Computer Security

Introduction, history, today, and terminology

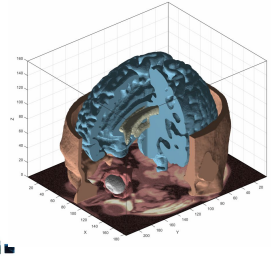
Dr Chris Willcocks

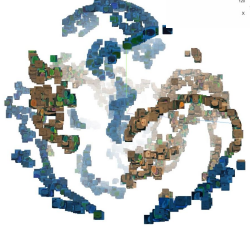
Durham University

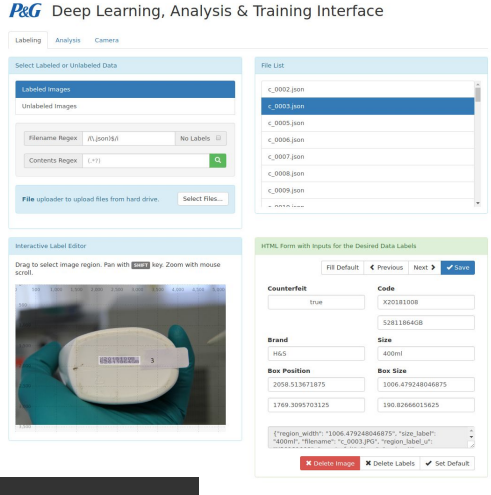
About me

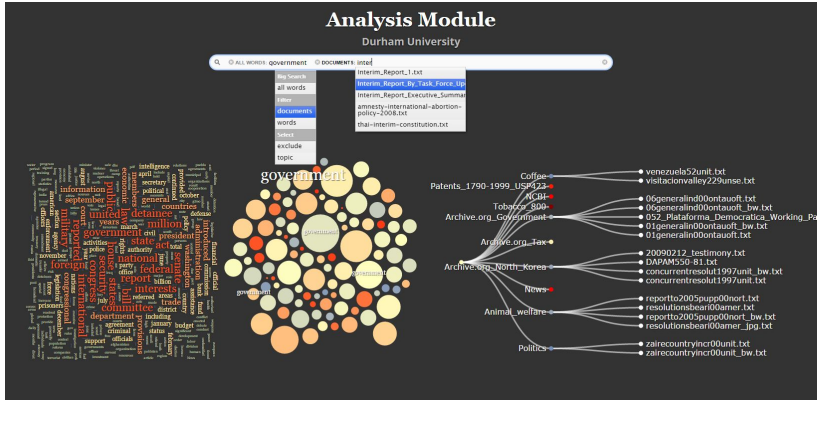
- Worked on various industry projects
- Government (defence) projects
- Medical projects with sensitive data
- Multi-user counterfeiting

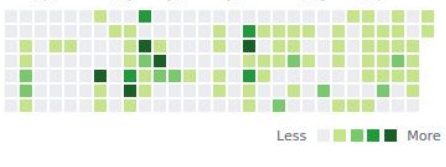
1. DSTL
2. P&G
3. Unilever
4. Dyson
5. AstraZenica











Introduction to the course

- New course with 10 lectures
- 4x 2-hour practicals
    1. Building a secure system
    2. Hacking the system
    3. Securing the system from the vulnerability
    4. Hacking the system again with a smarter method
    5. Repeating
- Summative assignment
    1. Given **early on** teaching week 2.
    2. Due on teaching week 9 (**3rd December**).

WARNING: Not everything you can technically do is **legal**!

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You will learn things in this module that are technically possible. **But**!

Nothing here is intended as an incitement to crack.

Breaking into systems to “demonstrate” security problems best causes a headache to overworked sysadmins, and at worst compromises the system for many users and could lead to **prosecution**.

If you spot a security hole, **don’t exploit it**, instead report it to the relevant administrators confidentially.

What is computer security?

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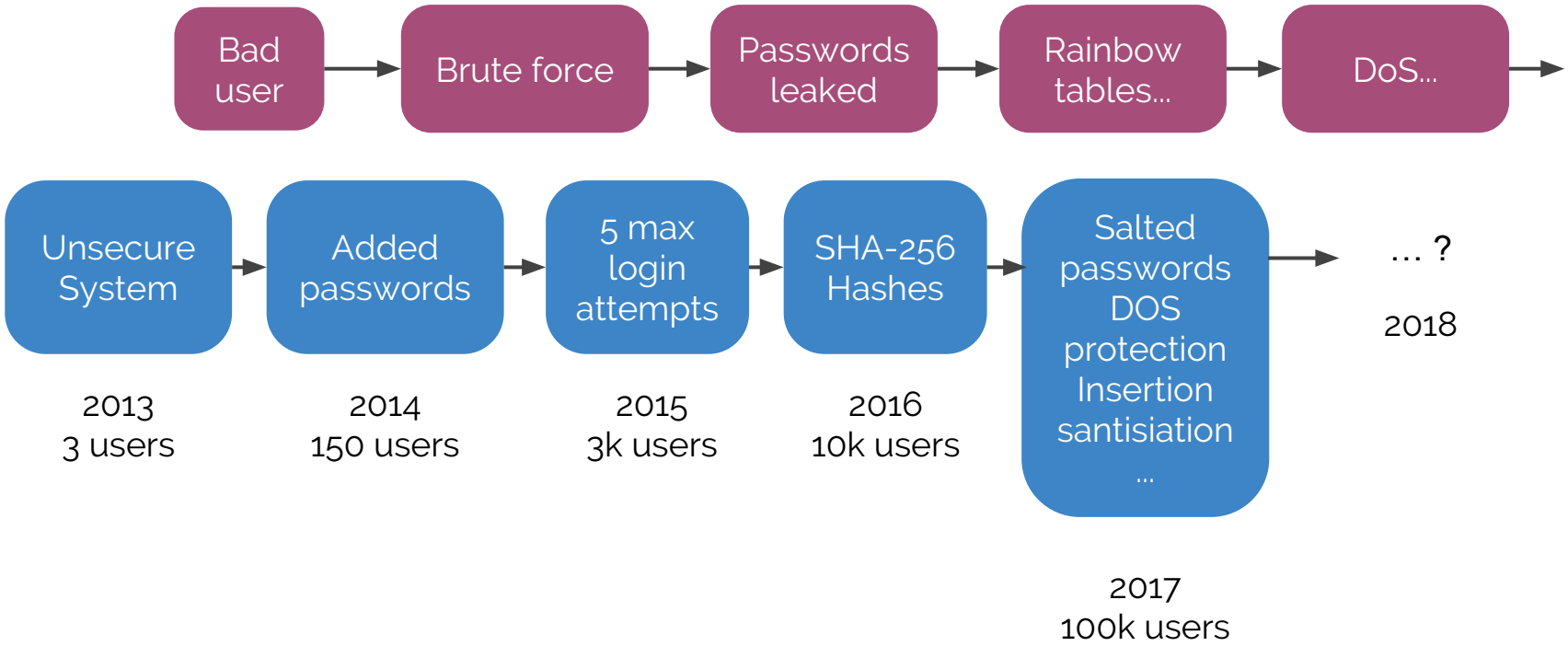
"Computer security is the protection of computer systems against adversarial environments"

conflicting/competing/attacking

1. Allow intended use
2. Prevent unintended use

...an arms race


Bad user
Brute force
Passwords leaked
Rainbow tables...
DoS...
Unsecure System
Added passwords
5 max login attempts
SHA-256 Hashes
Salted passwords DOS protection Insertion santisiation ...
... ?
2018
2013
3 users
2014
150 users
2015
3k users
2016
10k users
2017
100k users

However...

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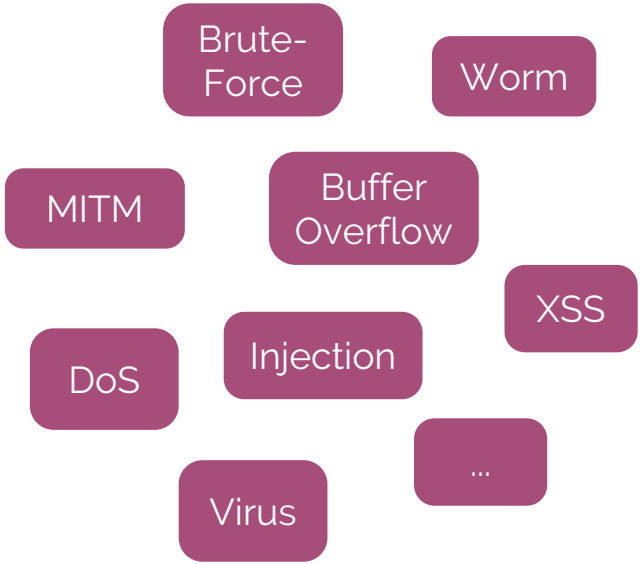
The same patterns tend to crop up again and again with new and evolving variations.

In this short course you will:

1. Learn these **patterns**
2. Learn how **easy** they are to exploit
3. Learn how to **protect** against them
4. Raise **awareness** of issues



Why is this compulsory?

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Undergraduate jobs:

1. **Software developer**

   Client logins at Tesla, billing systems at Ebay, User data at Facebook, Gmail, databases at AWS, ...

2. **Manager** with tight deadlines - hope you'll remember this sub-module
3. **Research** job with sensitive data
4. **Systems administrator** with user data
5. **Game developer** with user data
6. **Data analyst** with sensitive patient information on your local machine

   ...

A brief history of cybersecurity

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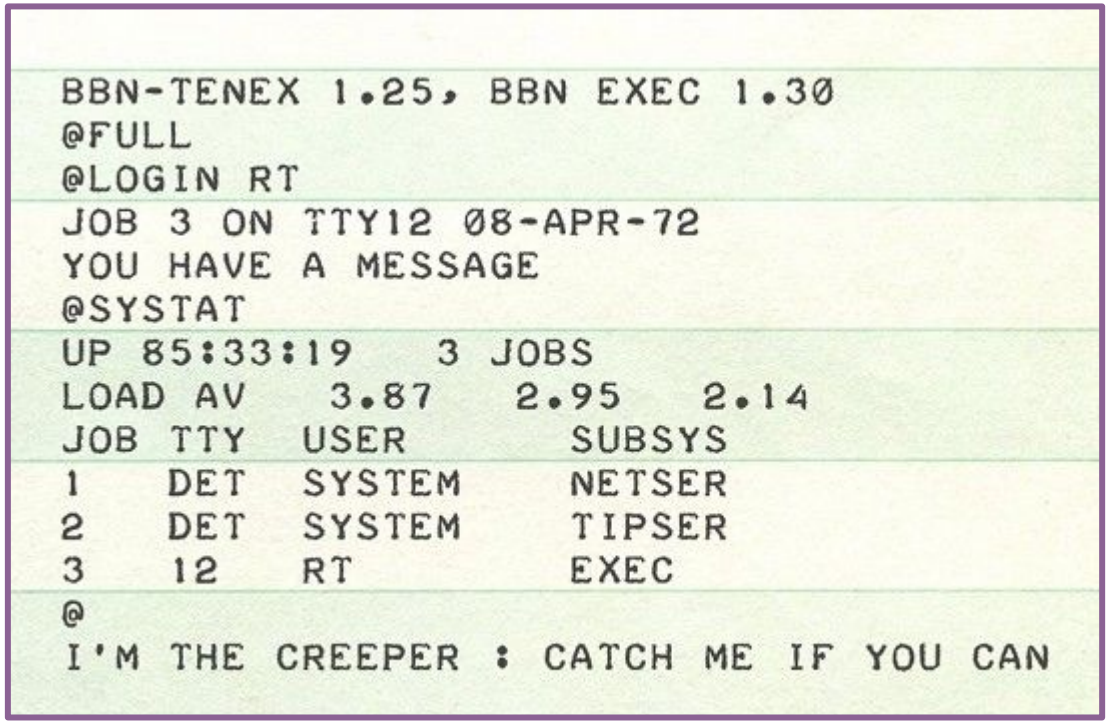
Major historical events:

1971: Creeper- first worm. On teletype! Reaper was made to delete Creeper.

1988: The Morris worm, created by Robert Morris to assess the size of the internet. First to be convicted under misuse act. Now a professor at MIT.



Selection of historical hacks

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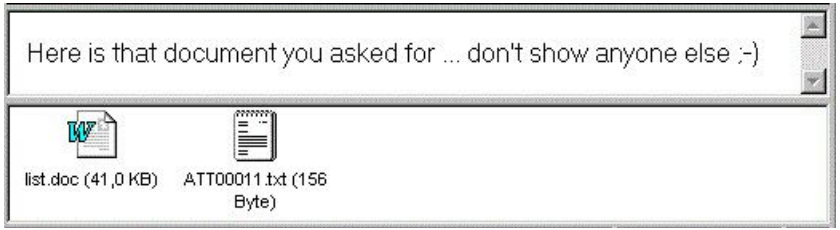
2000: The **Melissa** and **ILOVEYOU** virus. LOVE-LETTER-FOR-YOU.txt**.vbs** Windows hid extensions by default.



2005-2007: TJX was hacked (TK Maxx) 45 million credit card details stolen. Cost the company $256 million.

2013: Yahoo breach. Worse than initially reported; all 3 billion Yahoo users details stolen (new news since 3 October).

2017: WannaCry ransomeware. Encrypted hard drive demanding BitCoins. Not much money retrieved by estimated damage $4 billion.

2017: Net neutrality debate. Age of botnets 80% bots on FCC.

How big is cybersecurity today?

1. As of 2004 the cybersecurity market was **$3.5 billion**
2. As of 2017 the cybersecurity market is **£120 billion**
3. Spending predicted to exceed **$1 trillion** from 2017 to 2021 (report)

Link to real-time map

Link to visualisation of security breaches

New national cybersecurity centre, part of GCHQ.

Most of it is unreported

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Big stories hit the news every so often, but actually every day:

2 October 2017 (last week):

1. Privilege escalation
2. Arbitrary code execution

archlinux

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issues advisories todo login

Issues

vulnerable all

Group	Issue	Package	Affected	Fixed	Severity	Status	Ticket	Advisory
AVG-369	CVE-2017-12133 CVE-2017-12132	lib32-glibc	2.25-7		Critical	Vulnerable		
AVG-368	CVE-2017-12133 CVE-2017-	glibc	2.25-7		Critical	Vulnerable		
AVG-417	CVE-2017-12154	linux	4.13.3-1		High	Vulnerable		
AVG-390	CVE-2017-12858	libzip	1.2.0-1		High	Vulnerable		
AVG-359	CVE-2017-11608 CVE-2017-11605 CVE-2017-11555 CVE-2017-11554	libsass	3.4.5-1		High	Vulnerable		
AVG-355	CVE-2017-13066 CVE-2017-13065 CVE-2017-13064 CVE-2017-13063 CVE-2017-12937 CVE-2017-12936 CVE-2017-12935 CVE-2017-11403	graphicsmagick	1.3.26-1		High	Vulnerable		
AVG-331	CVE-2017-9986 CVE-2017-9985 CVE-2017-9984	linux	4.11.7-1		High	Vulnerable		
AVG-328	CVE-2017-9257 CVE-2017-9256 CVE-2017-9255 CVE-2017-9254 CVE-2017-9253 CVE-2017-9223	faad2	2.7-4		High	Vulnerable	FS#54613	

Topics in this sub-module

1. History, cybersecurity today and basic terminology (this week)
2. Applied cryptography
3. Identification, authentication, authorization
4. Operating system security (recommended for coursework)
5. Network & web security
6. Database security
7. Exploits and malware
8. Human factors
9. Software security

Terminology 1/2
(not examined, lots of definitions)

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1. **Assets**
   - Something of value to a person or organisation.
2. **Vulnerability**
   - Weakness of a system that could be accidentally or intentionally exploited to damage assets.
3. **Threat**
   - Potential danger of an adversary exploiting a vulnerability.
4. **Risk**
   - Asset x Threat x Vulnerability.
5. **Adversaries**
   - An agent (person, government, press, …) that circumvents the security of a system.
6. **Attack**
   - An assault on system security

Terminology 2/2
(not examined, lots of definitions)

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7. **Countermeasure**
   - Actions/processes that an owner may take to minimize risk of a vulnerability.
8. **Confidentiality**
   - Ensuring assets are only available to those who should be allowed.
9. **Integrity**
   - Ensuring consistency, accuracy and trustworthiness of data..
10. **Availability**
    - Ensuring that assets are only available to those who are permitted to use it.
11. **Accountability**
    - Recording actions so that users can be held accountable for their actions.
12. **Reliability**
    - Ensuring that a system can progress despite errors.

Not compulsory reading/watching

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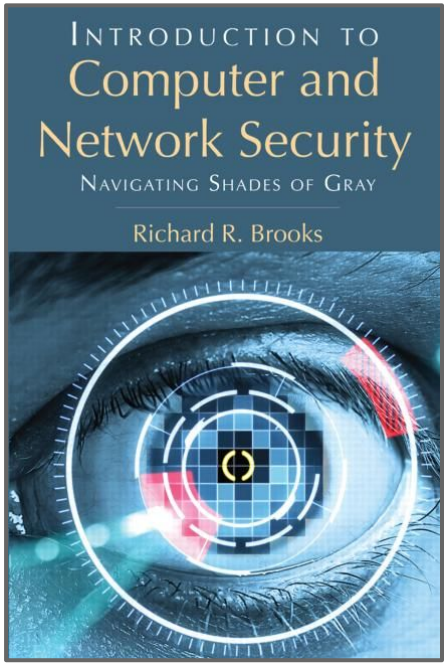
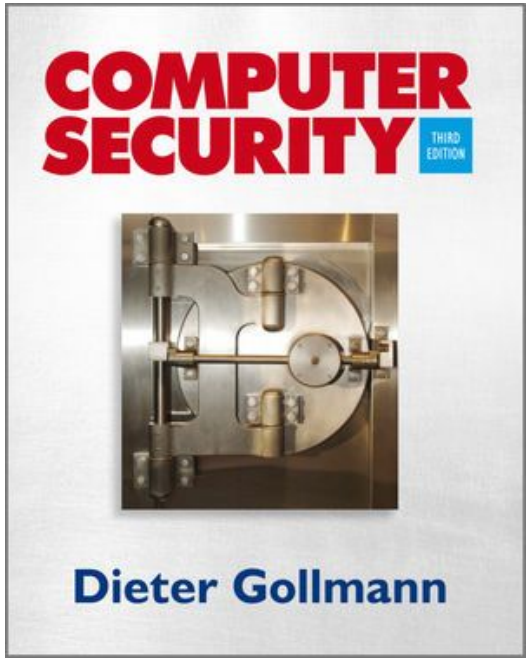
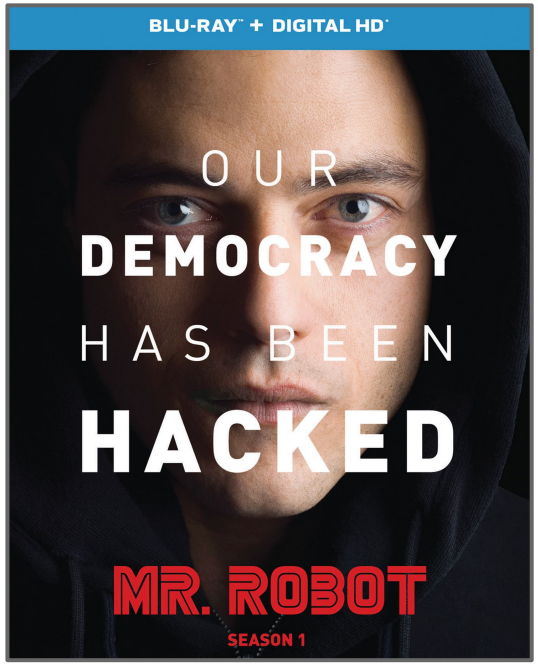


Recommended book



More traditional, level 3-4



Very good TV series!