Data Centric Systems and Networking (DCSN)

Session 1: Introduction to R212

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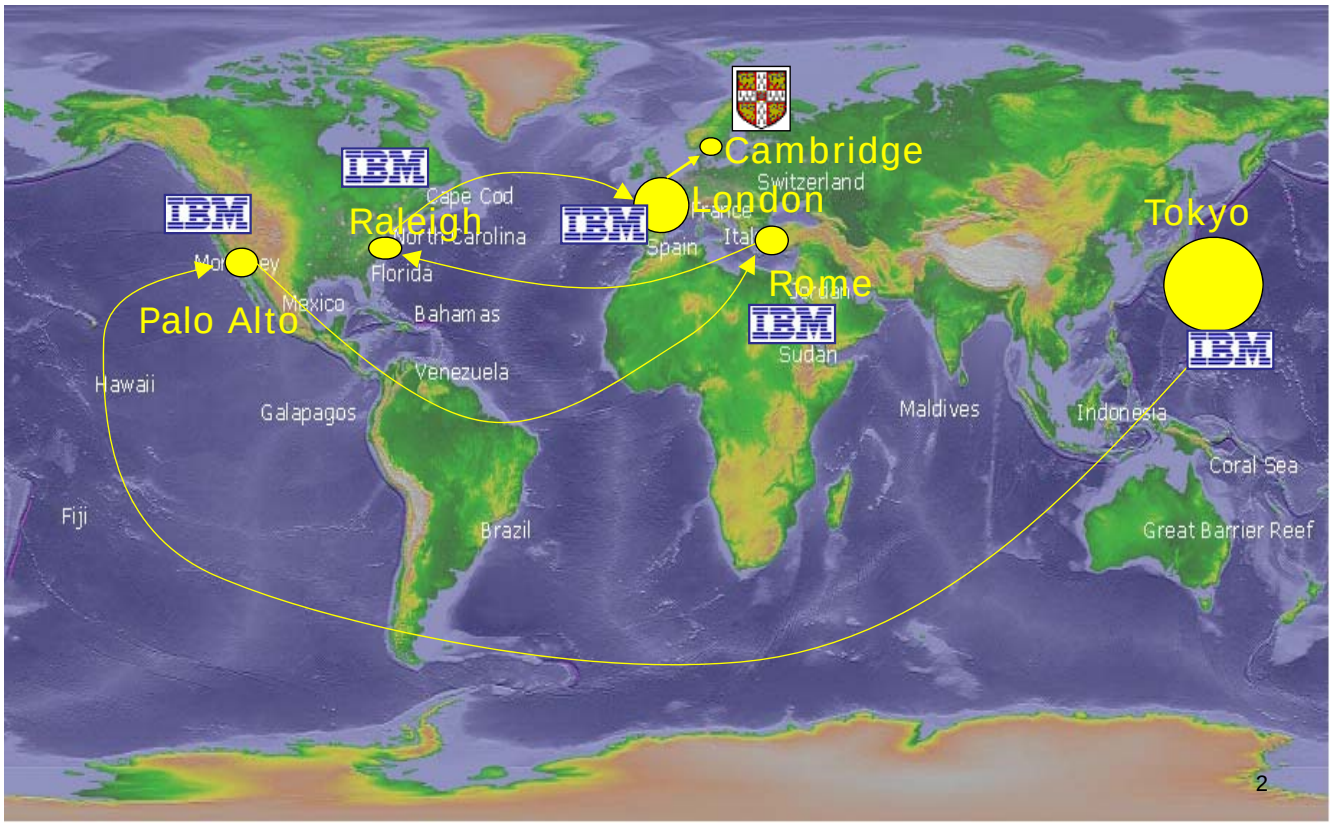
My Trajectory



My Research Interests

- Spanning over Distributed Systems, Networking and Database
- Current Focus: Large-Scale Graph Processing
- MPhil project Suggestions

http://www.cl.cam.ac.uk/~ey204/teaching/Projects/2014_2015

My Group: Data-Centric Systems

Digital Epidemiology

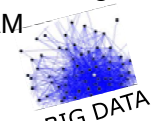
- Real world mobility data collection in Africa
- Analyse network structure to understand infectious disease spread
  - Multiple modes of spread in time

Content Distribution Networks

- Build self-adaptive CDN to understand behaviour in content networks
  - Use cognitive science (e.g. EEG, Eye Tracking)
- Enhanced content distribution with social diffusion information

Graph Specific Data Parallel

- Fast, flexible, and programmable graph processing
- Cost effective but efficient storage
  - Move to SSDs from RAM
- Reduce latency
  - Runtime prefetching
  - Graph algorithm specific runtime
  - Dynamic CPU/GPU scheduling
- Reduce storage requirements
  - Compressed adjacency lists
- Build efficient data analytic framework without huge computing resources
- Search/update real time (Graph DB)



Introduction to R212

- Welcome to R212
- First introduce yourselves
  - Tell about yourself
    - Your name and where you studied before ACS
    - What is your research interests (topics)
    - What is potential your ACS project
    - Why are you interested in R212

R212 Course Objectives

- Understand key concepts of data centric approaches
- Understand how to build distributed systems in data driven approach
- Research skills
  - Establish basic research domain knowledge in data centric systems
  - Obtain your view of research area for thinking forward

Course Structure

- Reading Club
  - ~3 or 4 Paper review presentations and discussion per session (~=20 minutes presentation + discussion)
  - Each of you will present about 2 reviews during the course
    - Revised (if necessary) presentation slides needs to be emailed on the following day
  - *Review_Log*: minimum 1 per session
    - Email me by noon on Sunday before
    - Prepare a couple of questions
  - Active participation to review discussion!

Review_Log

Paper Review Log: Session x (2014/xx/xx)

Name and (crsid):

Paper Title and Authors

1. Paper Summary (<100 words)
Describe a brief summary (extract essentials).

2. List other papers you read or skimmed for understanding this paper

3. Punch-line of the Paper (<250 words):
What is the significant contribution?
What is the difference from the existing work?

4. What didn't you understand?
Crystallise what you did not get from the paper and describe your potential questions to the presentation/discussion.

5. Any major criticism to the authors?
Any criticism and suggestions to the authors?

Review_Log

1. Paper summary (<100 words)
   - Describe a brief summary
   - Aim: you have read and extracted essentials
2. List other papers you read or skimmed
3. Punch-line of the Paper (<250 words)
   - What is the significant contribution?
   - What is the difference from the existing works?
   - What is the novel idea?
   - What is required to complete the work?
4. What didn't you understand? (<100 words)
   - Crystallise what you did not get from the paper and describe your potential questions to the presentation/discussion
5. Any major criticism to the authors?

Course Work: Reports 1&2

- Review report on full length of paper (1800 words ~3 pages)
  - Describe the contribution of paper in depth with criticism
  - Crystallise the significant novelty in contrast to the other related work
  - Suggestion for future work
- Survey report on sub-topic in data centric networking (<2000 words)
  - Pick up to 5 papers as core papers in your survey scope
  - Read them and expand your reading through related work
  - Comprehend your view and finish as your survey paper
- Hand in reports
  - Report 1: November 14 noon
  - Report 2: November 28 noon
  - No particular order

Study of Open Source Project

- Open Source project normally comes with new proposal of system/networking architecture
- Understand the prototype of proposed architecture, algorithms, and systems through running an actual prototype
- Any additional work
  - Writing applications
  - Extending prototype to another platform
  - Benchmarking using online large dataset
- Present/explain how prototype runs
- Some projects are rather large and may require extensive environment and time; make sure you are able to complete this assignment

Course Work: Reports 3

- Report on project study and exploration of a prototype (<2500 words)
  - Project selection by October 31, 2014
    - Title and brief description (100 words) by email
  - Project presentation on December 1, 2014
  - Final report on the project study on December 19, 2014

Candidates of Open Source Project

http://www.cl.cam.ac.uk/~ey204/teaching/ACS/R212_2014_2015/opensource_projects.html

- List is not exhausted and discuss with me if you find more interesting one for you
- Expectation of workload on open source project study is about intensive 3 full days work except writing up report
- One approach: pick one in the session topic, which you are interested in along your survey report
- Apache Giraph, Naiad, Spark, GraphLab, CIEL…

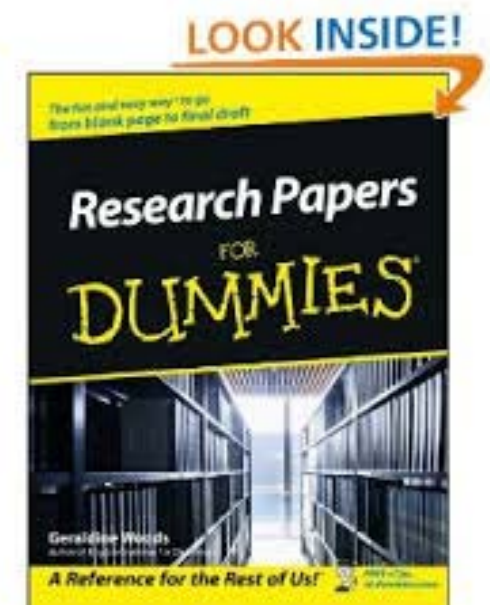
Important Dates

- October 31 (Friday)
  - Project selection
- November 14 (Friday)
  - Review report or Survey report
- November 28 (Friday)
  - Review report or Survey report
- December 19 (Friday)
  - Open source project study report

Assessment

- The final grade for the course will be provided as a letter grade or percentage and the assessment will consist of two parts:
- 20%: for a reading club (presentation, participation and *review_log*)
- 80%: for the three reports
  - 20%: Intensive review report
  - 25%: Survey report
  - 35%: Project study

How to Read a Paper?



How to Read a Paper?

- Scope of DCSN is wide
- ...includes distributed systems, OS, networking, programming language, database...
- Type of papers
  - Building a real system
  - Proposing algorithm/logic on architecture design
  - New idea

Critical Thinking

- Reading a research paper is not like reading a text book
- But the most important one is that the paper is not necessary the *truth*
  - there is no right and wrong, just good and bad
  - There are inherently subjective qualities...but you can't get away with just your opinion: must argue
- Critical thinking is the skill of marrying subjective and objective judgment of a piece of work

First Let's Argue for…

- What is the problem?
- What is important?
- Why isn't it solved in previous work?
  - Why graph specific parallel processing? MapReduce is not good enough?
- What is the approach?
  - Graph specific MapReduce
- Why is this novel/innovative?
  - Iterative operation for graph parallel

And Now against…

- Problem is overstated (or oversold)
- Problem does not exist
- Approach is broken
  - It does not work for all the algorithms…
- Solution is insufficient
  - Only works when data is in memory…
- Evaluation is unfair/biased
  - Use HPC for experiment

So Which is RIGHT Answer?

- There isn't one!
  - Most of arguments are mostly correct…
- Your judge on what is valuable on topic
- In this course, we'll be reviewing a selection of ~15 papers (3-4 per week)
  - All of these papers were peer-reviewed and published
  - However you can pick your opinion on papers!

Reviewing Tips & Tricks

- Identify a core/major idea of the topic
- Read related work and/or background section and read key other papers on the topic
- Capture the author's claim of contribution in *introduction* section and judge if it is delivered
- Understand the methodology that demonstrates paper's approach
- Capture what authors evaluate and judge if that is a good way to evaluate the proposed idea
- For theory/algorithm paper, capture what it produces as a result (rather than how)

Key in Review Comments

- What do YOU think?
  - Where you finally get to explain your opinion!
  - You should aim to give *a judgement* on the work
  - Your judgement should be backed by your argument
- Questions for the authors

How to Review a Paper Aid...

- S. Keshav: How to Read a Paper, ACM SIGCOMM Computer Communication Review 83 Volume 37, Number 3, July 2007.
- T. Roscoe: Writing Reviews for Systems Conferences, 2007.
- Simon Peyton-Jones: How to write a great paper and give a great talk about it, Microsoft Research Cambridge.
- David A. Patterson: How to Have a Bad Career in Research/Academia, 2001.

See course web page for the paper links.

Structure of Presentation

- Cover 3 things in your presentation

1. Background/context
   - What motivated the authors?
   - What else was going on in the research community?
   - How have things changed since?
2. What is problem to be tackled?
   - What is the problem they tried to solve?
   - What are the key ideas?
   - What did the authors actually do?
   - What were the results?
3. Your opinion of the paper
   - What you agree and what you disagree?
   - What is the strength and weakness of their approach?
   - What are the key takeaway?
   - What was the impact (possible impact)?

Preparing…

- Not too much basics: remember, others will have read the paper
  - Brief overview
  - Do not make exact repeat of the paper

- Aim: generate discussion – spit your straight opinion about the paper to stir the discussion
  - Explore the arguments they make and the conclusions they draw. What is your opinion on it?
  - When you argue, state clearly the point of argument

Presenting…

- Practice beforehand to ensure length of your presentation

- Getting nervous is normal!
  - We are in the same boat and we help each other to understand the paper
  - Presentation is a tool to provide a discussion forum
- Try not to get defensive or angry at questions
  - It is not your paper !

Listening Presentation…

- You need to get involved

- Ask questions from your review – bring your *review_log* copy
- Always be respectful of the speaker

How to Write Reviews (Report 1)

- Paper Summary
  - Provide a brief summary of the paper
  - At this stage you should try to be objective
- Problem
  - What is the problem? Why is it important? Why is previous work insufficient?
- Solution or Approach
  - What is their approach?
  - How does it solve the problem?
  - How is the solution unique and/or innovative?
  - What are the details?
- Evaluation is unfair/biased
  - How do they evaluate their solution?
  - What questions do they answer?
  - What are the strength/weakness of the system and evaluation itself?

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How to write Survey paper (Report 2)

- Demonstrate a summary of recent research results in a novel way that integrates and adds understanding to work in the research area
- Must expose relevant details associated, but it is important to keep a consistent level of details and to avoid simply listing the different works
- For example:
  - Define the scope of your survey
  - Classify and organize the trend
  - Critical evaluation of approaches (pros/cons)
  - Add your analysis or explanation (e.g. table, figure)
  - Add reference and pointer to further in-depth information

Summary

- R212 course web page:

  http://www.cl.cam.ac.uk/~ey204/teaching/ACS/R212_2014_2015

  Email: eiko.yoneki@cl.cam.ac.uk

- Slides of presentation, forms, other information will be on the web

Topic Areas

Session 1: Introduction

Session 2: Programming in Data Centric Environment

Session 3: Processing Models of Large-Scale Graph Data

Session 4: Map/Reduce Hands-on Tutorial with EC2

Session 5: Optimisation in Graph Data Processing
+ Guest lecture

Session 6: Stream Data Processing + Guest lecture

Session 7: Scheduling Irregular Tasks

Session 8: Project study presentation