internet Explorer</th>
<th>Firefox</th>
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<th>Safari</th>
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<tbody>
<tr>
<td>August</td>
<td>30.7 %</td>
<td>45.8 %</td>
<td>17.0 %</td>
<td>3.5 %</td>
<td>2.3 %</td>
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<tr>
<td>July</td>
<td>30.4 %</td>
<td>46.4 %</td>
<td>16.7 %</td>
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<tr>
<td>June</td>
<td>31.0 %</td>
<td>46.6 %</td>
<td>15.9 %</td>
<td>3.6 %</td>
<td>2.1 %</td>
</tr>
<tr>
<td>May</td>
<td>32.2 %</td>
<td>46.9 %</td>
<td>14.5 %</td>
<td>3.5 %</td>
<td>2.2 %</td>
</tr>
<tr>
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<td>2.2 %</td>
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<tr>
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<td>12.3 %</td>
<td>3.7 %</td>
<td>2.2 %</td>
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<tr>
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<td>2.2 %</td>
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### Browsers 2011

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</tr>
<tr>
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<td>42.0 %</td>
<td>29.4 %</td>
<td>3.6 %</td>
<td>2.4 %</td>
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<tr>
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<td>27.9 %</td>
<td>3.7 %</td>
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<tr>
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<td>4.0 %</td>
<td>2.5 %</td>
</tr>
<tr>
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<td>26.5 %</td>
<td>42.4 %</td>
<td>24.1 %</td>
<td>4.1 %</td>
<td>2.5 %</td>
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<td>42.8 %</td>
<td>23.8 %</td>
<td>4.0 %</td>
<td>2.5 %</td>
</tr>
</tbody>
</table>

- http://www.w3schools.com/browsers/
- However - these statistics are from the w3 log files.
  What does this mean about how they should be interpreted?
Group Activity

- How are the Internet and Web currently used in Cultural Heritage institutions and/or for DH research?
  - What are the major challenges faced? Infrastructure? Knowledge? User Expectations?
  - How can these challenges be overcome?

- 3-4 groups of 3-4 people!

- 15 minutes discussion then report back (1-2 minutes per group)

Transmission

- Computers are connected together via a network or transmission line
- The objective of the ARPAnet project was to investigate the development of a decentralized computer network
- The network then became known as the Internet
- It has since adopted a suite of protocols called the Internet Protocol Suite or as more commonly known as TCP/IP
- Now, the Internet has grown to encompass a huge number of autonomous networks
Internet Protocol Suite

- The Internet Protocol Suite includes a number of standard protocols. The two most common are:
  - Transmission Control Protocol (TCP)
  - Internet Protocol (IP)
- A computer communication protocol is a description of the rules computers must follow to communicate with each other.
- TCP/IP defines how electronic devices (like computers) should be connected to the Internet, and how data should be transmitted between them.
- The TCP/IP protocol is embedded in TCP/IP software that is part of the operating system (OS)

TCP/IP

- TCP handles communication between applications
  - TCP uses a fixed connection.
  - If one application wants to communicate with another via TCP, it sends a communication request. This request must be sent to an exact address. After a "handshake" between the applications a communication line opens.
- IP handles communication between computers
  - IP is a connection-less protocol. With IP, messages are broken down into small independent "packets" and are sent between computers via the Internet. IP is responsible for "routing" each packet to its correct destination.
  - Communicating via IP is like sending a long letter as a large number of small postcards, each finding its own (often different) way to the receiver.
- TCP/IP is TCP and IP working together.
  - TCP takes care of the communication between your application software (your browser) and your network software - the handshake
  - IP takes care of the communication with other computers - the postal system which lets you address the package and put it into the post
  - TCP is responsible for breaking data down into IP packets before they are sent, and for assembling the packets when they arrive.
  - IP is responsible for sending the packets to the correct destination. Every computer has a IP address
World Wide Web (www.)

- The World Wide Web (WWW or Web) is often confused with the Internet
- The Web didn’t exist until the 1980s
- In 1989 Tim Berners-Lee created a set of technologies that allowed information on the Internet to be linked together through the use of links, or connections in documents
  - [http://www.w3.org/History/1989/proposal.html](http://www.w3.org/History/1989/proposal.html)
- The language used to write these documents with links is HTML

The Web

- The Web was mostly text based until Marc Andreessen created the Mosaic browser in 1992
- Accredited for popularizing the WWW
- People started thinking about adding videos, sound, and graphics on the Web.
- Now many people think of the Web as the graphical or illustrated part of the Internet
IP Addresses

- Each computer must have an IP address before it can connect to the Internet.
- A Web site has an IP address or a URL to identify it.
- TCP/IP uses four numbers between 0 and 255, to address a computer.
- An IP address is a set of numbers such as 127.0.0.1.
- TCP/IP uses four numbers to address a computer. The numbers are always between 0 and 255.
- IP addresses are normally written as four numbers separated by a period, like this: 192.68.20.50

127.0.0.1
- Those four numbers are 32 bits
- 32 bits = 4 bytes
- TCP/IP uses 32 bit addresses. One computer byte is 8 bits. So TCP/IP uses 4 computer bytes.
- A byte can hold 256 different values:
  - 00000000, 00000001, 00000010, 00000011, 00000100, 00000101, 00000110, 00000111, 00001000 ....... and all the way up to 11111111.

There are four different ways in which this set of numbers can be broken into class type A, B, C & D:

<table>
<thead>
<tr>
<th>Class Type</th>
<th>Range of Network Addresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 to 126</td>
</tr>
<tr>
<td>B</td>
<td>128.xxx to 191.xxx</td>
</tr>
<tr>
<td>C</td>
<td>192.xxx.xxx to 223.xxx.xxx</td>
</tr>
<tr>
<td>D</td>
<td>224.xxx.xxx.xxx to 254.xxx.xxx.xxx</td>
</tr>
</tbody>
</table>
IP Addresses

- The rapid growth of the Internet has led to a shortage of IP addresses. No one could have anticipated the Internet when the protocol was first devised.
- The Internet Protocol (IPv6) will provide relief to this problem by lengthening the IP address from 32 bits to 128 bits.
- The new version is frequently referred to as IPng (IP Next Generation).
- In Dec, 2008 a study by Google showed that IPv6 penetration was less than 1% of Internet hosts.
- Last four IPv4 addresses allocated on February 3rd 2011.

Domain Names

- Names are easier to remember than a 12 digit (or longer!) number.
- Some applications let you identify a computer or an IP network by using a logical or domain name:
  - www.ncirl.ie is a domain name.
- When you address a web site, like http://www.tcd.ie, the name is translated to a number by a Domain Name Server (DNS).
- When a new domain is registered together with a TCP/IP address, DNS servers all over the world are updated with this information.
Uniform Resource Locators (URL)

- A Uniform Resource Locator (URL) is used to address a document on the Web.
- The name that corresponds to an IP address in the DNS is known as a URL.
- A full Web address is like:
- A URL usually follows these syntax rules:
  - scheme://host.domain.country_code:port/path/filename

URL Codes

- For International use, the domains end in the country code
  - .ie For Irish websites
  - .fr French websites
  - .co.uk United Kingdom
- Some URLs end in the following
  - .com Commercial institute or service provider
  - .me Personal website
  - .edu Educational institute
  - .gov Government
  - .org Nonprofit organization
  - .net Network Service Provider
  - .mil U.S. military

Retrieving a URL

- TCP/IP is a collection of communication protocols that controls the way that information is broken up and posted over the Internet.
- HTTP takes care of the communication between a web server and a web browser.
- To retrieve a Web resource, the user either specifies a URL in the Web browser's address or clicks on a hyperlink in a document.
Retrieving a URL

• HTTP is used for sending requests from a web client (a browser) to a web server, returning web content (web pages) from the server back to the client.

• The Web browser specifies the details of the required Web page in a HTTP Request message.

• The Web server receives this request and after processing it completes the operation by returning either the document or an error in the HTTP Response message.

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HTTP

• Hypertext Transfer Protocol

• HTTP takes care of the communication between a web server and a web browser.

• HTTP is used for sending requests from a web client (a browser) to a web server, returning web content (web pages) from the server back to the client.

• Before the Web, the Internet protocol was FTP (File Transfer Protocol)

• FTP was too slow, and HTTP was invented.
HTTP

- HTTP adopted the concept of hypertext links but its protocol includes other methods
- There are four messages within this protocol
  - **Connection**: Establishes a connection between the client and the server
  - **Request**: Asks for a resource
  - **Response**: Delivers the resource
  - **Close**: Terminates the connection

Client/Server Computing

- All web activity begins on the clients side - you could type a web address into the browser. The browser first consults with the DNS to translate the home page name into an IP address. It then sends a request to the server using the HTTP standard
- A server spends most of its time *listening to the network* waiting for a document request

Intranets & Extranets

- The first serious use of Web technology within business was for the implementation of Intranets
- Internet, Intranets, and Extranets are all networks that transmit data.
- The difference is geographical location and security
- An Intranet is a secure network contained within an organization. It uses a firewall for maintaining security. Intranets are used only by company employees
- An Extranet is a secure network that allows outsiders to use an Intranet with permission. It is used to connect company suppliers, contractors, and partners with employees
E-Mail Address

- E-Mail Addresses have a similar naming scheme to domain names
- Often they take the following format:
  - UserName @ Organization.country_core
  - or Owen.Conlan@scss.tcd.ie
- There are many Web based e-mail services
- Eg. Microsoft offers hotmail, Google offers gmail

Port Numbers

- A port number is used to distinguish between the individual networking applications that are running simultaneously above the TCP/IP protocol stack
- Port numbers for standard TCP/IP services may be referred to as well-known port numbers:
  - 80 HTTP (Hypertext Transfer Protocol) - WWW
  - 194 IRC (Internet Relay Chat) - Conferencing
  - 21 FTP (File Transfer Protocol)
  - 25 SMTP (Simple Mail Transfer Protocol) - E-mail
  - 23 Telnet

- Server processes are associated with a fixed port and the client must know the port in order to connect with the network service
- A Web server will normally be listening for connections on port 80. A web browser will use this port number by default when attempting to connect to the remote computer
Who owns the Internet?

- No person or organization owns the entire Internet
- As the Internet is a network of networks, each network is owned by a company
- This is similar to the motor-way and road system. Each town or state owns and maintains roads in its jurisdiction

More Info

- Where can I find definitions for much of the Internet-related jargon?
  - www.whatis.com
  - www.w3schools.com
  - www.webopaedia.com

Ireland’s Top Sites
(alexa.com sep 2009)

1. google.ie
2. google.com
3. youtube.com
4. facebook.com
5. yahoo.com
6. live.com
7. bebo.com
8. wikipedia.org
9. blogger.com
10. msn.com
11. bbc.co.uk
12. google.co.uk
13. twitter.com
14. rte.ie
15. boards.ie
16. ebay.ie
17. daft.ie
18. partypoker.com
19. nasza-klasa.pl
Ireland's Top Sites
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1. google.ie
2. google.com
3. facebook.com
4. youtube.com
5. yahoo.com
6. wikipedia.org
7. live.com
8. twitter.com
9. blogspot.com
10. linkedin.com
11. rte.ie
12. aib.ie
13. google.co.uk
14. bbc.co.uk
15. boards.ie
16. ebay.ie
17. msn.com
18. amazon.co.uk
19. irishtimes.com
20. amazon.com

Future of the Internet?

- Mobile Internet or the Internet on your mobile.
- Speed.
- Ubiquitous computing.
- More devices Internet enabled.
- Sensors.
- Adaptive and intelligent web-based systems.
- Consumers being in control of context dependent advertisements.
- Artificial Intelligence.
- QR codes.
Lecture Overview

• The Internet and the World Wide Web
• History of the Internet and the WWW
• Transmission Across the Internet
• TCP/IP and Domain Names
• Basic Services from FTP to the WWW
• Uniform Resource Locators (URLs)
• Intranets and Extranets

Questions?

• Contact: Owen.Conlan@scss.tcd.ie
• Slides: http://www.scss.tcd.ie/Owen.Conlan