Internet-scale Experimentation

Today

- Welcome
- Class organization and guidance
- Some good advice
The state of affairs

- An ever growing Internet ~ 3 billion people!
- More, ever-lager Internet-scale systems – FB, Skype, Twitter, Google, Akamai, Amazon, Netflix …
- Society’s increased dependency on them
- We still
  - Can’t predict the behavior of large-scale systems
  - Can’t trust their security, performance, resilience, …
  - Don’t know how the network underneath looks like
  - …
Answers from experimentation

- Other reasons for measurement and experimentation
  - Technical – Designing network components and protocols
  - Commercial – Demographic, performance properties
  - Social – Statistics on network activities, characterizing popularity and content

- But not without challenges
  - *How to do experimentation at Internet-scale?*
  - *What’s representative?*
  - *What’s reproducible?*
  - ...
Our goal

- To explore the challenges with Internet-scale experimentation and strengths/weaknesses of existing and proposed experimental platforms

- A higher level goal – learn research by doing
  - Reading research papers
  - Discussing them in depth
  - Presenting research ideas (yours and others)
  - Picking a research project and executing it
  - Writing a research paper
Class structure

- **Meetings**
  - Read research papers
  - Present research ideas
  - Learn about ongoing work

- **Take part of a mini-conference**
  - *You* as the Program Committee
  - Part of our reading list as the submissions
  - Task – review 3-4 papers and discuss them in a PC meeting

- **Project**
  - Come up with fresh idea, we can brainstorm together
  - Research, build, test, …
  - Write a report/paper on your project
  - Present it to the class
What it means to you

- Reading and class discussion (10%)
  - About 34 papers over the quarter (~4 papers per week), but you can “quickly” read most of them

- Writing reviews and discussing papers as part of a program committee (20%)
  - 4 reviews over the quarter

- Presenting papers (20%)
  - 2 paper presentations, one on each “side” of the midterm

- Working on a project (50%)
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Reading papers – why and what to read

- Why reading?
  - For a conference or a class
  - To learn a new field
  - To keep up to date

- Way too many papers
  - SIGCOMM ~32
  - IMC ~42
  - CoNEXT ~31
  - ...
  - Per year >200 papers on your area

- Deciding what and how to read – determine your goal
  - To learn about a hot topic, to get up to speed on a subfield, to learn a new area, ...
Reading papers – how to read

- Top-down
  - Abstract, intro, conclusions
  - Rest if necessary (to do follow-up research, …)

- Next steps depend on specific goals
  - News reading, deep diving, literature survey

- Invariant comprehension questions
  - What is the problem? What are the contributions? What are the conclusions? What is the support for the conclusions?

- Invariant evaluation questions
  - What’s the intellectual nugget? What’s the main conclusion/contribution? Why is that important? Does the content support it?

- Take notes
  - Highlight major points, definitions, construct an example, …
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Reading, reviewing, discussing

- Taking part of a mini-conference as a PC member
  - Practice reviewing papers

- How does it work?
  - State your preferences
  - Papers assigned based on them
  - Each paper will receive 2 reviews, you will write ~4 (32 papers * 2 reviews / 17 students)
  - Discuss papers in a two-part PC meeting

- To do next – read the linked papers on reviewing
  - Mark Allman’s Thoughts on reviewing
  - Timothy Roscoe’s Writing reviews for systems conferences
  - Register with HotCRP (find it in the course website)
Review form

- Overall merit
- Reviewer confidence
- Paper summary
  - Showing you understood the paper
- Paper strengths and weaknesses
  - Short sentences to the point
- Comments for authors
  - Details, avoid English/grammar/style (unless it gets offensive)
- Comments for PC
Reviewing papers

- Goal is to
  - Determine a paper’s suitability for a conference – WINE is very, very open!
  - Provide feedback to improve it

- Things to ask
  - Does the paper make a significant contribution: Surprising results? Would the paper spur new research? Are the ideas clearly explained?

- Consider the audience and the standards

- Process
  - Read first for main ideas
  - Read it again and take notes
  - Start organizing your review
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Giving a good research talk ...

- Not easy – some guidelines
- The talk is just a taster, not an in-depth treatment of the work but intended to stimulate interest
  - Who is your primary audience? *Easy to do in our case*
  - If they remembers one thing from the talk, what should it be?
- Think of what motivated you (or the authors)
  - Use examples to motivate the work and approach
  - Use examples to illustrate your points
- Saying enough without saying too much
  - Enough to convey your ideas, not to much to overwhelm your audience – follow a non-uniform approach
To include in your presentation

- Motivation
- Structured related work/background
  - What does the paper build on?
- Main ideas
- Evaluation approach
- Summary of key results
- Moving forward
  - Open issues
  - How has the paper been built on/cited/used?
Giving a good research talk

- Don’t put too much on the slide
  - Prune multiple times
  - People can only take very limited info per slide: 5+/−2 things
  - Just one figure per slide!
  - Don’t repeat what you plan to say
  - Use the slide header when possible
- Consider dropping the “overview/roadmap” slide
- Mind the time!
- ...
- Pick papers to present and email me
- We need 4 presenters for next week
  - Incentive, you will have 1 less paper to review
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Project

- One single project – critical part of the course – 50%
- Your goal
  - Experiment with/measure an interesting system or property
  - Present your results at the end of the course
  - Write project up in a term paper
- Teams of 2+ people; based on topics you will be assigned a project leader (could be me or somebody from outside the class)

- To keep in mind …
  - Paper registration / Submission: April 29 / May 6
From reading to research

- How can we get new ideas from studying papers describing solved problems?!

- Questions to ask
  - Unfinished business? Look for future work, directions, things not tried, open problems
  - Time – Revisiting old solutions in new, always different environments
  - Context – Good (and not so good) solutions in a different context (server replica selection from wired Internet to cellular networks)
  - Removing assumptions
Schedule

- Form a group – Jan 6-8
- Project meeting with me – Jan 13-15
- Project initial presentation – Jan 20-22
- Midterm presentation and report – Feb 10
- Project meeting with me – *Once a week, 30’*
- Final presentation – Finals week
- Final report due – Finals week

  - HotNets format: *submissions should contain six or fewer two-column pages, including all figures and references, using 11-point fonts, standard spacing, and 1-inch margins.*
Light project presentations

- **Initial presentation – 4-6 slides**
  - Project name & team members
  - What is the research contributions of the project? List of new/interesting concepts to explore
  - Why do we care if you are successful?
  - Project milestones and schedule for the rest of the quarter

- **Midterm presentation and report – 4-6 slides**
  - Project name & team members
  - Revised statement of project goals and list of new/interesting concepts to explore
  - List of issues addressed and pending
  - Updated project milestones, highlighting accomplishments to date, and schedule for the rest of the quarter

- **Final presentation – ~15’ based on final report**
Final report

- **Abstract**
  - *What did you do, why is important & what are your high-level results?*

- **Problem statement**
  - *What is the problem you tried to solve?*

- **Prior work**
  - *How has the problem being dealt with before? Why was that not enough?*

- *...*
Final report

- ...
- Research approach
  - Approach to solving the problem? What did you design, built? What was your evaluation methodology?
- Results
  - How did you evaluate the work? What were your figures of merit?
- Lessons learned and future work
  - What would you have done differently? What’s left for future work?
- Summary and conclusions
Summary and next time/Todo

- **Summary**
  - You’ll read in depth about 6 papers
  - Write reviews for 4 of them
  - Skim++ another ~20-30
  - Do two presentations
  - Work in a project with a team

- **You’ll learn**
  - How to do experimentation at Internet scale
  - What’s the state of the art and what are some of the open issues?
  - How to do reviews, present at a conference, discuss papers, carry on a research project …

- **Form a group if you haven’t already! Start reading**