

# Introduction to Web Technologies



## The Internet and the World Wide Web

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## Module Overview

### • Web Technologies (CS7062)

- |                       |   |
|-----------------------|---|
| 1) Intro to the Web   | Background to the Web, terminology etc. (Owen Conlan) (3 Lecture)     |
| 2) HTML and CSS       | Static Web Design (Séamus Lawless) (1 Lecture, 2 Lab)                 |
| 3) HTML and CSS       | Static Web Design (Séamus Lawless) (1 Lecture, 2 Lab)                 |
| 4) Intro to Databases | Intro and Lab Interaction (Séamus Lawless) (1 Lecture, 2 Lab)         |
| 5) Intro to Databases | Intro and Lab Interaction (Séamus Lawless) (1 Lecture, 2 Lab)         |
| 6) PHP and MySQL      | Intro and Lab - Web Form (Alex O'Connor) (1 Lecture, 2 Lab)           |
| 7) Reading Week       | Intro and Lab - Web Form (Alex O'Connor) (1 Lecture, 2 Lab)           |
| 8) PHP and MySQL      | Intro to XML and Lab - Render Data from XML (Alex O'Connor) (1        |
| 9) PHP and XML        | Lecture, 2 Lab)   |
| 10) CMS               | Intro to the Various Types and Install (Shawn Day) (1 Lecture, 2 Lab) |
| 11) Analytics         | Intro and some practical examples (Shawn Day) (1 Lecture, 2 Lab)      |
| 12) Visualisations    | Intro and some practical examples (Shawn Day) (1 Lecture, 2 Lab)      |

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Be prepared to get your hands dirty...



... but not today ; -)

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# 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

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## Internet or World Wide Web

- Is there a difference? What is it?

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## The InterNet is short for..

- **INTER**connected **NET**work

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# How do we use the Internet?

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# 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
  - ...

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# 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?

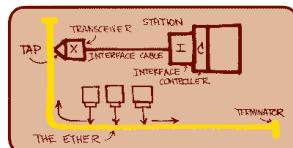
- Original aim was to create a network that would allow users of a research computer at one university to be able to ‘talk to’ research computers at other universities.
  - A side benefit of ARPAnet’s design was that, because messages could be routed or rerouted in more than one direction, the network 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



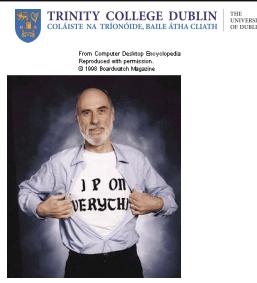
- The **ethernet** was developed by Xerox during this period. This was inspired by Robert Metcalfe's PhD on 'packet networks'.
- An ethernet is a protocol for describing how computers can be connected in a LAN (Local Area Network)
- Through the use of Ethernet and ARPAnet the US were able to develop 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.

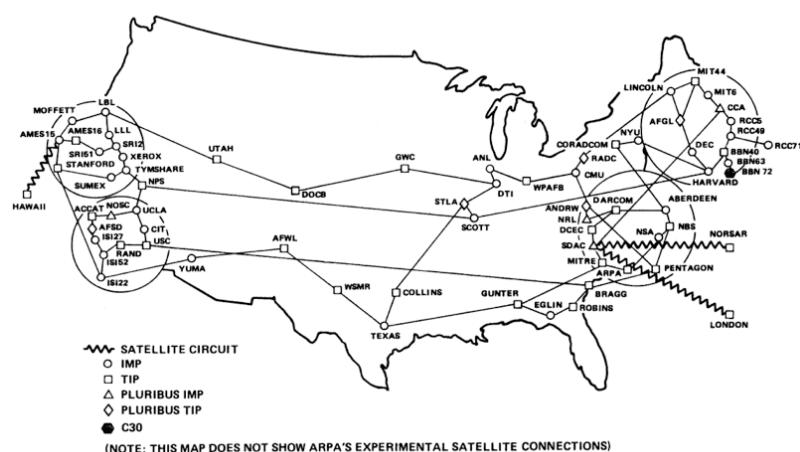
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# ARPAnet

ARPANET GEOGRAPHIC MAP, OCTOBER 1980



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# 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



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# 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 BBN. It can be accessed at the ISI site via <network-help>TCTALK. Questions relative to it can be answered by Calvin or Geoff at SRI-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-MAY-78 22:09:57-PDT,2463;000000000001  
Mail-from: USC-ISI rcvd at 7-JUN-75 2024-PDT  
Date: 7 JUN 1975 2024-PDT  
From: WALKER at USC-ISI  
Subject: MSGGROUP# 002 Message Group Status  
To: MessageGroup:

First let me appologize 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 nasty 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 appologize in advance.

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# USENET



Web Images Groups News Froogle Maps Scholar more >

Advanced Groups Search Preferences

My Groups

My profile

My topics

My recent groups

Global Voices Regional Editors Group (2490)

Middle East Global Voices (55)

Recently visited [clear]

comp.lang.perl.misc

au.jobs

soc.culture

de.soc.netzwesen

Groups Alerts

Create a new group

About Google Groups

Group directory  Directory Search

All groups > USENET > comp

Group	Members	Last Post
comp.admin.* (1)	comp.databases.* (49)	comp.human-factors
comp.ai.* (17)	comp.dcom.* (33)	comp.hypercube
comp.answers.* (1)	comp.distributed	comp.ibm.* (4)
comp.apps.* (3)	comp.doc.* (3)	comp.infosystems.* (36)
comp.arch.* (9)	comp.dsp	comp.internet.* (3)
comp.archives.* (6)	comp.editors	comp.videodisc
comp.bbs.* (6)	comp.edu.* (3)	comp.job.* (2)
comp.benchmarks	comp.emacs.* (2)	comp.jobs.* (8)
comp.bugs.* (5)	comp.emulators.* (9)	comp.lang.* (117)
comp.cad.* (10)	comp.fonts	comp.laptops
comp.client-server	comp.forsale.* (7)	comp.laser-printers
comp.cog-eng	comp.games.* (6)	comp.local.* (1)
comp.compilers.* (4)	comp.graphics.* (39)	comp.long.* (1)
comp.compression.* (2)	comp.groupware.* (8)	comp.lsi.* (3)
comp.constraints	comp.hackers	comp.mac.* (23)
comp.data.* (1)	comp.hardware.* (1)	comp.mail.* (23)
comp.database.* (6)	comp.home.* (2)	

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## 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 tearoom.

This cosy, Tudor room is where all British Legends exposed oak beams and soft, velvet-covered furnishings ideal atmosphere in which to relax before venturing timeless realm. A sense of decency and decorum prevails kinship with those who, like you, seek their destinies in all directions, each of which leads into obvious teleportative properties...

\*north

Dense forest.

You are standing in some dense forest, which slopes \*north

The forest becomes too dense to go any farther. You

■

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## MUDs to MMORPGs -)

- 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.

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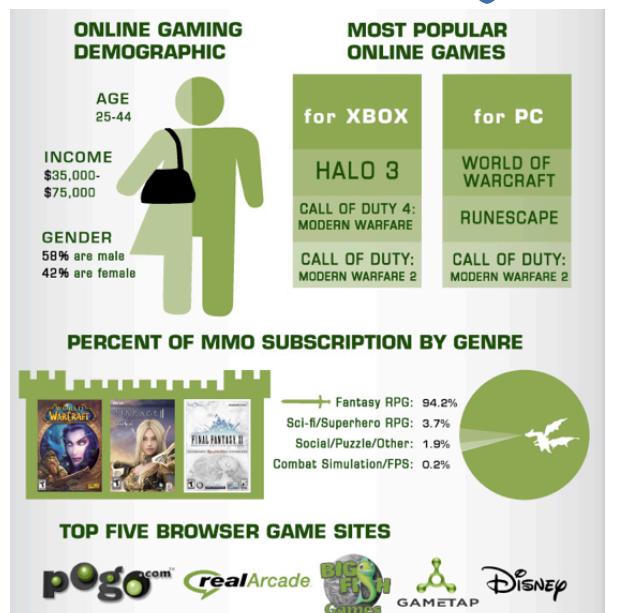
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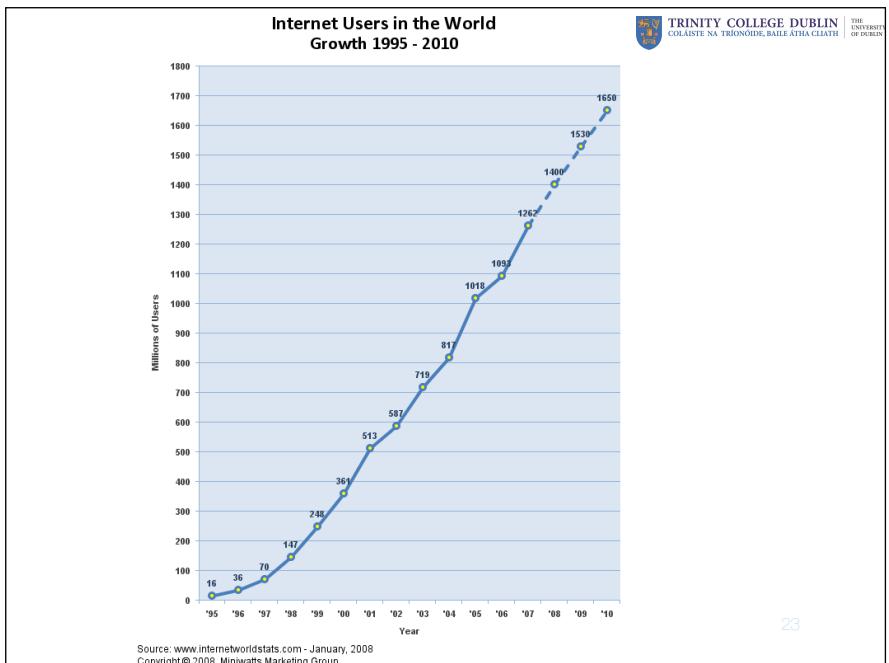


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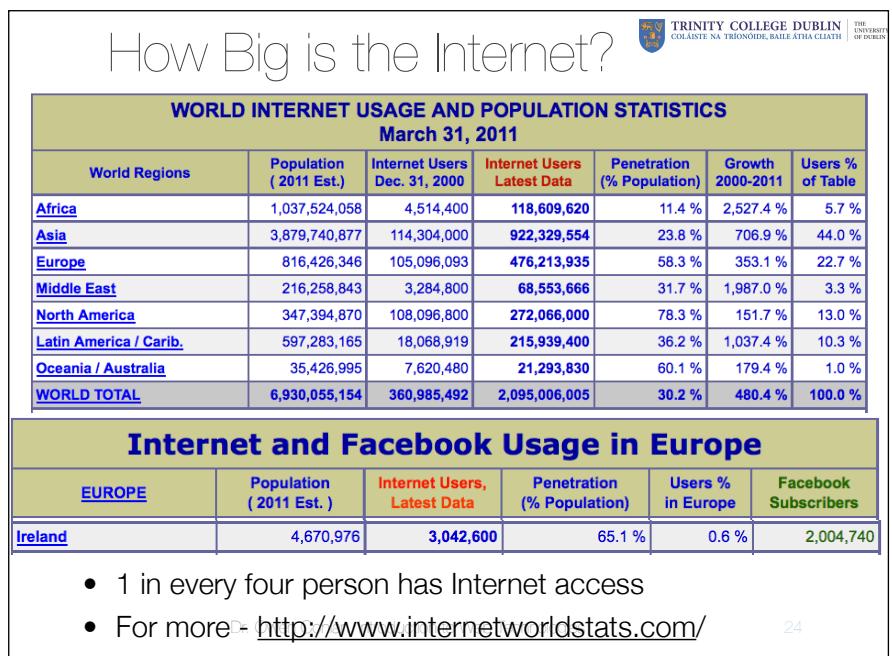
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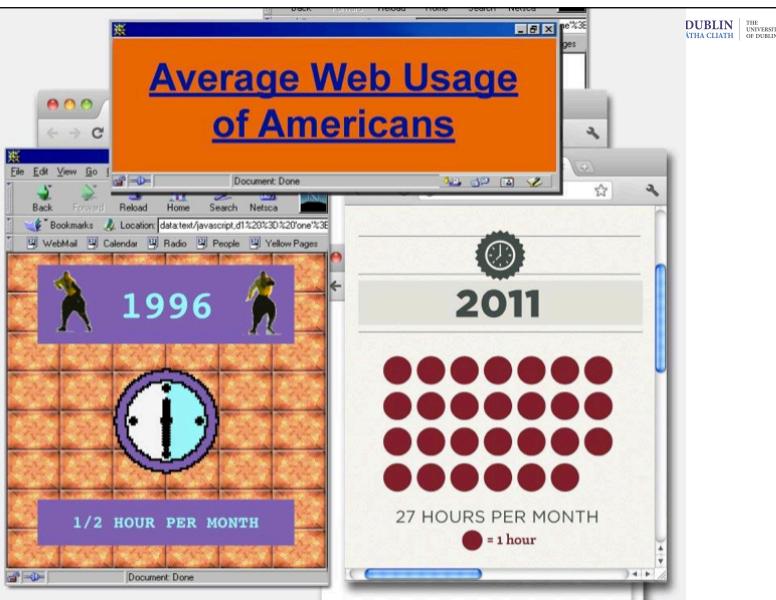
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- <http://www.theblogismine.com/wp-content/uploads/2011/09/Internet-of-Yesterday-and-Today-1996-vs.-2011-infographic-full.jpg> 25

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# 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



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# Browsers

- Which do you use?



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## Browsers 2009

<b>2009</b>	<b>Internet Explorer</b>	<b>Firefox</b>	<b>Chrome</b>	<b>Safari</b>	<b>Opera</b>
December	37.2 %	46.4%	9.8%	3.6%	2.3%
November	37.7 %	47.0%	8.5%	3.8%	2.3%
October	37.5 %	47.5%	8.0%	3.8%	2.3%
September	39.6 %	46.6%	7.1%	3.6%	2.2%
August	39.3 %	47.4%	7.0%	3.3%	2.1%
July	39.4 %	47.9%	6.5%	3.3%	2.1%
June	40.7 %	47.3%	6.0%	3.1%	2.1%
May	41.0 %	47.7%	5.5%	3.0%	2.2%
April	42.1 %	47.1%	4.9%	3.0%	2.2%
March	43.3 %	46.5%	4.2%	3.1%	2.3%
February	43.6 %	46.4%	4.0%	3.0%	2.2%
January	44.8 %	45.5%	3.9%	3.0%	2.3%

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## Browsers 2010

<b>2010</b>	<b>Internet Explorer</b>	<b>Firefox</b>	<b>Chrome</b>	<b>Safari</b>	<b>Opera</b>
August	30.7 %	45.8%	17.0%	3.5%	2.3%
July	30.4 %	46.4%	16.7%	3.4%	2.3%
June	31.0 %	46.6%	15.9%	3.6%	2.1%
May	32.2 %	46.9%	14.5%	3.5%	2.2%
April	33.4 %	46.4%	13.6%	3.7%	2.2%
March	34.9 %	46.2%	12.3%	3.7%	2.2%
February	35.3 %	46.5%	11.6%	3.8%	2.1%
January	36.2 %	46.3%	10.8%	3.7%	2.2%

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## Browsers 2011

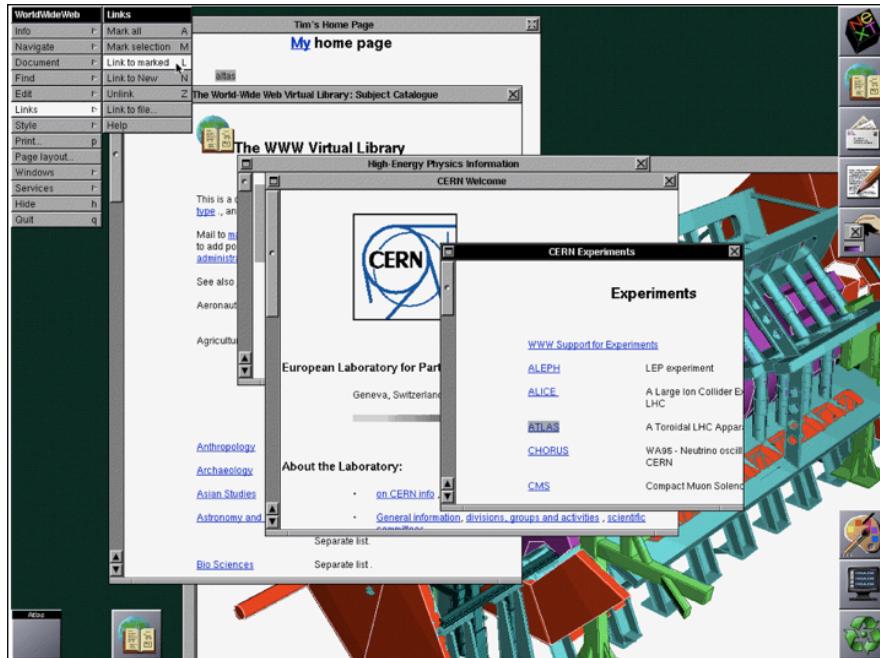
<b>2011</b>	<b>Internet Explorer</b>	<b>Firefox</b>	<b>Chrome</b>	<b>Safari</b>	<b>Opera</b>
August	22.4 %	40.6 %	30.3 %	3.8 %	2.3 %
July	22.0 %	42.0 %	29.4 %	3.6 %	2.4 %
June	23.2 %	42.2 %	27.9 %	3.7 %	2.4 %
May	24.9 %	42.4 %	25.9 %	4.0 %	2.4 %
April	24.3 %	42.9 %	25.6 %	4.1 %	2.6 %
March	25.8 %	42.2 %	25.0 %	4.0 %	2.5 %
February	26.5 %	42.4 %	24.1 %	4.1 %	2.5 %
January	26.6 %	42.8 %	23.8 %	4.0 %	2.5 %

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

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## 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)

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## 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

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# 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)

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## 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.

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## TCP/IP

- 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**

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# 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>
- The language used to write these documents with links is HTML



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## The Web

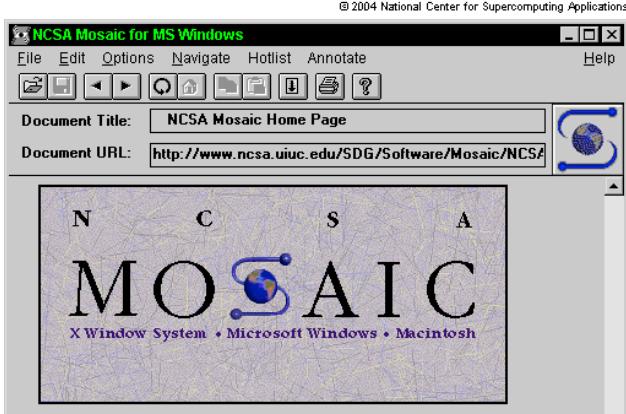
- The Web was mostly text based until Marc Andreessen created the Mosaic browser in 1992
- Accredited for popularizing the WWW
- People started thinking about adding videos, sound, and graphics on the Web.
- Now many people think of the Web as the graphical or illustrated part of the Internet

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From Computer Desktop Encyclopedia  
Reproduced with permission.  
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Welcome to NCSA Mosaic, an Internet information browser.  
Mosaic was developed at the National Center for Supercomputing Applications (NCSA) at the University of Illinois in Urbana-Champaign. NCSA is a center of the National Science Foundation's Supercomputer Centers Program.  
The Board of Trustees of the University of Illinois UI.

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# 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

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# IP Addresses

- 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.

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# IP Addresses

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

Class Type	Range of Network Addresses
A	1 to 126
B	128.xxx to 191.xxx
C	192.xxx.xxx to 223.xxx.xxx
D	224.xxx.xxx.xxx to 254.xxx.xxx.xxx

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# 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

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# 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](http://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

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# 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:
    - <http://www.scss.tcd.ie/Owen.Conlan/php/xpath/index.html>
  - A URL usually follows these syntax rules:
    - scheme://host.domain.country\_code:port/path/filename

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# 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

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# Retrieving a URL

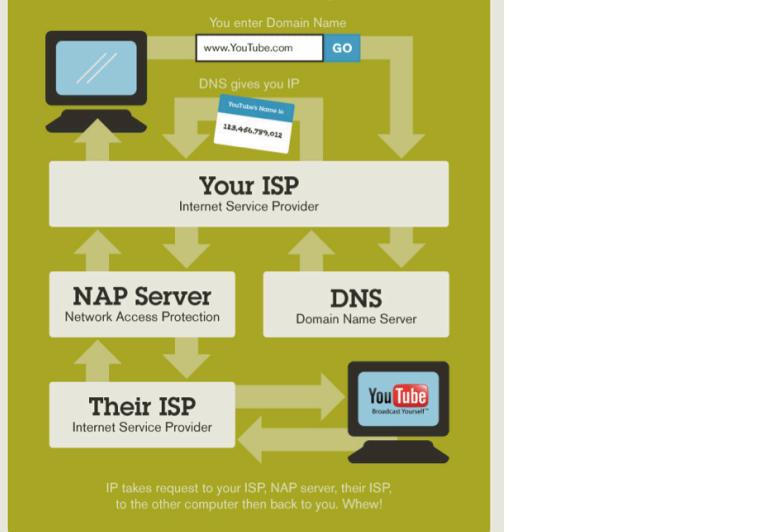
- TCP/IP is a collection of communication protocols that controls the way that information is broken up and posted over the Internet.
  - HTTP takes care of the communication between a web server and a web browser.
  - To retrieve a Web resource, the user either specifies a URL in the Web browser's address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

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## 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*

### 4. Okay, so, I've got my address, how does information get to me?



- <http://www.onlineschools.org/blog/how-the-internet-works/>

## 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

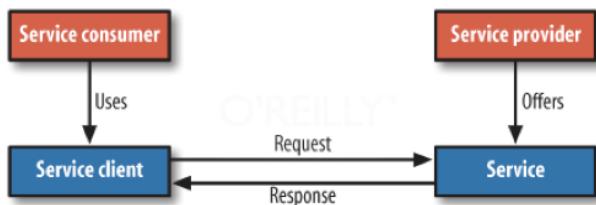
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## Client/Server Computing

- 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



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## 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

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## 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](mailto: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

## Port Numbers

- 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

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## More Info

- Where can I find definitions for much of the Internet-related jargon?
    - [www.whatis.com](http://www.whatis.com)
    - [www.w3schools.com](http://www.w3schools.com)
    - [www.webopaedia.com](http://www.webopaedia.com)
    - [http://alexa.com/](http://http://alexa.com/)

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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. mspn.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

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# Ireland's Top Sites (alexa.com sep 2010)

- |                  |                    |
|------------------|--------------------|
| 1. google.ie     | 11. rte.ie         |
| 2. google.com    | 12. aib.ie         |
| 3. facebook.com  | 13. google.co.uk   |
| 4. youtube.com   | 14. bbc.co.uk      |
| 5. yahoo.com     | 15. boards.ie      |
| 6. wikipedia.org | 16. ebay.ie        |
| 7. live.com      | 17. msn.com        |
| 8. twitter.com   | 18. amazon.co.uk   |
| 9. blogspot.com  | 19. irishtimes.com |
| 10.linkedin.com  | 20.amazon.com      |

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# Ireland's Top Sites (alexa.com sep 2011)

- |                  |                  |
|------------------|------------------|
| 1. google.ie     | 11. rte.ie       |
| 2. google.com    | 12. bbc.co.uk    |
| 3. facebook.com  | 13. ebay.ie      |
| 4. youtube.com   | 14. aib.ie       |
| 5. yahoo.com     | 15. boards.ie    |
| 6. wikipedia.org | 16. amazon.co.uk |
| 7. linkedin.com  | 17. paypal.com   |
| 8. live.com      | 18. daft.ie      |
| 9. twitter.com   | 19. donedeal.ie  |
| 10.blogspot.com  | 20. amazon.com   |

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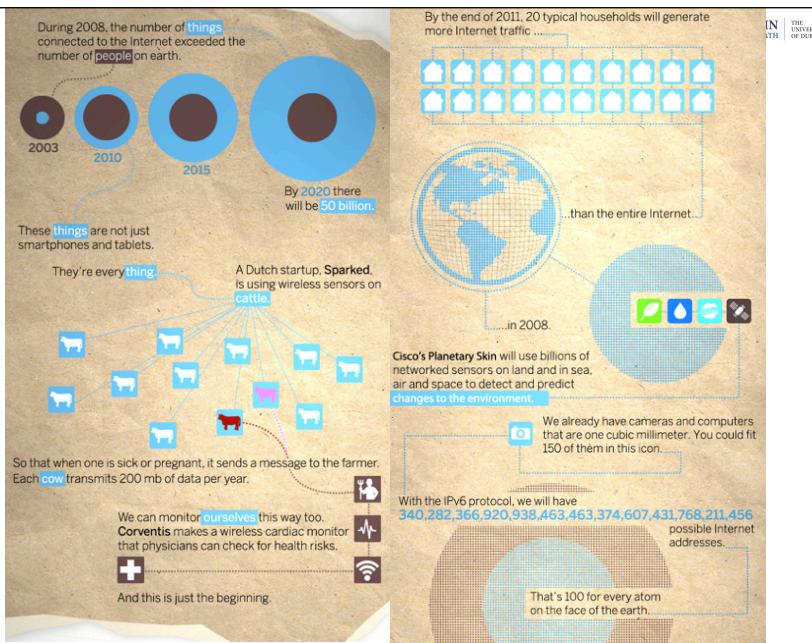
## Future of the Internet?

- 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.

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CISCO: [http://www.techjournalsouth.com/wp-content/uploads/2011/07/internet\\_of\\_things\\_infographic\\_3final.jpg](http://www.techjournalsouth.com/wp-content/uploads/2011/07/internet_of_things_infographic_3final.jpg)

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## 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

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## Questions?

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- Slides: <http://www.scss.tcd.ie/Owen.Conlan>

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