CSU44000 Internet Applications

Week 1 Lecture 1

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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 Manager, npm

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 Submitty 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 and a demonstrator

- All topics covered in the labs will be assessed

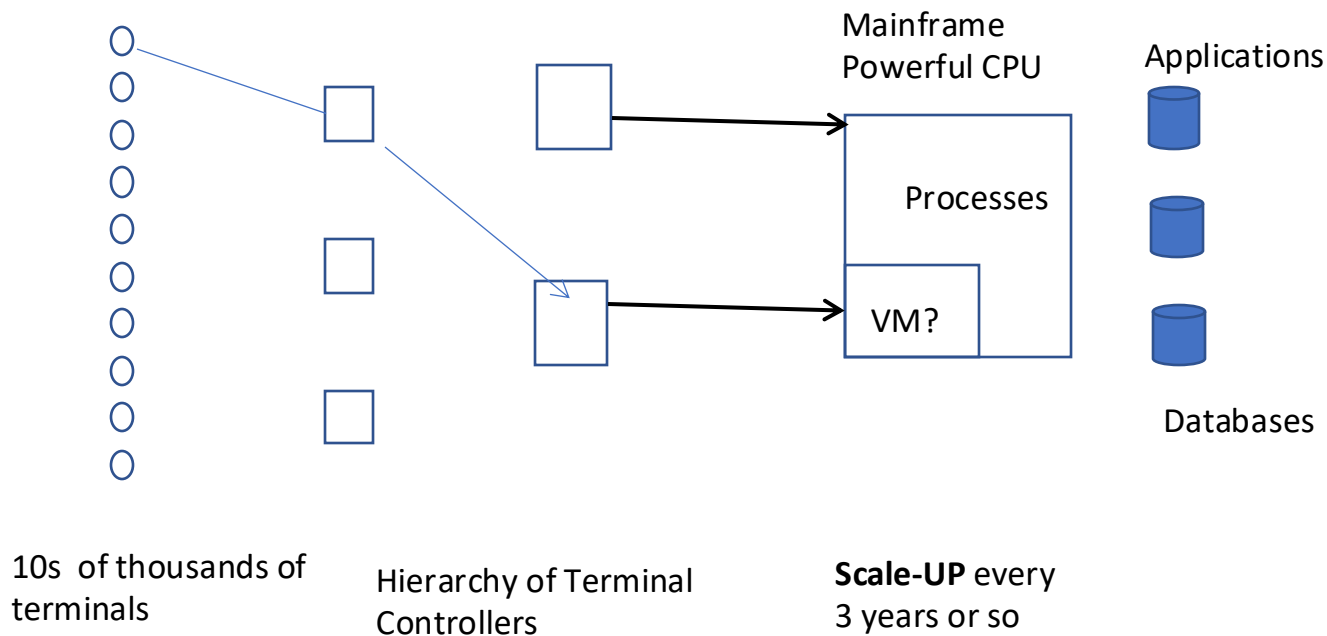- The last 2 lab sessions will be assessments

TCD Calendar

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

Academic Year Calendar (2024-25)

Week	Week beginning	Academic Year Calendar 2024-25
		Undergraduate continuing years / Postgraduate all years
1	26 Aug 2024	**Reassessment** * (for Semesters 1 and 2 of 2023-24)
2	2 Sep 2024	**Orientation** (Postgraduate, Visiting, Erasmus) **Marking/Results**
3	9 Sep 2024	Teaching and Learning
4	16 Sep 2024	Teaching and Learning
5	23 Sep 2024	Teaching and Learning
6	30 Sep 2024	Teaching and Learning
7	7 Oct 2024	Teaching and Learning
8	14 Oct 2024	Teaching and Learning
9	21 Oct 2024	**Study/Review**
10	28 Oct 2024	Teaching and Learning (Monday, Public Holiday)
11	4 Nov 2024	Teaching and Learning
12	11 Nov 2024	Teaching and Learning
13	18 Nov 2024	Teaching and Learning
14	25 Nov 2024	Teaching and Learning
15	2 Dec 2024	**Revision** *[1]
16	9 Dec 2024	**Assessment** *[1]
17	16 Dec 2024	**Christmas Period**
18	23 Dec 2024	(College closed 24 December 2024 to 1 January 2025, inclusive)
19	30 Dec 2024	

Large-Scale Computing Application pre 1990 e.g. Airline Flight Booking

Mainframe
Powerful CPU

Applications

Processes

VM?

Databases

10s of thousands of terminals

Hierarchy of Terminal Controllers

Scale-UP every 3 years or so

Large Scale Computing Application in 2020s e.g. Search

Cloud Computing Facility with
Up to 500,000 servers

Hierarchy of
Data Center Switches

Rack-mounted
Servers

Applications

Databases

Billions of PCs,
phones, IoT, Cars
Often running Browsers

Cell base-stations, Wi-Fi
Switches, Routers, Middle-boxes,
Caches

VMs, Containers
Microservices

Apps **scale-OUT**/in
constantly
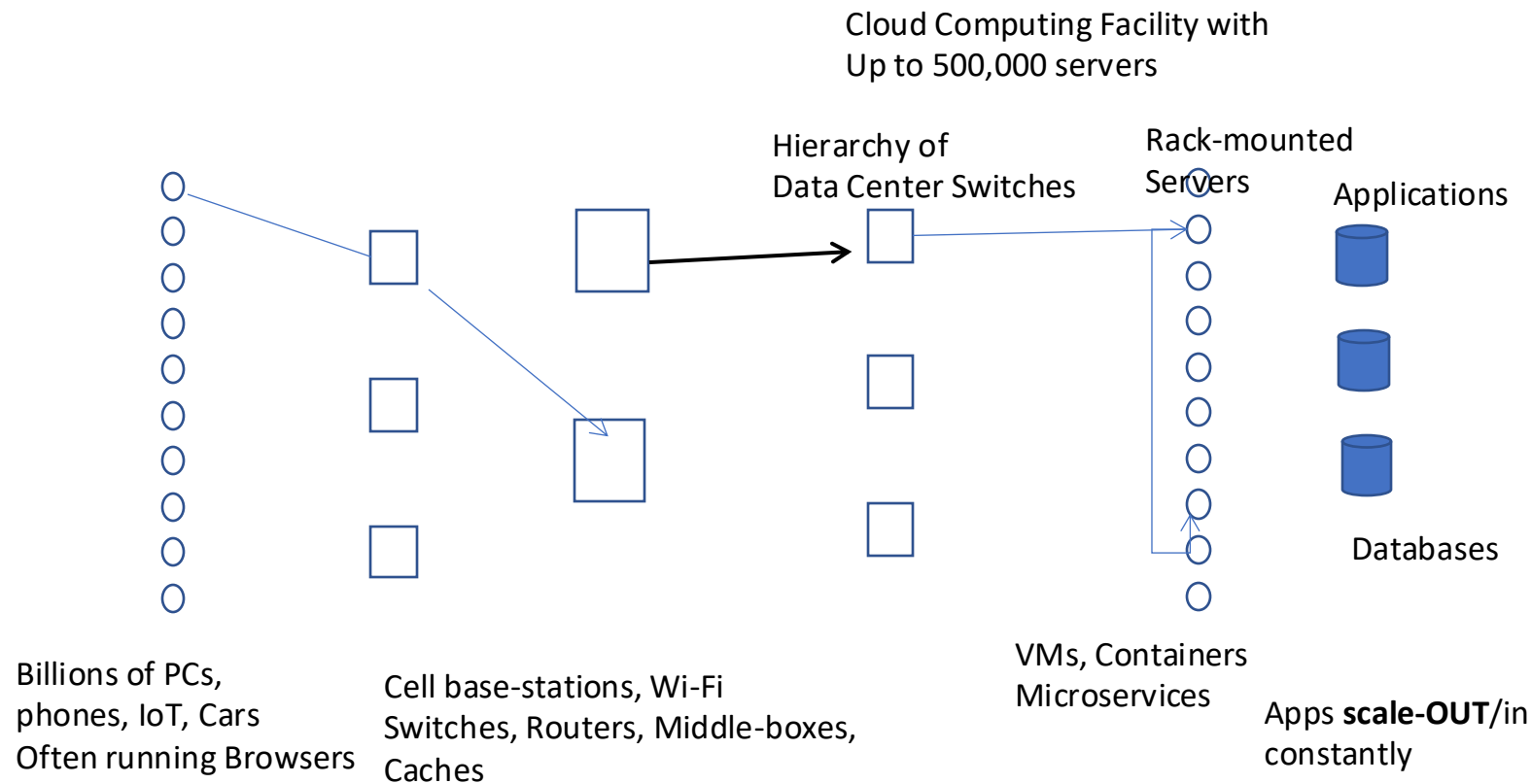
In 2022 there were about 70 data centers in Ireland that are up and running and 65 of them are in the greater Dublin area.

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
01	GOOGLE.COM	8M 03S	10.67
02	YOUTUBE.COM	8M 34S	4.95
03	FACEBOOK.COM	9M 25S	3.96
04	BAIDU.COM	7M 13S	5.71
05	WIKIPEDIA.ORG	4M 10S	3.11
06	QQ.COM	3M 32S	3.64
07	YAHOO.COM	3M 54S	3.55
08	AMAZON.COM	7M 49S	7.65
09	TAOBAO.COM	7M 56S	4.06
10	TWITTER.COM	6M 20S	3.27

#	WEBSITE	TIME / DAY	PAGES / DAY
11	TMALL.COM	7M 11S	2.84
12	REDDIT.COM	10M 32S	6.84
13	INSTAGRAM.COM	5M 41S	3.78
14	LIVE.COM	3M 40S	3.69
15	VK.COM	9M 38S	4.66
16	SOHU.COM	3M 45S	3.98
17	JD.COM	4M 48S	5.49
18	YANDEX.RU	6M 56S	3.28
19	SINA.COM.CN	3M 04S	3.16
20	WEIBO.COM	5M 51S	4.34

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

https://www.youtube.com/watch?v=MirrGCbsIp4

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