

Performance of Computer System

Introduction

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Class times

First two weeks

- Lectures
- Practicals

Friday 13:30-15:05

Tuesday 15:25-17:00

From the third week

- Lectures
- Practicals

Tuesday 15:25-17:00

Friday 13:30-15:05

Grading

- The grades for this module are split between the final exam and all other assessments. This includes practicals, quizzes and assignments
- Breakdown
 - ▶ Final Exam 60%
 - ▶ Other assessment 40%
- Attendance at labs is **mandatory**
 - ▶ If you do not attend the lab, you will get 0
 - ▶ Even if you complete the work

Course Textbook

For this course we will be using the following textbooks

- Art of Computer Systems Performance Analysis Techniques For Experimental Design, Measurements, Simulation And Modeling , by Raj Jain
- Queueing networks and Markov chains: modeling and performance evaluation with computer science applications, by G Bolch, S Greiner, H De Meer and KS Trivedi

It's not all about Textbook

Use any online resource you could find and searching actively... Academic papers, UCD library

Plagiarism

Plagiarism is when you copy another students work and pretend that it is your own

- This is a very serious offence
- Any student caught plagiarising will be reported to the plagiarism committee
- I will give some examples of this later

Assignments and Worksheets

I will set some work for you to complete most weeks. Some rules will apply

- Anything that you submit should be **your** own work
- All work must be submitted by the deadline, I will accept no excuses
- If you have not fully completed the work, you should submit whatever you have done

Contacting me

If you need to contact me about this course, use e-mail. In your e-mail you should include:

- Your name (English or non character Chinese)
- Your UCD student number
- Which module you are asking about

Topics of this Module

This is the list of topics that we are going to study this semester

- What are computer systems?
- General approaches to evaluate such systems
- Specific tools/method used for system evaluations
 - ▶ Workload selection and Characterisation
 - ▶ Analysis of Sample data including Regression analysis
 - ▶ Performance modelling
 - ▶ Simulation
 - ▶ Queuing Theory
 - ▶ Optimisation model

Course Objectives

Learn techniques to approach performance problems

- Identify performance bottlenecks
- Determine the optimal value of a parameter
- Predict the performance of future workloads

Learn mathematical techniques for performance analysis

- Queuing theory
- Linear regression

Understand the use of different analysis strategies

- Measurement
- Simulation
- Analytical modeling

Why We do Performance Analysis

The ultimate goal: to obtain or provide the **highest performance** at the **lowest cost**.

However, the definitions for the “performance” and the “cost” depend on the systems and context

In many cases, the performance and the cost are measured in multiple metric space.

How You Should See the Problem

- What is system?
 - Hardware, software?
- Evaluation techniques
 - Measurement, simulation, analytical modeling
- Metrics to use
 - Criteria used to quantify system performance
- Workload
 - The requests made by the users of the system
- Parameters
 - Include system parameters and workload parameters

One example

Comparison Between WiFi and LTE:

Downloading file size (MB)	LTE	WiFi
3	0.7s	0.1s
10	1.8s	2.1s
30	6.1s	24.3s

Downloading speed

Evaluation Analysis

System: LTE and WiFi communication infrastructure

Evaluation techniques: Real time measurements

Parameters and factors: File size

Metrics: File downloading speed

Workload: Downloading files

Insight of the Results

- Normally comparing average values is not sufficient enough to determine the system performance.
- In which context the system is examined is always critical.

More Statistics

Location Name	(Lat, Long)	# of Runs	LTE %
US (Boston, MA)	(42.4, -71.1)	884	10%
Israel	(31.8, 35.0)	276	55%
US (Portland)	(45.6, -122.7)	164	45%
Estonia	(59.4, 27.4)	124	71%
South Korea	(37.5, 126.9)	108	66%
US (Orlando)	(28.4, -81.4)	92	35%
US (Miami)	(26.0, -80.2)	84	52%
Malaysia	(4.24, 103.4)	76	68%
Brazil	(-23.6, -46.8)	56	4%
Germany	(52.5, 13.3)	40	20%
Spain	(28.0, -16.7)	40	80%
Thailand (Phichit)	(16.1, 100.2)	40	80%
US (New York)	(40.9, -73.8)	24	33%
Japan	(36.4, 139.3)	16	25%
Sweden	(59.6, 18.6)	16	0%
Thailand (Chiang Mai)	(18.8, 99.0)	16	75%
US (Chicago)	(42.0, -88.2)	16	25%
Hungary	(47.4, 16.8)	8	0%
Italy	(44.2, 8.3)	8	0%
US (Salt Lake City)	(40.8, -111.9)	8	0%
Colombia	(7.1, -70.7)	4	0%
US (Santa Fe)	(35.9, -106.3)	4	0%

Geographical coverage and diversity of the crowd-sourced data collected from 16 countries using Cell vs WiFi, ordered by number of runs collected. The last column shows the percentage of runs where LTE throughput is higher than WiFi.

From paper "WiFi, LTE, or Both? Measuring Multi-Homed Wireless Internet Performance" 