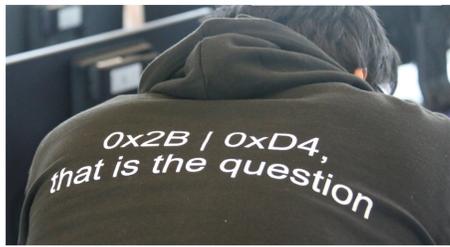


Raising a new generation of cyber defenders

The first three years of the *Cambridge2Cambridge* and *Inter-ACE* cyber security competitions

Frank Stajano, Graham Rymer and Michelle Houghton



The skills gap in cyber security is estimated at over a million jobs globally. There simply aren't enough competent security experts to recruit. As university educators we can, and do, teach security to our students, but to close the skills gap

we must *entice many more young people* than those already in our course to *take up computer security at university*. We must let them discover at a young age that cyber security can be a stimulating intellectual challenge, a societally beneficial role and, why not, a lucrative career path. Towards this end, in 2015-16 we *founded two cyber security competitions*

for university students: the international Cambridge2Cambridge, in partnership with MIT CSAIL, and the UK-wide Inter-ACE, among the GCHQ-endorsed Academic Centres of Excellence in Cyber Security Research (ACE-CSRs). We have been running these two events for three years, hosting four of them in Cambridge, supported by various parts of the UK government and many industry sponsors, and involving students from dozens of Universities in UK and US. We are now expanding further: through the INCS-CoE we are partnering with universities in Japan and Israel and we shall henceforth admit students from any university in the world.



Security is an inherently adversarial business: nobody can build a robust lock without being skilled at lockpicking. Our competitions therefore involve the use of similar attack tools and techniques as

those used by the bad guys, from password cracking to network sniffing to reverse engineering. *Our defenders must be at least as skilled as the bad guys if we want them to stay one step ahead of them.*

We developed training materials (later ported as practical exercises to the Cambridge computer science syllabus) and delivered specialized hands-on seminars to classes of over 250 delegates at a time from most of the UK ACE-CSRs. Our comprehensive technical report (download it by scanning the QR code below) contains detailed write-ups of many sample problems as well as the latest handout for our 64-bit reverse engineering and exploitation seminar.

Taking the long term view, in a decade or two some of the talented students who competed in our events will be Chief Security Officers, Heads of Homeland Security and other positions of responsibility in their respective countries. We therefore also provided an extensive social programme to encourage them to mingle and make friends while here, so that later on they may rely on each other to defend tomorrow's digital society when one of them is under attack. *The bad guys are organized, so we must be, too.*



In designing the competitions we aimed for the following targets: outreach, newcomer-friendliness, networking, diversity, education and *ethical* hacking, which we discuss in detail in the report. We explain how the competitions were supported and run and we highlight and document some of the lessons we learnt, which we hope will be useful to our successors, their supporters and future participants. We document our efforts towards rebalancing gender diversity, handling cheating, encouraging newcomers to learn from their seniors, and promoting socialization and cooperation rather than mere competition.

Frank Stajano, Graham Rymer, Michelle Houghton. "Raising a new generation of cyber defenders—The first three years of the Cambridge2Cambridge and Inter-ACE cyber security competitions". University of Cambridge Technical Report 922, June 2018, 307 pages, 68 MB. URL: <http://www.cl.cam.ac.uk/techreports/UCAM-CL-TR-922.pdf>



Cambridge 2 Cambridge
cybersecuritychallenge

March 4-5, 2016
Innovation and Collaboration

Cambridge2Cambridge 2016
Hosted at: MIT CSAIL
Dates: 2016-03-04 and 05
Universities: 2 (MIT and Cambridge)
Competitors: 25
Platform provider: ForAllSecure
Supporting institutions: UK Cabinet Office, British Consulate Boston
Industrial sponsors: Microsoft, BT, Facebook, Rapid7, Threatstream, Cisco
Video: <https://youtu.be/TKeixPta2vI>

Inter-ACE 2016
Hosted at: University of Cambridge
Date: 2016-04-23
Universities: 10 (from UK)
Competitors: 40
Platform provider: Facebook
Supporting institutions: UK Cabinet Office, EPSRC
Industrial sponsor: Facebook
Video: <https://www.bbc.co.uk/news/technology-36153391>

INTER-ACE CYBERCHALLENGE

Inter-ACE 2017
Hosted at: University of Cambridge
Date: 2017-03-18
Universities: 12 (from UK)
Competitors: 100
Platform provider: Leidos
Supporting institutions: NCSC, UK Cabinet Office
Industrial sponsors: Leidos, NCC Group
Video: <https://vimeo.com/211456053>

Cambridge2Cambridge 2017
Hosted at: University of Cambridge
Dates: 2017-07-24, 25 and 26
Universities: 23 (from UK and US)
Competitors: 111
Platform provider: Leidos
Supporting institutions: NCSC, UK Cabinet Office, US National Science Foundation
Industrial sponsors: Leidos, NCC Group, ForAllSecure, ImmersiVE Labs, Context, KPMG, Palo Alto Networks, Wiley
Video: <https://vimeo.com/227942592>

Cambridge 2 Cambridge
cybersecuritychallenge

Can you solve the K's crypto-sculpture we created for C2C 2017? It is on display elsewhere in the Computer Laboratory building.

Inter-ACE 2018
Hosted at: University of Cambridge
Dates: 2018-03-16 and 17
Universities: 18 (from UK)
Competitors: 134
Platform provider: University of Cambridge
Supporting institution: NCSC
Industrial sponsors: BT, Context, Palo Alto Networks, Facebook
Video: <https://vimeo.com/262210646>