ACS/Part III R209
Computer Security: Principles and Foundations

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Today's Class

1. Module introduction
2. Paper: *Protection of Information in Computer Systems*
3. Paper: *Using Encryption for Authentication in Large Networks of Computers*
4. Discussion: security motivations and methodology

Welcome!

- *Seminar-style* research readings module
- R209: Principles and Foundations (Michaelmas)
  - History, discourse, methodology, and themes
  - Topics include local systems, crypto/protocols, human factors, and economics
- R210: Current Research and Applications (Lent)
  - Guest conveners lead sessions on current research topics (usually current or past lab researchers)
  - E.g., censorship resistance, tamper-proof hardware…
- Ambitious scope, limited time

Prerequisites

Goal: transition from ‘factual’ understanding to engagement with core debates, intellectual history, methodology, and evolution of the field

- Undergraduate degree in computer science
  - Or similar education/experience
  - Basic background in computer security
  - Also beneficial: OS, networking, programming languages…
- Some topics familiar, but cast as research not ‘fact’
- Other topics will not yet be widely taught

Brushing up on computer security

Anderson, R. J., **Security Engineering** (2nd edition), Wiley, 2008.

Gollmann, D., **Computer Security** (3rd edition), Wiley, 2010.

McKusick, M. K., Neville-Neil, G. N., and Watson, R. N. M., **Design and Implementation of the FreeBSD Operating System** (2nd edition): *Chapter 5 – Security*, Pearson, 2014.

Seminar-style teaching (1)

- Preparation for research and development
  - Trace intellectual history
  - Study evolving vocabulary and discourse
  - Appreciate (+critique) research as published
  - Consider contemporary implications
  - Contrast with original research context
  - Discuss future research directions
- Student-led discussion is critical to this format

Seminar-style teaching (2)

Each week you will:

1. Critically read three original papers/reports

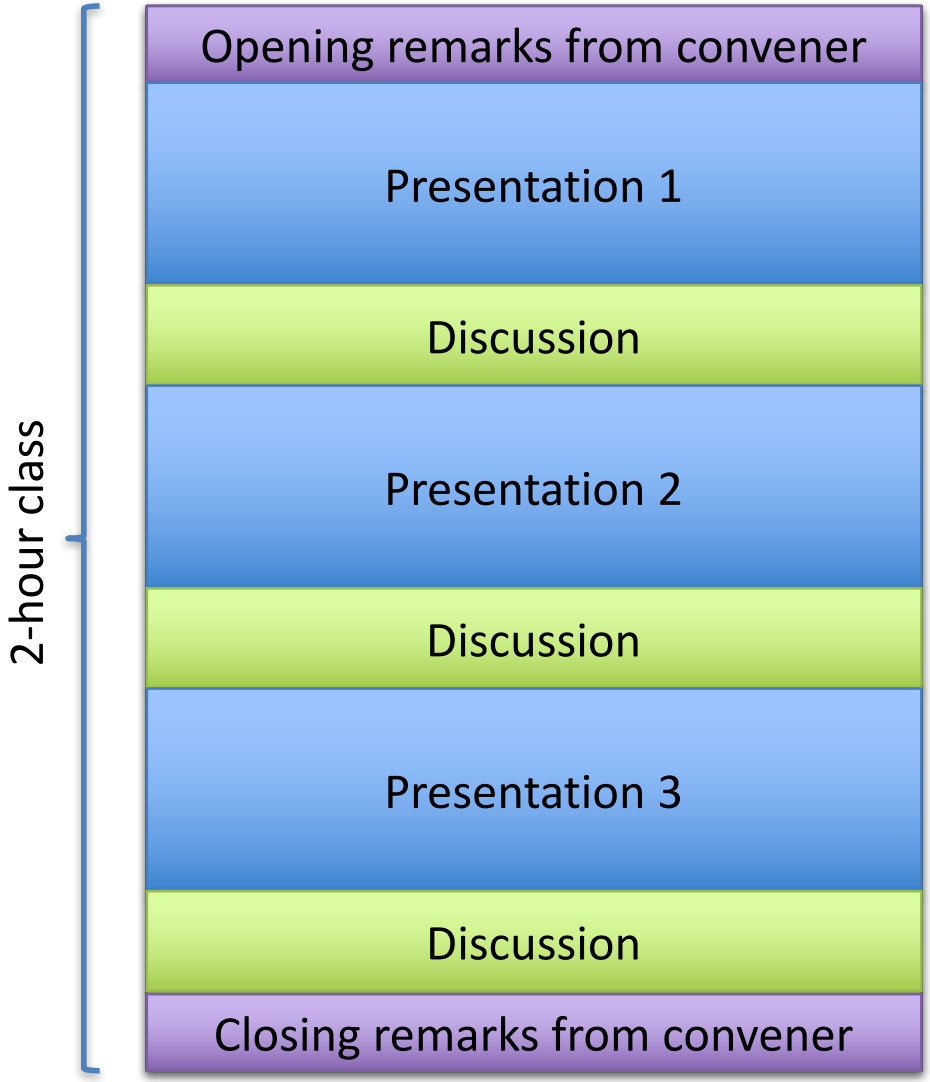
2. Submit synthesis essays across all readings

or

2. Present and lead discussion on a specific reading

3. Participate in classroom discussion of the readings

Typical class structure



- 3x 15-20-minute student presentations **(do not run shorter/longer!)**
- 3x 10-15-minute student-led discussions
- Discussions are cumulative: pull ideas forward as we look at later papers

Assessment

- One presentation or essay a week
  - R209: Seven total (none today)
  - R210: Eight total (hit ground running)
- Marking
  - 10 marks per assessed essay or presentation
  - **Lowest mark** each term will be dropped (usually the first)
  - Remaining scores scaled to a total out of 100
- Department aggressively penalizes late submissions
  - Instructors cannot grant extensions
  - Contact the graduate education office **as early as possible**

WEEKLY ESSAY

Synthesis Essays

- *Synthesis writing* reports, organizes, interprets works of others
  - **Not an original research paper!**
  - More a formulaic series of short answers than an actual essay

- Your essays will have the following sections headings:

1.	**Summaries of readings**	(1-2 para/reading)
2.	**Three key themes spanning papers**	(1 para/theme)
3.	**Ideas in our contemporary context**	(2 para)
4.	**Brief literature review**	(2 para)
5.	**Proposed discussion questions**	(4 bullet points)

- All essays **must** include a bibliography
- NB: word limit (1,500) enforced; see the website for details

Notes on essay marking

- 10 divided equally across each of five sections

0	failed to submit
1-4	seriously lacking
5-6	poor or (minimally) adequate
7-8	good
9-10	exceptional

- First essay will likely have a lower mark than you hope
- If so, it will probably be dropped as the lowest

Essay Submission

- Deadline 12:00 on the Friday before we meet *
- Submit on paper to the graduate education office
- E-mail as PDF to: cl-acs-r209-essays@lists.cam.ac.uk

- Bring discussion questions to class and be prepared to ask (and answer) them

- Marks/comments returned via the graduate education office; we usually e-mail them as well
- We attempt to return essays to you within two weeks, but sometimes this is not possible

* Except for the first essay, which is due next Monday at 12:00 to give you a full week.

Weekly Presentations

- 7 sessions, 3 talks/session, **15-20 minutes each**
  - You will present at least once per term
  - No essay due for classes where you present
  - Do not run much shorter or longer than 17 minutes!
  - 10 marks per presentation; similar criteria to essays

- Initial presentation schedule has been e-mailed
  - If you like, you can exchange presentation slots…
  - Both students must agree; let us know in advance

Presentation Structure

- Prepare a teaching- or research-style presentation
  - ⟶ What motivated the work?
  - ⟶ What are the key ideas?
  - ⟶ How were scientific ideas evaluated?
  - ⟶ Critique the argument/evaluation
  - ⟶ Compare to related research – especially other readings
  - ⟶ Consider current-day research and applications
  - ⟶ Prepare for adversarial Q&A – defend the work

- Don’t just follow paper outline
- Slides without pictures (e.g., this one) are uninspiring!

Your Slides

- You will present with slides
  - All presentations will be on our computer
  - Slides will be in **PDF format** – no fancy animations
- Submit slides by e-mail no later than 12:00 on the Monday to cl-acs-r209-slides@lists.cam.ac.uk
  - Also submit on paper to graduate education office
  - Failure to prepare or submit will be heavily penalized due to disruption it will cause
- Usually presented in roughly syllabus order

Class Discussion

- Roughly half of each two-hour class is set aside for discussion
  - Bring discussion questions to class and be prepared to ask (and answer) them
- No explicit marks for participation…
  - … but presenter is rewarded for interesting discussion, so mutual benefit to participating!

READING

About the Readings

- Original research papers or early surveys
  - Highly cited and/or first appearance of key ideas
- Questions to consider (in advance)
  - Why have the authors done this work?
  - Has it aged well? Are the ideas used today?
  - How would we attack the system they propose?
  - Are they Science? Engineering? Mathematics? How does this affect the style, evaluation, etc.?
  - Why did we pick this paper and not another?
  - Is there a retrospective piece?

How to Read (a Lot)

- Read strategically
  - Plan ahead for the time it takes to read and digest papers
  - Skim in the first pass to decide what is important
  - Take notes in moderation
  - With practice, you will get much faster at reading papers
- As you read, highlight ideas that answer key questions:
  - Framing/motivation of the paper
  - Key ideas that influenced the paper / related work
  - Key contributions of the paper – and their implications
  - Evaluation approach, limitations
  - Common themes and ideas across the papers
- See Keshav's "How to Read a Paper", CCR 2007

ADMIN THINGS

Module E-mail and ‘Hangers On’

- We will e-mail reading and schedule updates, clarifications, room changes, etc. there!
  - We will use your CRSid (via a class mailing list)
  - If you are not registered, but are sitting in, please e-mail robert.watson@cl.cam.ac.uk
- Recurring guests (e.g., PhD students, RAs) will be asked to present 1-2 times during the term
  - E-mail me to talk about which papers

Module Website

- Reading list, marking criteria, etc. found here:
  https://www.cl.cam.ac.uk/teaching/1617/R209/
- Beginnings of next term's website here:
  https://www.cl.cam.ac.uk/teaching/1617/R210/
- Look at the 'Materials', 'Assessment' pages
- Model, including presentations/essays/etc, remain the same for R210

How to Reach Us

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ross.anderson@cl.cam.ac.uk

daniel.thomas@cl.cam.ac.uk

Essays: cl-acs-r209-essays@lists.cam.ac.uk

Slides: cl-acs-r209-slides@lists.cam.ac.uk

R209 Weekly Meetings

Date	Topic	Convener(s)
10 Oct	Origins and Foundation of Computer Security	Watson, Anderson, Beresford
17 Oct	Adversarial Reasoning	Anderson
24 Oct	Access Control	Watson
31 Oct	Capability Systems	Watson
7 Nov	Security Economics	Anderson
14 Nov	Passwords	Stajano (guest convener)
21 Nov	Cryptographic Protocols	Anderson
28 Nov	Correctness vs. Mitigation	Thomas

R210 Weekly Meetings
(last year's, but a good predictor)

Session	Topic	Convener
1	Covert and Anonymous Communications	Murdoch
2	Bootstrapping Security Relationships	Stajano
3	Mobile-System Security	Beresford
4	Censorship Resistance	Khattak
5	Psychology and Security	Anderson
6	Banking Security	Anderson
7	Vulnerability Management	Leverett
8	Hardware Security and Tamper Resistance	Skorobogatov

QUESTIONS

INTRODUCTIONS
WHAT IS SECURITY?

TODAY'S READINGS