UNIVERSITY OF
Southampton

COMP3220 Web Infrastructure

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What's this module about?

- What is the Web?
- How is the Web made?
- What came before the Web?
- Where is the Web going?

What's this module *not* about?

- How to write HTML (although we will look at its evolution and capabilities)
- How to write CSS (although we will look at its capabilities)
- How to set up a web server
- How to write applications in PHP/ASP.NET/Ruby on Rails/Django/node.js

Other ECS modules cover some of this, most notably COMP6205 Web Development

Some material is covered in more depth in COMP6215 Semantic Web Technologies

Lecturers

Dr Nick Gibbins

Dr Heather Packer

Module structure

Three lectures per week:

- Monday 2pm in 4/3057
- Monday 3pm in 4/3057
- Thursday 4pm in 4/3057

One lab per week (starting in Week 3):

- Tuesday 4pm in 65/2141 (note: on Avenue campus)

Links to all module resources will be at
https://secure.ecs.soton.ac.uk/module/COMP3220/

Laboratories

Starting Week 3 (w/c 18 Oct 2021)

The first four labs have formative exercises to prepare you for the coursework:
- HTTP
- HTML
- CSS
- REST

Subsequent labs will run as coursework clinics

Assessment

Examination: 50% (120 minutes, 3 questions from 4)

REST architecture coursework: 50%
- Specification published in week 6
- Submission due week 11
- Feedback due week 15

Week-by-week topics

Week 1:   Hypertext and the Architecture of the Web (nmg)

Week 2:   Web Protocols (nmg)

Week 3:   Web Formats (nmg)

Week 4:   Styling the Web, and Advanced Protocols (nmg)

Week 5:   RESTful Web Services (nmg)

Week 6:   History of Hypertext (nmg)

Week 7:   Open Hypermedia (nmg)

Week 8:   Web Graph and Search Engines (hsp)

Week 9:   Caching, Content Delivery and Web Advertising (hsp)

Week 10:   Linked Data, Open Data and Open Access (hsp)

Week 11:   Intellectual Property and Net Neutrality (nmg)

Week 15:   Review (nmg/hsp)

A note on assessable content

Not everything we cover on this module can be sensibly assessed, so we'll indicate topics of which you only need a high-level understanding as follows.

If a topic concerns technologies which are currently undergoing standardisation (and so which are subject to change), we'll indicate it like this:
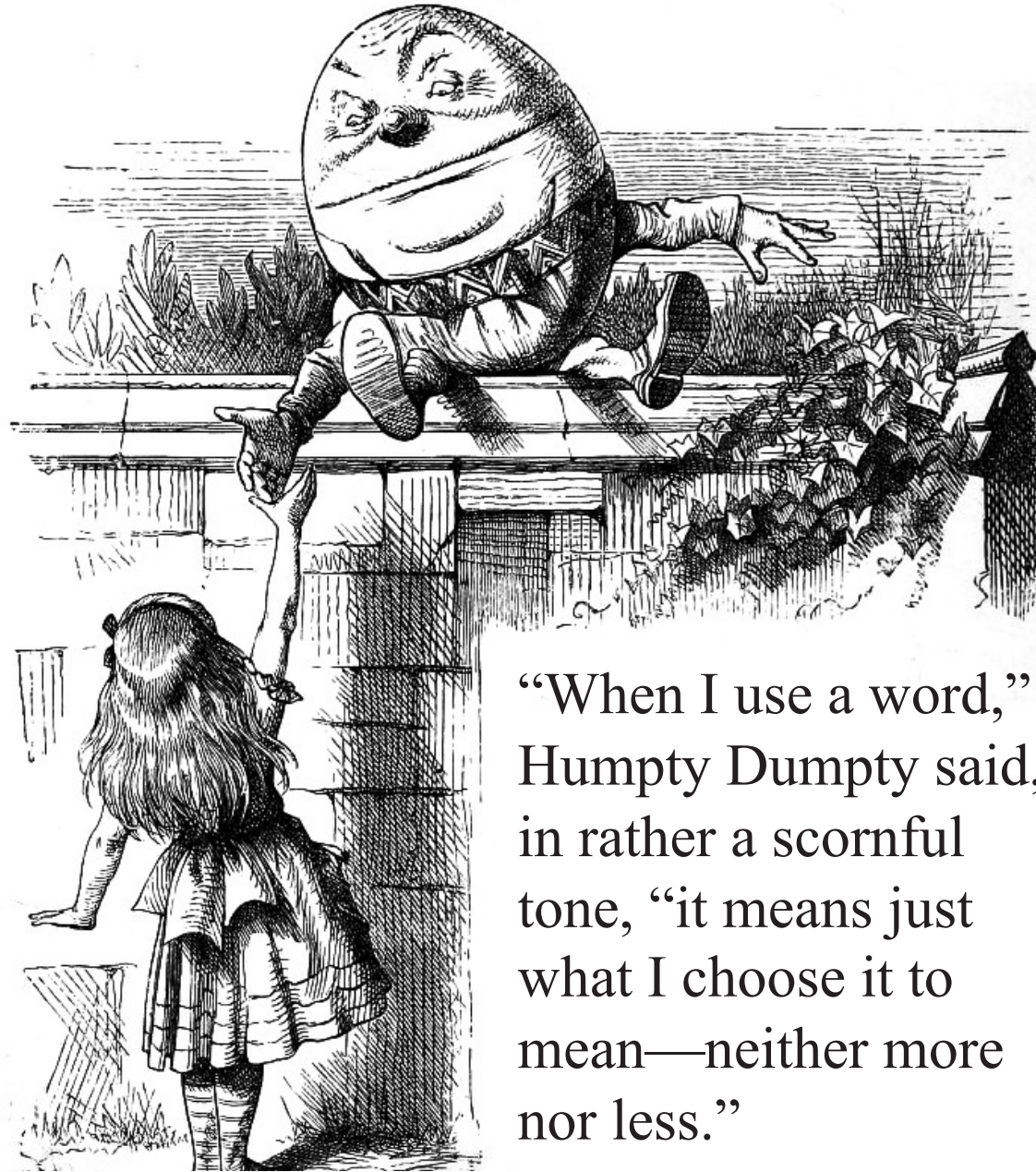
If a topic goes into large amounts of detail that's primarily there only for illustrative purposes, we'll indicate it like this:

The World Wide Web

What is the World Wide Web?

"When I use a word," Humpty Dumpty said, in rather a scornful tone, "it means just what I choose it to mean—neither more nor less."

Before the Web

- A user typed a host address into a client program
- The client communicated with a file server using the File Transfer Protocol (FTP)
- The user typed commands into the client:
  - To navigate to the right directory
  - To specify whether the file being transferred was binary or ASCII
  - To get the right file
- The server sent a file back
- The client stored the file on the hard disk
- The user printed the file, or used a separate viewer

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juno:~ nmg$
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The Web experience

- A user clicks on a link in a browser
- (the browser talks to a web server)
- (the server sends a document back)
- The browser displays the document
- The user clicks on another link (etc)
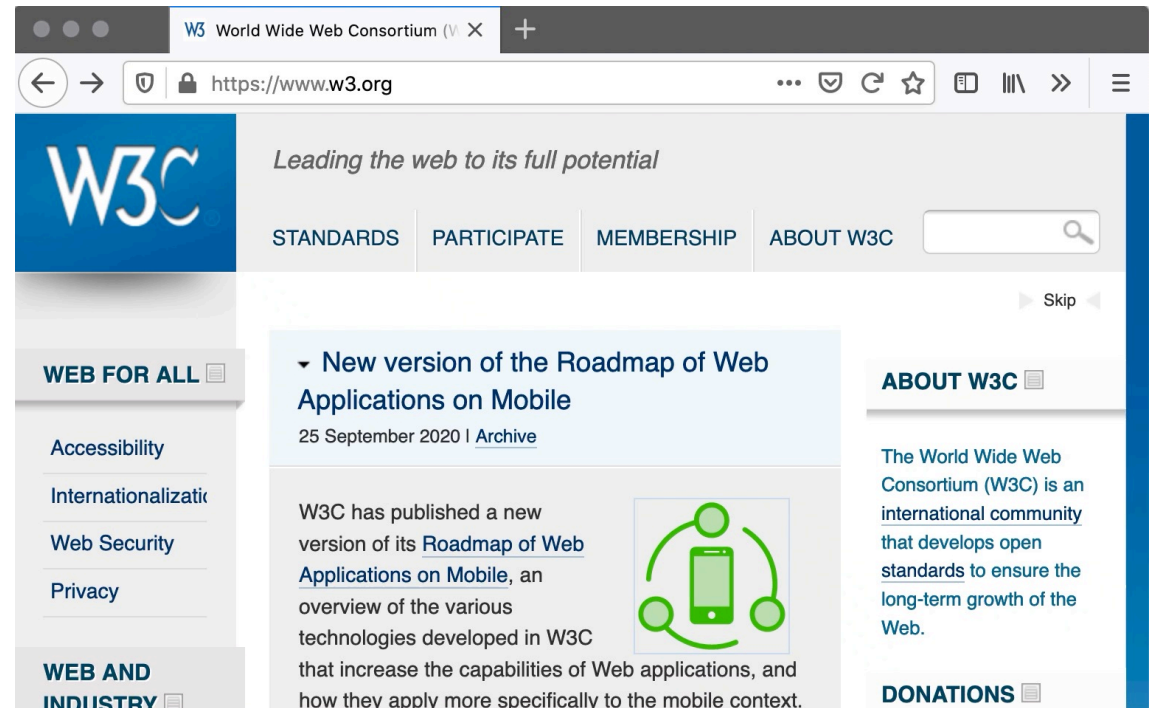
Web evolution

The Web is for scientists (1991-1995)
- Document-centric
- Limited interactivity

The Web is for commerce (1996-2000)
- Invention of Secure Sockets
- The dot-com bubble

The Web is for users (2000-2005)
- Web 2.0 (just a marketing slogan?)
- Emphasis on user-generated content
- Web browser as rich client

The Web as application platform (2005-)

What is the World Wide Web?

A distributed information system that provides access to hypertext documents and other objects of interest

We have a general name for these objects of interest:
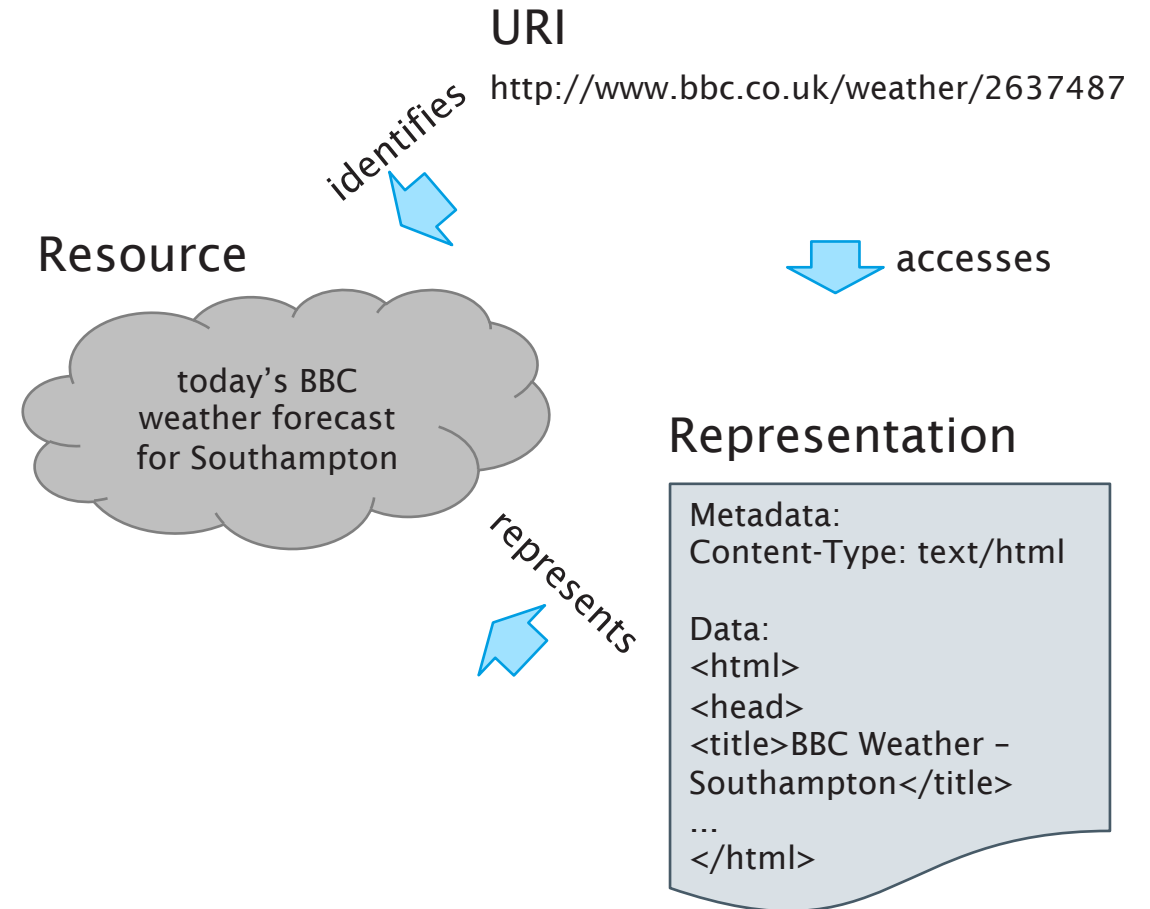
resources

What is a resource?

"Familiar examples [of resources] include an electronic document, an image, a source of information with a consistent purpose (e.g., 'today's weather report for Los Angeles'), a service (e.g., an HTTP-to-SMS gateway), and a collection of other resources. A resource is not necessarily accessible via the Internet; e.g., human beings, corporations, and bound books in a library can also be resources. Likewise, abstract concepts can be resources, such as the operators and operands of a mathematical equation, the types of a relationship (e.g., 'parent' or 'employee'), or numeric values (e.g., zero, one, and infinity)."

Berners-Lee, T. et al (2005) *Uniform Resource Identifier (URI): Generic Syntax*. RFC3986.

Web Architecture

Resources are *identified* by URIs
(Uniform Resource Identifiers)

Resources have *representations* in different formats (HTML, text, PDF)

Resources can be *interacted* with using network protocols (HTTP)

URI
http://www.bbc.co.uk/weather/2637487

identifies

accesses

Resource

today's BBC weather forecast for Southampton

represents

Representation

Metadata:
Content-Type: text/html

Data:
<html>
<head>
<title>BBC Weather – Southampton</title>
...
</html>

Web principles

- All entities of interest should be identified by URIs
- All URIs should be resolvable (i.e. you can use them to fetch something)
- When you resolve a URI, you get some data about the identified resource
- Data should be provided using standard formats
- Data should be linked with other data

5 Stars of Linked Data (2010)

★   Available on the Web (in whatever format) under an open licence

★★   As above, but as machine-readable structured data
(e.g. Excel instead of an image of a table)

★★★   As above, but in a non-proprietary format
(e.g. CSV instead of Excel)

★★★★   As above, but using W3C standards (RDF, SPARQL) to identify things,
so that others can point at your data

★★★★★   As above, but linked to other people's data to provide context

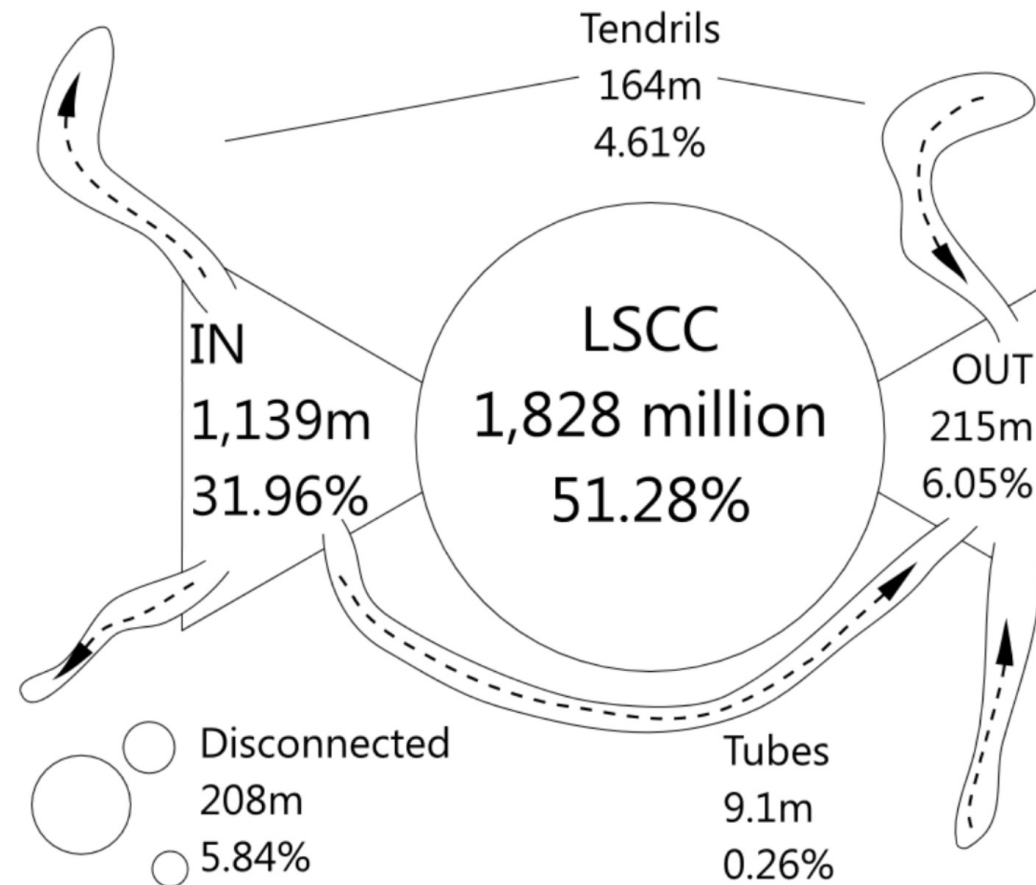# What is the World Wide Web?

Web growth
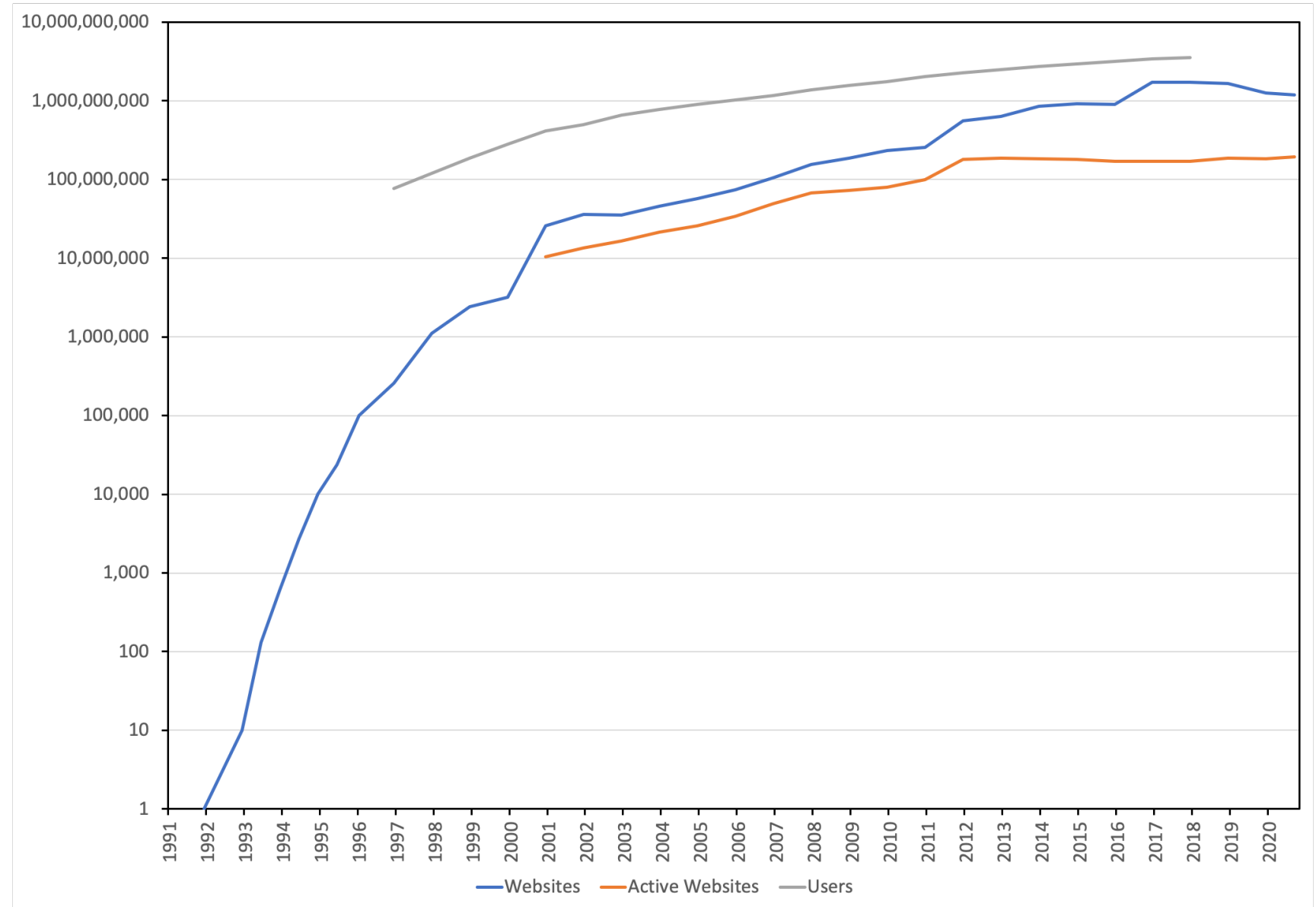
Measuring the Web

How many webpages are there?
- Harder to count than websites (deep Web – not linked)
- Estimate size of the indexed Web using search engines
- Around 800 million in 1999 (compare with ~3 million websites)
- At least 10 billion in 2005 (compare with ~34 million active websites)
- At least 1 trillion in 2016 (compare with ~170 million websites)

What is the diameter of the Web?
- How many links do you need to follow to travel between an arbitrary pair of webpages?
- Longest shortest finite path
- Even harder to measure…
- Estimated at 19 in 1999

Lawrence, S. and Giles, C.L. (1999) Accessibility of information on the Web. Nature, 400, pp. 107-109.
Albert, R. and Barabási, A-L. (1999) Diameter of the World-Wide Web. Nature, 401, pp.130-133.

The shape of the Web

Broder, A. et al (2000) *Graph Structure in the Web*. Computer Networks 33, pp. 309-320.
Meusel, R. et al (2015) *Graph Structure in the Web – Revisited*. In Proceedings of the 14th International World Wide Web Conference. pp. 427–432.

Next Lecture:
Hypertext