



**Trinity College Dublin**

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin

# CSU44000 Internet Applications

Week 1 Lecture 1

Conor Sheedy

# Course Outline

## **What is an Internet Application and how have these evolved?**

- Was it planned?
- Would you get this If you set out to design a system to implement internet applications?
- We need to know a little about the history of the technology
- To understand how it evolved
- What the forces are in this evolution
- we will look at the future direction of internet applications

# Course Outline

## Key Technologies

- HTML
- CSS
- HTTP / HTTPS
- Javascript
- Node.JS
- Node Package Managers

## Cloud Computing Architectures

- Software as a Service (SaaS),
- Internet as a Service (IaaS),
- Platform as a Service (PaaS),
- Serverless Computing

# Course Outline

## **Web Frameworks**

- Angular
- React
- Vue

## **Architectural Patterns**

- E.g. The Model-View-Controller paradigm

## **A simple Cloud-based Internet Application**

## **Database Services**

## **Load Balancing**

## **Scaling & Monitoring**

# Course Outline

**Introduction to Containers**

**Serverless Computing**

**Characteristics and Enabling Technologies for Decentralised Internet Applications**

**Web 3.0**

# Course Assessment

- **Development of an Internet Application**
  - Write a Node.js based REST server with a Vue Front-end
    - using local computing environment
    - In the Lab you will learn some underlying technologies used to develop and deploy Internet Applications
    - You need to document your approach to the developments of the Internet Application, justify each technical decision, referring to the topics covered in the lectures and labs
- **Learn how to Deploy a web service on AWS**
  - A range of technologies and approaches to deploying an Internet Application to the cloud are covered in Lectures and labs.
  - **Quiz** (and/or Submitty) assessing all topics to this point in the course
- **Decentralized Internet Applications**
  - A range of technologies underlying the development of Decentralized Internet Applications are introduced
  - Quiz covering the underlying technologies used in the development of Decentralized Internet Applications

# Course Assessment

Assessment Component	Topics Assessed	Method of Assessment	% of Total
Assessment 1	All technologies required to develop a simple Internet Application	Programming Assignment	40%
Assessment 2	All technologies required to develop and deploy an Internet Application in a Cloud Context. Everything in the course Lectures and Labs except topics relating to Decentralized Internet Applications	Multiple Choice Quiz Or Submittity or both	40%
Assessment 3	All technologies required to develop and deploy a Decentralized Internet Application	Multiple Choice Quiz	20%

# Course Structure

**2 lectures a week**

## **Labs**

- Allow you to build the skills you need for the assessment
- Interact with your peers
- All topics covered in the labs will be assessed
- The last 2 lab sessions will be assessments



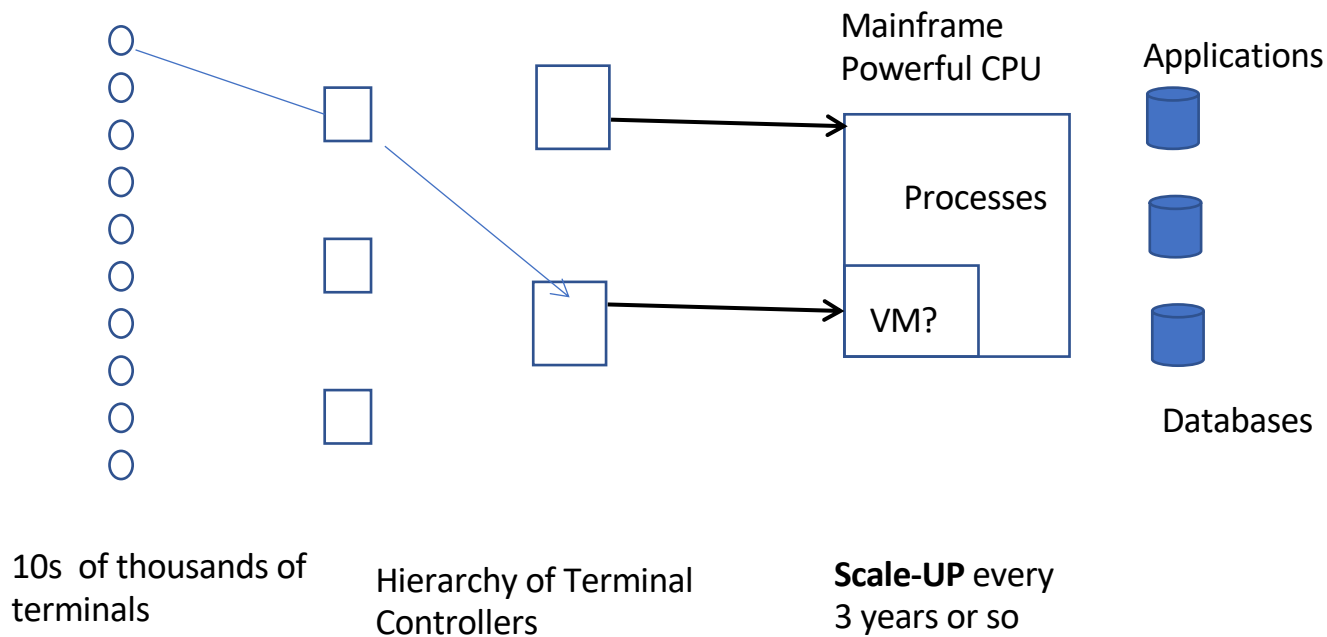
# TCD Calendar

<https://www.tcd.ie/calendar/>

Week	Week beginning	Academic Year Calendar 2023-24
		Undergraduate continuing years / Postgraduate all years
1	28 Aug	<b>Reassessment*</b> (for Semesters 1 and 2 of 2022-23)
2	4 Sep	<b>Orientation</b> (Postgraduate, Visiting, Erasmus) Marking/Results
3	11 Sep	Teaching and Learning
4	18 Sep	Teaching and Learning
5	25 Sep	Teaching and Learning
6	2 Oct	Teaching and Learning
7	9 Oct	Teaching and Learning
8	16 Oct	Teaching and Learning
9	23 Oct	<b>Study/Review</b>
10	30 Oct	Teaching and Learning (Monday, Public Holiday)
11	6 Nov	Teaching and Learning
12	13 Nov	Teaching and Learning
13	20 Nov	Teaching and Learning
14	27 Nov	Teaching and Learning
15	4 Dec	<b>Revision</b>
16	11 Dec	<b>Assessment*</b>
17	18 Dec	<b>Christmas Period</b>
18	25 Dec	(College closed 22 December 2023 to 1 January 2024, inclusive)

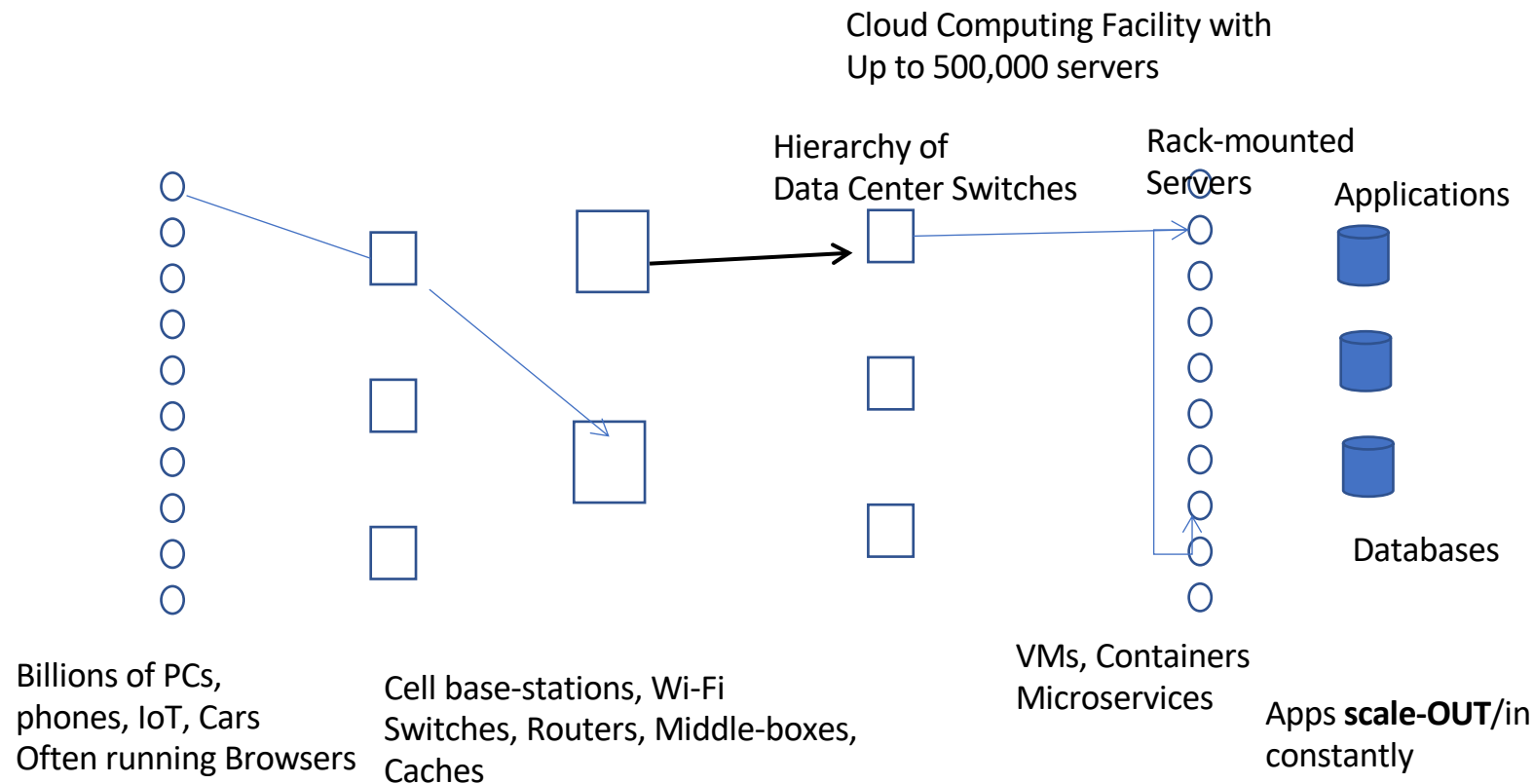
# Large-Scale Computing Application pre 1990

## e.g. Airline Flight Booking



# Large Scale Computing Application in 2020s

## e.g. Search





In 2022 there were about 70 data centers in Ireland that are up and running and 65 of them are in the greater Dublin area.

In 2023 there are 82 data centers

<https://bitpower.ie/index.php/dashboard>

data centers currently use 12 percent of electricity in Ireland, and this could grow to between 21 and 30 percent by 2030.

EirGrid

<https://baxtel.com/data-center/europe>



Quiz: A company serving web-users from a bank of 8 web-servers encounters complaints from users about sluggish database performance

**They respond by adding an extra 100Gb of memory to each of the 8 web-servers and the situation improves**

**Is this :**

- 1 : Scale Out
- Or
- 2: Scale Up

# What is an Internet Application?

**Something that interacts with a user through an Internet Browser – that ‘Does Something’**

**Gmail**

**Google Maps**

**Ryanair Flight Booking**

# World's Most Visited Websites

#	WEBSITE	TIME / DAY	PAGES / DAY	#	WEBSITE	TIME / DAY	PAGES / DAY
01	GOOGLE.COM	8M 03S	10.67	11	TMALL.COM	7M 11S	2.84
02	YOUTUBE.COM	8M 34S	4.95	12	REDDIT.COM	10M 32S	6.84
03	FACEBOOK.COM	9M 25S	3.96	13	INSTAGRAM.COM	5M 41S	3.78
04	BAIDU.COM	7M 13S	5.71	14	LIVE.COM	3M 40S	3.69
05	WIKIPEDIA.ORG	4M 10S	3.11	15	VK.COM	9M 38S	4.66
06	QQ.COM	3M 32S	3.64	16	SOHU.COM	3M 45S	3.98
07	YAHOO.COM	3M 54S	3.55	17	JD.COM	4M 48S	5.49
08	AMAZON.COM	7M 49S	7.65	18	YANDEX.RU	6M 56S	3.28
09	TAOBAO.COM	7M 56S	4.06	19	SINA.COM.CN	3M 04S	3.16
10	TWITTER.COM	6M 20S	3.27	20	WEIBO.COM	5M 51S	4.34

<https://www.youtube.com/watch?v=Ko8Pz4Y-tYo>

<https://www.youtube.com/watch?v=MirrGCbslp4>

# How did we get here?

**Started with the WWW – aimed at browsing Hypertext Documents across the Internet**

**TCP/IP around since 1974**

- first link to Ireland - TCD (June, 1991)

**Internet penetration was primarily to Universities**

- Main application was Email, telnet, (anonymous) ftp etc

**Could find useful data on other Internet sites (software, papers etc) and retrieve it using FTP**

**Hardest part was to discover what is out there – and where?**

- RESOURCE DISCOVERY

**Users at the time (early 1990s) were using a mix of Terminals, PCs (with and without Windows (1985), Mac (1984), X-windows (early 1980s)**



# The World Wide Web

One of the efforts at “Resource Discovery” involved an international group including Tim Berners-Lee at CERN

In December, 1990, They developed:

- HTML – Hypertext Markup Language
  - a stripped down version of the Standard Generalized Markup Language (SGML)
- HTTP - The Hypertext Transfer Protocol
  - An Application Layer Protocol

And Implemented:

- A prototype web-server (CERN httpd)
- The ‘WorldWideWeb’ client
  - (A Browser and Web Editor, later renamed ‘Nexus’)
  - that ran on a NeXT workstation
- The second Browser – Line Mode Browser
  - Portable
  - Experience recreated at:

<https://worldwideweb.cern.ch/>

**Key Point: The WWW was designed for LOOKING at Hypertext Documents**

