

# Introduction to Agile Web Development

CITS3403 and CITS5505 - Agile Web Development

# Unit teaching staff



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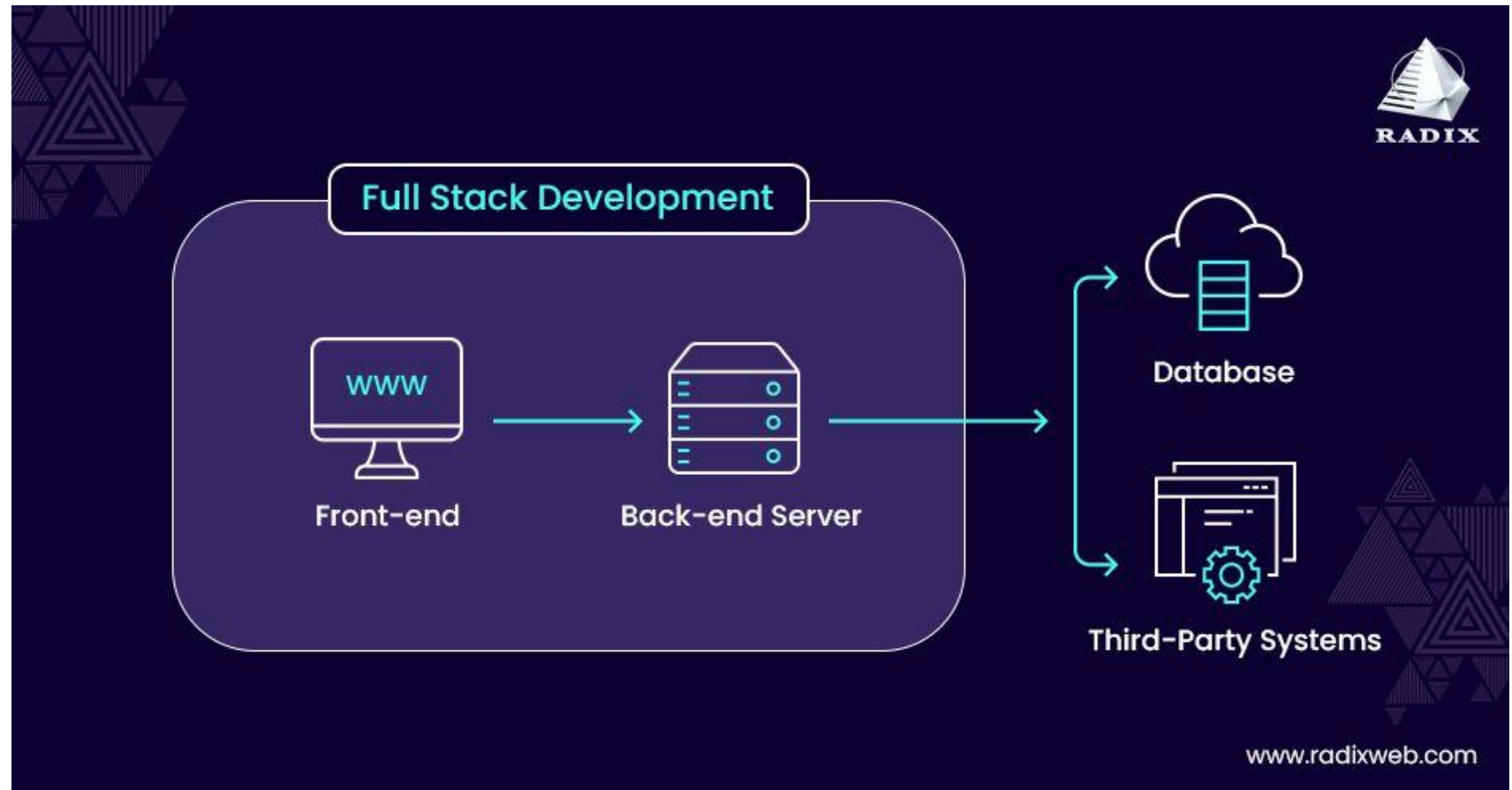
Facilitator  
Lynn Huang



Facilitator  
Henri Scaffaldi

# Welcome to Agile Web Development

- Focus on **Programming** for the Web and **Agile software development**.

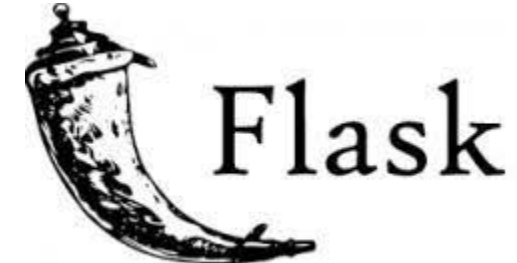


# The syllabus

- First 6 weeks – Front-end:
  - How the web works
  - Constructing web pages with HTML
  - Web Styling with CSS and Bootstrap
  - Client-side scripting with JavaScript, jQuery and AJAX
  - Document object models and event handling
  - Agile development and GIT



- Second half – Back-end
  - Flask Python web application development
  - MVC architecture and object relational modelling
  - Security, testing
  - Deployment
  - REST API design



- We use open source and free technologies
  - You can use it at home!

# Unit admin

- Unit links:
  - LMS: <https://lms.uwa.edu.au/>
  - Help forum: [Microsoft Teams](#)
  - Email: [cits-3403-5505@uwa.edu.au](mailto:cits-3403-5505@uwa.edu.au)

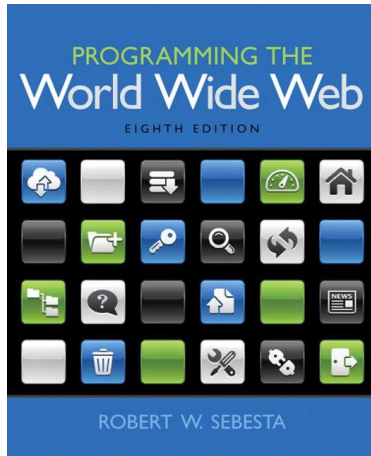
# Weekly timetabling

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 AM		CITS5505 (SEM-1) Laboratory ENCM: [ 207B] Wks 10-16, 18-21		CITS3403 (SEM-1) Laboratory CSSE: [ 205] Wks 10-16, 18-21	
9:00 AM	CITS3403 (SEM-1) Laboratory MATH: [ 123D] Wks 10-16, 18-21				CITS3403 (SEM-1) Lecture_Tutorial PHYS: [ G41],PHYS: [ 243] Wks 9-16
10:00 AM		CITS5505 (SEM-1) Laboratory ENCM: [ 207B] Wks 10-16, 18-21	CITS5505 (SEM-1) Laboratory ELEC: [ 207B] Wks 10-16, 18-21	CITS3403 (SEM-1) Laboratory CSSE: [ 203] Wks 10-16, 18-21	CITS5505 (SEM-1) Lecture_Tutorial PHYS: [ G41],PHYS: [ 243] Wks 9-16
11:00 AM	CITS5505 (SEM-1) Laboratory MATH: [ 123A] Wks 10-16, 18-21		Office hours 1.12 CSSE		
12:00 PM		CITS3403 (SEM-1) Laboratory ENCM: [ 207A] Wks 10-16, 18-21			CITS3403 (SEM-1) Laboratory ENCM: [ 207B] Wks 10-16, 18-21
1:00 PM				CITS3403 (SEM-1) Laboratory MATH: [ 123A],MATH: [ 123B] Wks 10-16, 18-21	
2:00 PM					
3:00 PM		CITS5505 (SEM-1) Laboratory MATH: [ 123A] Wks 10-16, 18-21			
4:00 PM			CITS3403 (SEM-1) Lecture PHYS: [ G41] Wks 9-16, 18-21	CITS5505 (SEM-1) Lecture PHYS: [ G41] Wks 9-16, 18-21	
5:00 PM					
6:00 PM					

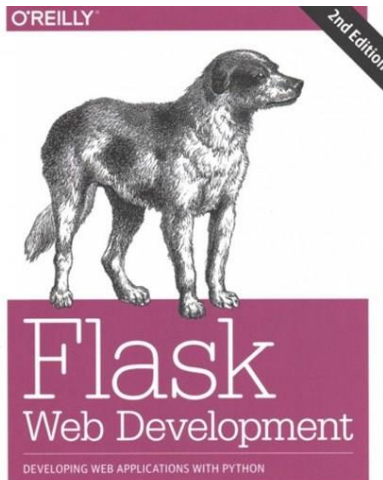


# Recommended Reading

## General references



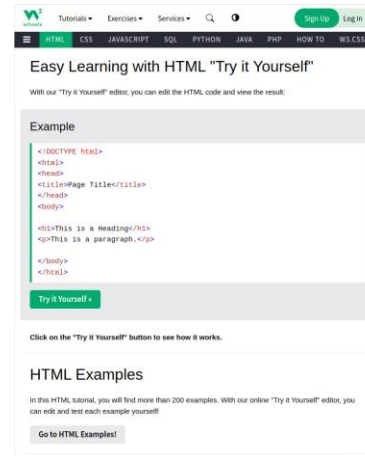
Robert W. Sebesta,  
*Programming the  
World Wide Web  
2015*,  
8th Edition,  
Pearson/Addison  
Wesley.



Miguel Grinberg

Miguel Grinberg,  
*Flask Web  
Development*,  
2nd Edition,  
O'Reilly, 2018

## Lab material



### Part I

W3Schools

<https://www.w3schools.com>

### Part II

Miguel Grinberg  
Flask Mega-Tutorial

<https://blog.miguelgrinberg.com/post/the-flask-mega-tutorial-part-i-hello-world>



# Assessment

- CITS3403 Mid-semester test: Friday April 4th, 9am LMS Online.
  - 10% or final grade
  - < 10 questions, written answers, 60 minutes
- CITS5505 Individual Project: Due Friday April 4th, 11:59pm
  - 10% of final grade
  - Write a basic web page, with researched content
- Group Project: Sunday, Friday May 16th, 11:59pm.
  - 40% of final grade
  - Done in groups of 4.
  - Fully dynamic website with backend!
  - Lab work will step through this process.
- Written final exam: exam period
  - 50% of final grade
- Please ensure you have consulted the Unit Outline for information on:
  - unsatisfactory progress
  - late assessment penalties
  - plagiarism and AI tools policy
  - including ACE and academic misconduct
  - faculty marks adjustment policy



# AI use policy

- LLM-based tools are awesome at many parts of web-development and are seeing rapid adoption in industry.
- This course **explicitly encourages** your use of AI tools to generate code. The tutorial sessions will explain how to setup your dev environment to use GitHub CoPilot.



- However, you are still expected to be able to read, write and critique code on your own.
  - **Tutorials:** will label which parts you should use CoPilot for and which parts you should not.
  - **Individual (CITS5505) and group projects:** you can use it freely if you cite it properly.
  - **Tests (CITS3403):** you can use it freely but may be of only limited help for certain questions.
  - **Exams:** closed book so you may not use it. You will be expected to read, but not write, code.
- If you don't understand the code being generated, you will not pass the exam!

# A project success story

Email received on February 26th 2024...

*I took CITS3403 in 2022 semester 1, it was one of the best units in the whole degree. For the final project we built Minecraftle which was wordle + minecraft crafting recipes. When we completed the project, we deployed it online using a small server. Since the unit finished, I gave it a few more updates to fix bugs and forgot about it.*

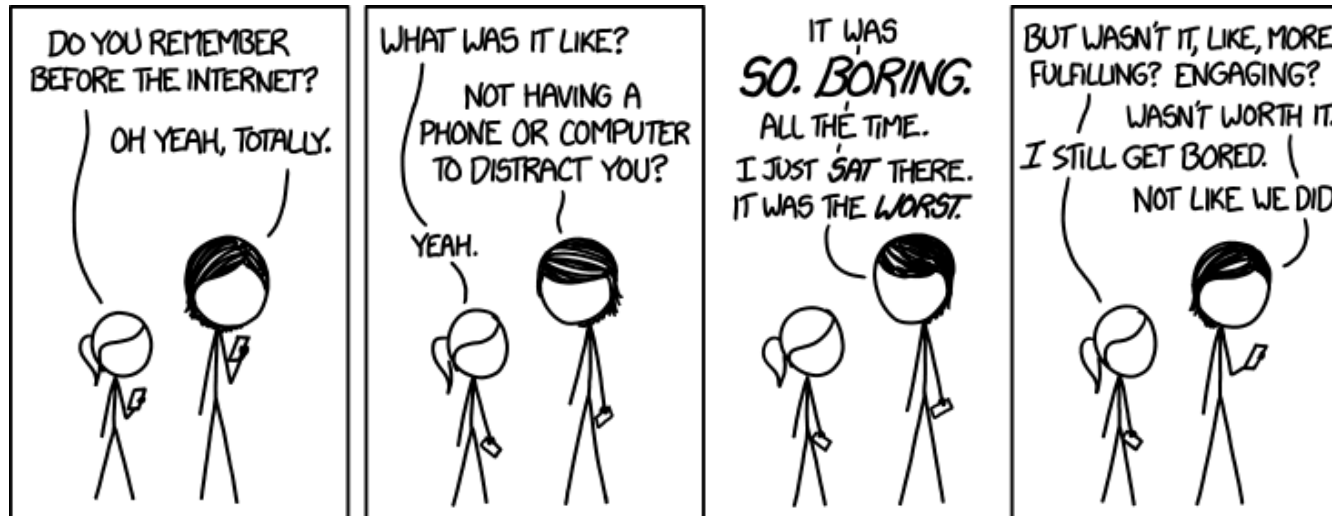
*Near the end of last year someone on YouTube started making videos of the game and it has since become quite popular. As of yesterday, it just hit 1 million players! The game has contributed to getting a software engineering job in Melbourne that I started in January.*



<https://github.com/zachpmanson/minecraftle/>

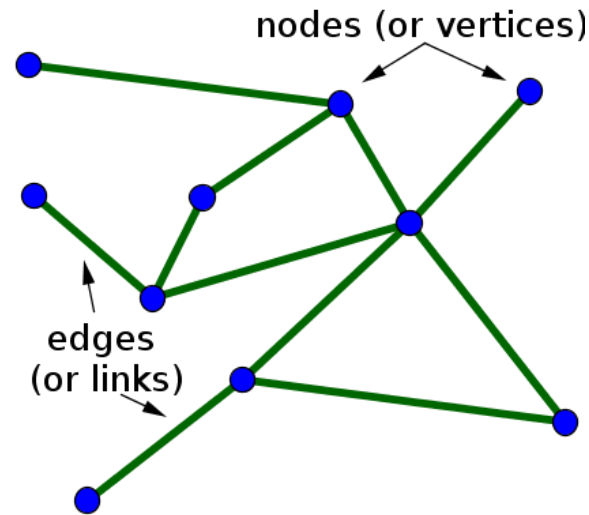
<https://minecraftle.zachmanson.com/>

# A (very) brief history of the Internet



# What is a computer network?

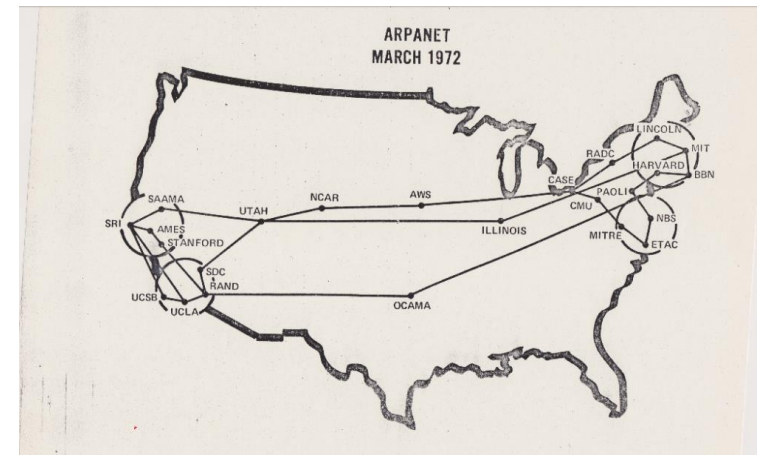
- A **network** is a structure linking devices together for the purpose of communication and can be modelled as a graph.



- Each individual device is modelled as a **node** in the graph.
- The physical connection between two devices is modelled as an **edge** in the graph.

# Networks before the Internet

- In the US, the DoD created the Advanced Research Projects Agency (ARPA, now DARPA) in 1958. ARPA was interested in creating networks that:
  - allowed communications, program sharing, remote computer access.
  - were robust and would continue to work if some nodes “taken out” by malicious forces.
- This resulted in the **ARPAnet** in the late 1960s and early 1970s
  - linked about a dozen ARPA-funded research labs and universities.
  - graduate students played a large part in its development!
  - didn’t live up to intentions - mostly text-based email and limited reach.
  - but still useful and the snowball had started to roll...
- Non-ARPA-funded Universities wanted in, so other networks were created in the late 70s and early 80s
  - BITnet (Because It’s Time Network), initially electronic mail and file transfer
  - CSnet (Computer Science Network), primarily email



# The Birth of the Internet

- **NSFnet** was created in 1986 by the National Science Foundation (NSF).
- Originally for non-DoD funded organisations, it initially connected five supercomputer centres but quickly spread to other academic institutions and research labs.
- By 1988/89 - began to be used commercially - mail, ISPs.
- By 1990, it had replaced ARPAnet for non-military uses and it soon became the network for everyone.
- Other networks created gateways and eventually merged with NSFNet (e.g. JANET, BITnet, Usenet, ...).
- By 1992 connected more than 1 million computers around the world and eventually became known as "**the Internet**".



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olduse.net: a real-time historical exhibit

Usenet, updated in real time as it was thirty years ago. Also available in your local news reader via nntp.olduse.net.
FAQ & Blog & Forum & Announcement & Current Usenet Map & Find & Mirrors

      alt.activism (198 67 0* 0: 0o 0K)                                h=help    Recent messages at 2:18
-> 1 + 2 10 US Invades Panama                                           Cheol Kim      am Tue 20 Feb 1990:
2 + 6 25 Jesse Helms pulls an all-nighter                             Michael McClary DATetris info
3 + 3 50 I have seen the Light! (Re: Does the US G                   Michael D. Riston by keith to
4 + 2 14 Addresses                                                    Michael McClary  comp.sys.mac
5 + 6 6 AutoCAD                                                       Kent Chao       Trying to get BASH
6 + 56 Hong Kong Camps for Vietnamese Termed "In                    John.a.dinardo going.
7 + 4 29 Panama Info                                                  Peter Glen Berger by rock to
8 + 32 Gun Control Poll                                              Tom Klemmer     comp.unix.1386
9 + 3 58 Lobbying for Refuge for the Vietnamese Re                  John.a.dinardo Re: How to set a
10 + 25 'Women and Children' possible innocent vi                   John M. Sulak   "Reply-To: " filed in
11 + 24 8 Akwesasne Notes -- Basic Call to Consciou                 Kenneth Arrondee the mail header?
12 + 2 32 Undercounting (was Anti-Invasion protest                  & Dyer          by argvturnpike to
13 + 40 Akwesasne Notes & gambling                                   Michael C. Berch comp.mail.headers
14 + 11 alt.inactivism                                               & Dyer          MACL Recover from
15 + 4 22 Trashing Greenpeace                                       & Dyer          symbol name conflicts
16 + 79 El Salvador PROJECT                                         Harel Barzilai by mesard to
17 + 2 56 Chipmunk Spearfishing Update                             Carl Tausch     comp.lang.lisp
18 + 6 39 The Bill of Rights: A Luxury of simpler t                Ed Ipsier      Re^2: Can you read
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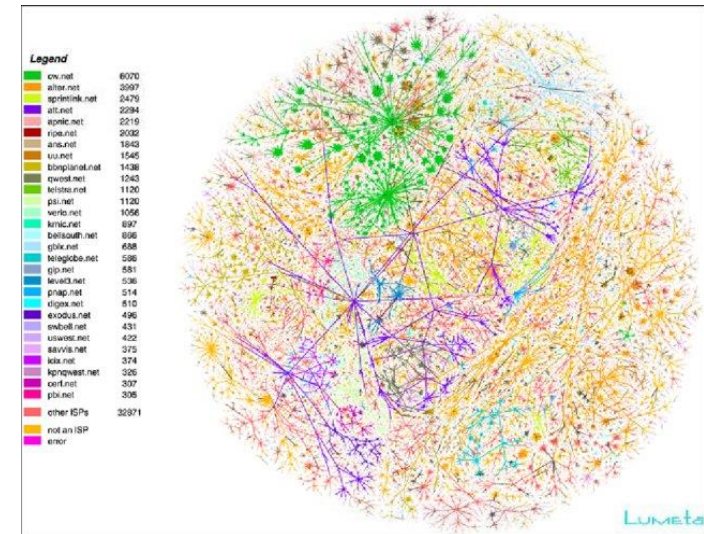
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Nothing visible? Press @ a few times...

Last edited 3 years and 5 months ago
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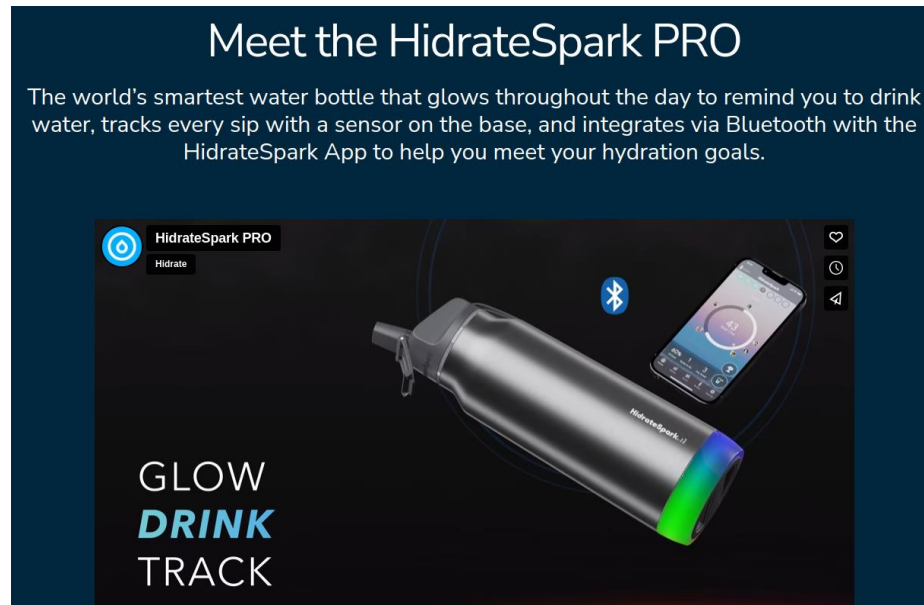
# The Evolution of the Internet

- The Internet is still a network of interconnected networks.
- As it evolved high-speed **backbone links** were created to carry large amounts of data.
- Smaller networks connect to the backbone, enabling any user on any network to exchange data with any other user.
- Both backbone links and individual networks can be owned by companies, universities or nation states.
- It achieved ARPA's original goal that if part of its infrastructure is destroyed, data can still flow through the remaining networks (in principle).
- By the 2000s it had become indispensable global infrastructure.



# The Internet Today

- Today the Internet has grown to include tens of billions of interconnected computers, smart phones, televisions, printers, fridges, watches and most crucially... *water bottles*.

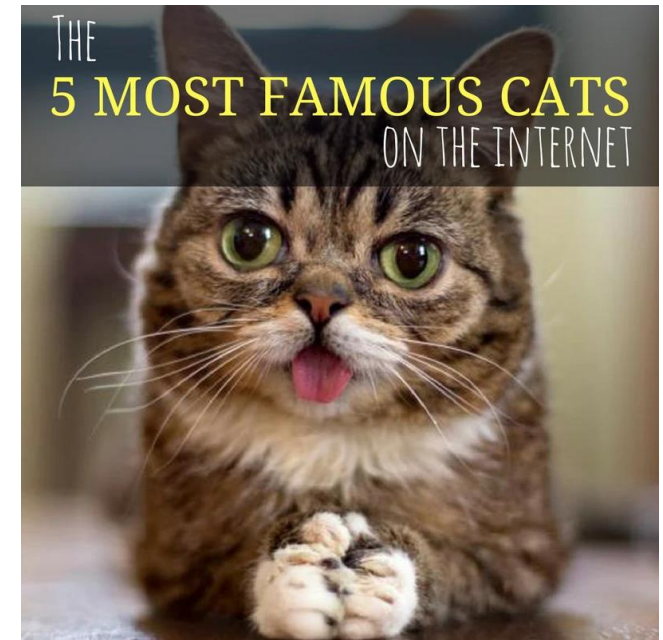


- All these devices on the Internet are connected using a wide range of different types of links: copper cables, fibre-optic cables, satellites, phone lines etc.

# How does the internet work?

# Communication protocols

- No matter whether using fibre-optics, satellite links etc, the physical connections all send data as a sequence of bits, e.g. 10101111011010000011001.
- Network communication is possible only if computers “speak” a common language and know how to interpret the bits. These common languages are known as *protocols*.
- *It's protocols all the way down:*
  - IP – consistent addressing of entities on the internet
  - BGP – finding the best routes across the internet
  - TCP – error-free delivery of streams of data
  - SMTP – sending and receiving emails.
  - FTP – sending and receiving files.
  - etc. etc.

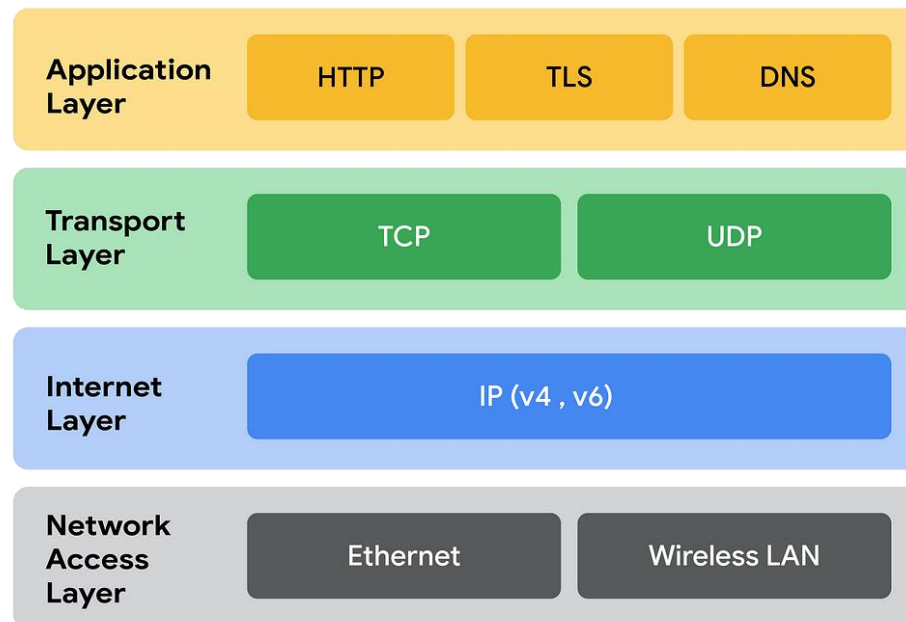


# The TCP/IP model

- Every computer and network on the Internet uses the same set of protocols - the **Transmission Control Protocol/Internet Protocol**, or TCP/IP for short.
- No matter what type of computer system you connect to the Internet, if it uses TCP/IP, it can exchange data with any other type of computer.
- TCP/IP was developed to guarantee the proper transmission of data, since the physical layer (e.g. wires/wi-fi/satellite) in the network may be unreliable.
- For transmission not needing guarantees, one can use **User Datagram Protocol** (UDP) instead of TCP. Data transmitted by UDP arrive **faster**, with **none of the error detection or correction overheads** that are in TCP/IP.
- In TCP/IP a stream of data is split into **packets** which are sent individually over the network.

# The TCP/IP model layers

- The TCP/IP model is split up into four layers:
  - The **application layer** protocols dictate what format the stream of data should be in for different high-level applications.
  - The **transport layer** protocols convert the stream of data to and from a sequence of packets and are responsible for detecting and fixing packets that are lost or corrupted during transport.
  - The **internet layer** protocols are responsible for transmitting a single packet from the source device to the destination device across the network.
  - The **network access layer** protocols describe how a single packet is transmitted across a single physical link in the network.






# Client-Server Architecture

- Most communication on the internet takes the form of a **client-server** relationship.
  - The **server** is computer whose address is known, and which stores information on its file system.
  - The **clients** sends a request for information to the server via an agreed protocol (FTP, SMTP etc.).
  - The server transmits the requested information back to the clients.
- Advantages
  - Multiple clients can use a single server.
  - New clients can join the system without having to be registered in advance.
  - We have a single, central source of information.
- Disadvantages:
  - There is a single point of failure – the server.
  - If too many clients, the server may be overloaded with requests.
- To get around the disadvantages, we can have many duplicate servers containing the same content, at the cost that more work must be done to keep the copies of information synchronised...

# **Internet Applications**

# Bulletin Board System (BBS)

- Early interactive software, late 1970s to 1980s
- Users could login to:
  - exchange messages through mail or public message boards
  - read news and bulletins
  - upload/download software
  - even on-line games
  - accessed using modem and phone line
  - precursor to today's WWW



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[M] Monochrome (1.101w 07-May-08) (Last on Wed May 14 13:36) [M]
-----
  O B S C U R E  Q U O T E S
New streamlined layout! Easier to use! New files! Extra exclamation marks!
-----
Dish some dirt at <MT0> today!
----- archon ~
Menu [ESC] = Utilities (inc. Talker & EXIT)

You don't use ssh. Boooh! Menu [I] = Help and Information on Monochrome

Welcome to the new version of Monochrome! (version 1.101w)
Menu [N] = News and Media
Menu [T] = Science, Technology and Medicine
Menu [E] = Entertainment
Menu [C] = Society and Culture
Menu [R] = Recreation

Menu [M] = Monochrome Users

Hello 'SexDrugs&DrumMachinesForAgRaveGeneration'. (evilandi:4)
<< 22 other users at Sun Jan 11 19:30 BST >>

```

# Usenet

- Idea conceived by Duke University grad students in 1979
- Unlike BBS, distributed network of servers (e.g. each university)
- A variety of forums called *newsgroups* (not just news - users posts)
- Threaded discussions
- Formed social communities
- Precursor to Internet forums



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olduse.net: a real-time historical exhibit

Usenet, updated in real time as it was thirty years ago. Also available in your local news reader via nntp.olduse.net.
FAQ & Blog & Forum & Announcement & Current Usenet Map & Find & Mirrors

      alt.activism (19B 67 0* 0: 0o 0K)      h=help      Recent messages at 2:10
-> 1 + 2 10 US Invades Panama                  Cheol Kim      am Tue 20 Feb 1990:
  2 + 6 25 Jesse Helms pulls an all-nighter    Michael McClary DATetris info
  3 + 3 59 I have seen the Light! (Re: Does the US G Michael D. Riston by keith to
  4 + 2 14 Addresses                          Michael McClary comp.sys.mac
  5 + 6 AutoCAD                               Kent Chao      Trying to get BASH
  6 + 56 Hong Kong Camps for Vietnamese Termed "In john.a.dinardo going.
  7 + 4 29 Panama Info                       Peter Glen Berger by rock to
  8 + 32 Gun Control Poll                    Tom Kiermaier   comp.unix.i386
  9 + 3 58 Lobbying for Refuge for the Vietnamese Re john.a.dinardo Re: How to set a
10 + 25 'Women and Children' possible innocent vi John M. Sulak "Reply-To: " filed in
11 + 24 8 Akwesasne Notes -- Basic Call to Consciou Kenneth Arromdee the mail header?
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13 + 40 Akwesasne Notes & gambling            Michael C. Berch comp.mail.headers
14 + 11 alt.inactivism                       & Dyer          MACL Recover from
15 + 22 Trashing Greenpeace                  & Dyer          symbol name conflicts
16 + 79 El Salvador PROJECT                  Harel Barzilai by mesard to
17 + 2 56 Chippewa Spearfishing Update       Carl Tausch    comp.lang.lisp
18 + 6 39 The Bill of Rights: A luxury of simpler t Ed Ipser    Re^2: Can you read
19 + 2 11 Addresses?                        v291nht@ubvms.cc.buffal this? If so. let me

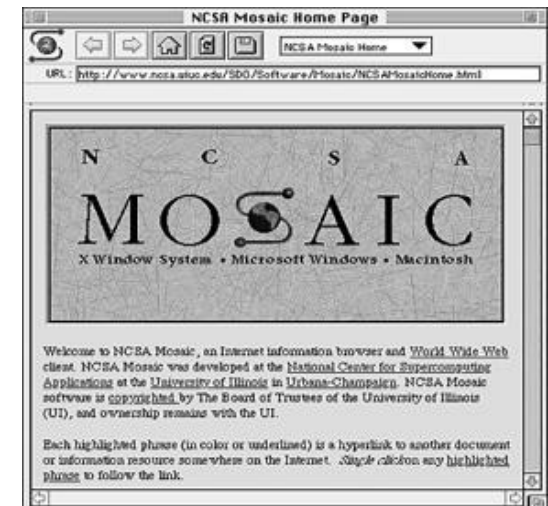
Done reading? Leave an interesting post visible for the next visitor!
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Source: Benjamin D. Esham, Wikimedia Commons  
[http://en.wikipedia.org/wiki/File:Usenet\\_Big\\_Nine.svg](http://en.wikipedia.org/wiki/File:Usenet_Big_Nine.svg)

# The "killer app" - the World Wide Web

- Early internet was mainly used by people in universities and research labs.
  - Lots of information but very difficult to access.
  - You needed the IP address of the computer you wanted to connect to.
  - No uniform way of visualising the information.
- In 1991, CERN publicised new World Wide Web project, invented earlier by Tim Berners-Lee and colleagues in 1989:
  - DNS (Domain Name System) resolves URLs (names) to IP addresses.
  - Included the first browser "WorldWideWeb" on the NeXTSTEP platform
  - First ever website still [online](#)!
- In 1993, the National Center for Supercomputing Applications (NCSA) at the University of Illinois released v1.0 of Mosaic browser:
  - written by a student, Marc Andreessen, and Eric Bina
  - first multimedia browser (mixed images and text)!
- Explosion in internet use!
  - growth of web usage in 1000s of percent
  - changed internet use forever
  - the "killer app" of the 90s



# A URL (uniform resource locator)

<http://www.domain.edu.au:1000/path/to/file?parameters=true#fragment>

- **The protocol used.** Typically, *http*, *ftp*, *https*, ...
- **The domain name.** A *domain name server* maps this to an IP address
- **The port number.** Servers have ports 0-65535, but HTTP defaults to port 80.
- **The path (route) to the file to execute.** The file is typically an HTML file, but it could also be PHP, text, PDF.
- **The parameters of the request.** These are specified as a set of key value pairs.
- **The fragment.** This anchors to a location in a page.
- There are also hidden parts of the request including the browser name and cookies.



# Client-Server Architecture of the Web

- Communication is by an agreed protocol, e.g. the HTTP (HyperText Transfer Protocol).
- The user requests a **web page** through the **browser**, a program running locally on their computer.
- The browser, as the client, locates the correct server and communicates the request.
- The server retrieves the web page from its local file system and transmits the files back to the browser.
- The browser receives the files, (usually text file containing HTML instructions) and uses them to **render** the web page resulting in the intricate graphics and formatting you see on your screen.



# The World Wide Web today

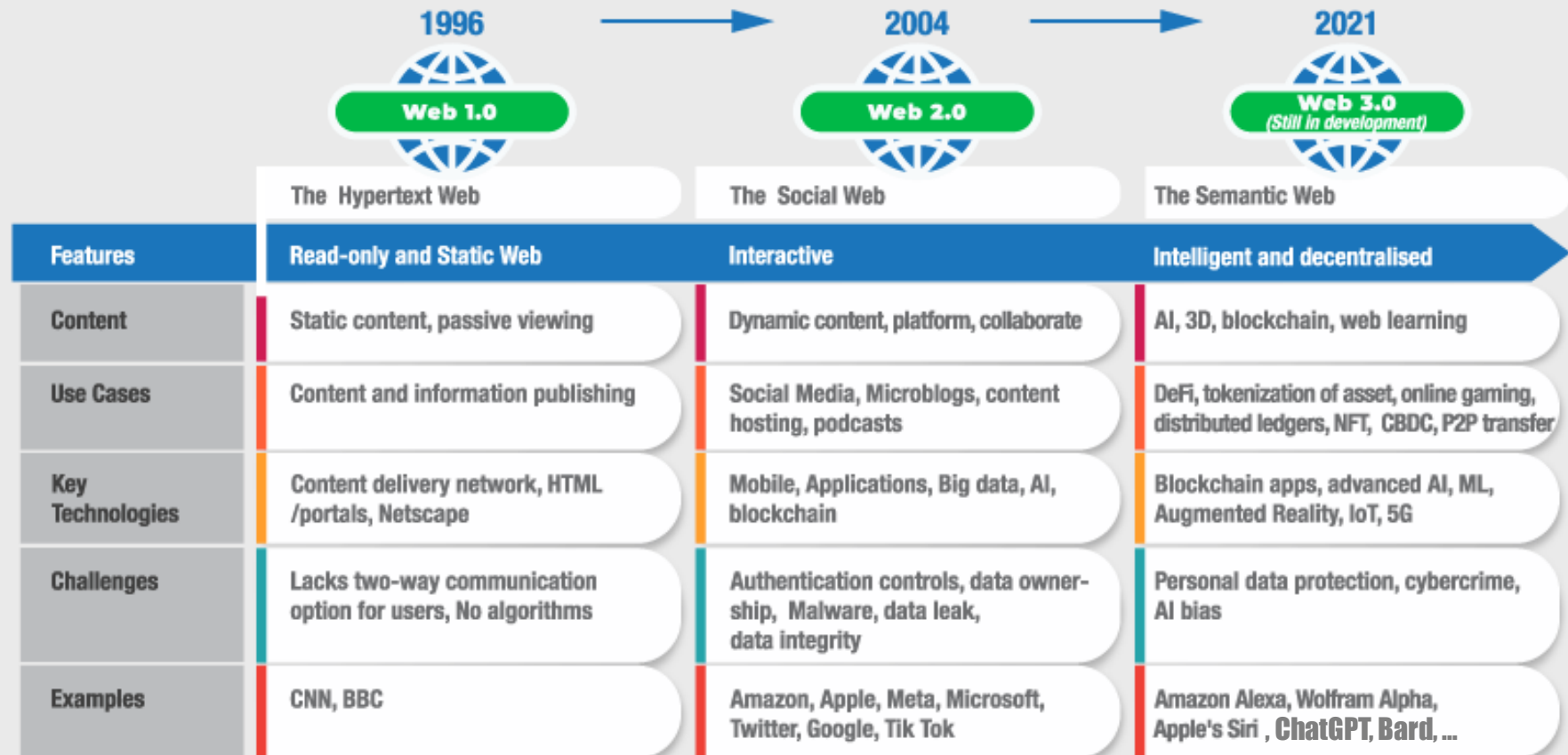
- The world wide web is essentially the fragment of the internet accessible through web browsers.
- It is a unique engineering environment with obscure ownership and control.
- Arguably the most impressive piece of infrastructure ever built by humanity.
- Hundreds of standards have evolved that define interaction over the webpages.
- As search has come to dominate, URLs are now nearly irrelevant to users.



# The World Wide Web tomorrow

## New web technologies that shape future business models

### Transition in web technologies



Source: TABInsights