2004-2009 BT Chair of Information Security*

Yvo Desmedt

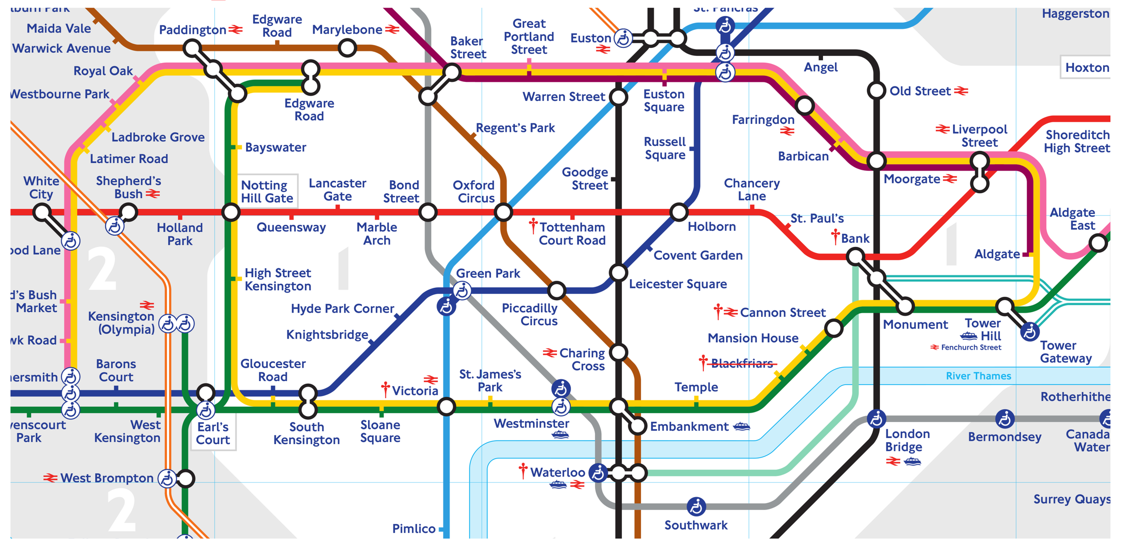
Department of Computer Science, University College London

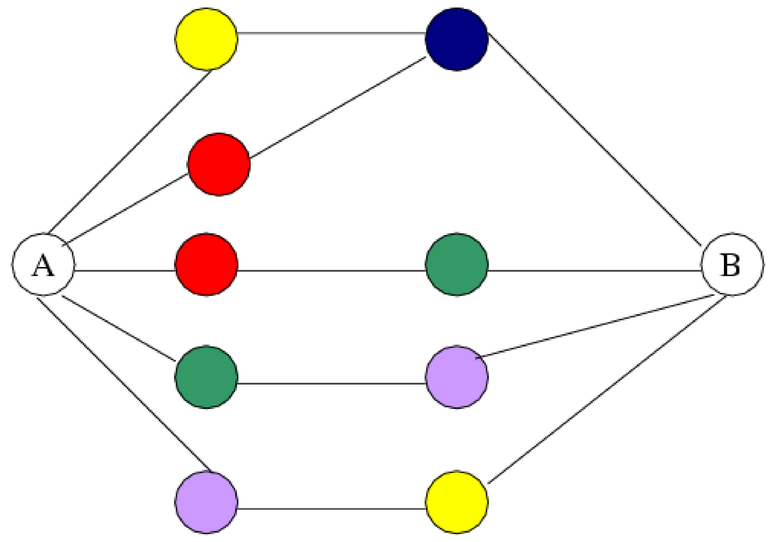
1 Reliable and Private Communication

- What is it? Sender and a receiver do not share keys. They want to privately and reliably communicate over a network provided that the number of nodes (or edges) the adversary can control is limited and that the network has enough connectivity.
- Potential applications: Prevent Denial of Service, backup in case public key is broken, prevent the UK being the subject of a death-switch.
- Results achieved on:

1. Ethernet like networks: solved a 13 year open problem (by Franklin-Wright)
2. Point-to-point networks: generalised Kurosawa-Suzuki Eurocrypt 2008 result
3. Almost Secure Message Transmission (slightly relaxed security): more efficient protocols
4. The directed graph case: introduced the problem, found conditions for special case.
5. Other results: showing others wrong, color adversary structures.

- Illustrative examples:





- Publications at: Africacrypt 2010, Asiacrypt 2010 & 2011, ICITS 2009, IEEE IT 2008, ISAAC 2005

2 Secret Sharing and Threshold cryptography

- What is it? Secret sharing allows backup of data in a reliable and private manner.
- Potential applications: Cloud storage, distributed security
- Results achieved on:

1. threshold cryptography: three new schemes, one based on pairings
2. Secret sharing: linking bounds to combinatorics

- Publications at: FC 2006, ICITS 2008, ISC 2007

3 Voting

- Plurality voting is not optimal:

	Voter 1	Voter 2	Voter 3	Voter 4	Voter 5
Most preferred candidate:	A	A	B	B	C
Second preferred candidate:	B	B	C	C	B
Least preferred candidate:	C	C	A	A	A

- Results achieved on:

1. Equilibria of plurality voting with abstentions, e.g., is sequential voting better?
2. Hacking Helios 2.0, an Internet voting scheme using lots of cryptography
3. A new Internet voting scheme: submitted
4. Other results: (a) Keeping the tally private, (b) Klein bottle routing.

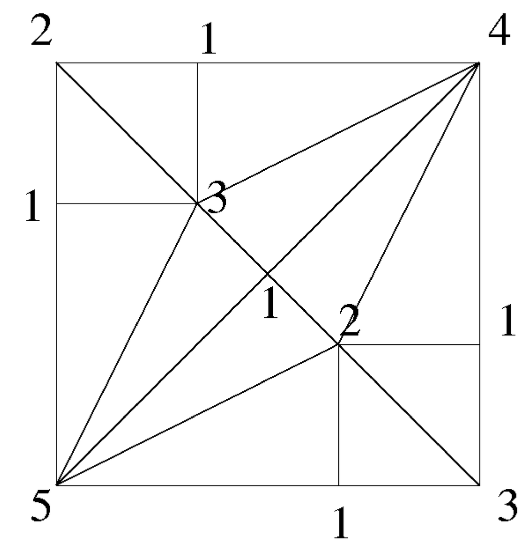
- Publications at: ACM EC 2010, EVT/WOTE 2010, ICISC 2005, ISC 2005.

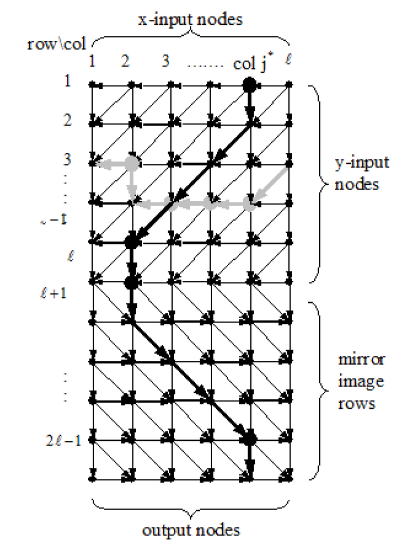
4 Secure multiparty computation

- What is it? Parties P_1, P_2, …, P_n knowing respectively x_1, x_2, …, x_n want to privately compute $f(x_1, x_2, \ldots, x_n)$, i.e., nothing leaks more than what follows from the output.
- Potential applications: Private cloud computing, privacy in general.
- Results achieved on:

1. Using black-box groups to perform secure multi-party computation
2. Reduce the use of VSS to make it more practical: submitted
3. Asymmetric Trust and its applications in secure multi-party computation

- Some details:





Sun-Yao-Tartary (2008) made a link with perturbation theory.

- Publications at: Asiacrypt 2007, Crypto 2007, Journal of Cryptology (accepted).

5 Critical infrastructures

- Results achieved on, e.g.:

1. Robust Operations, i.e., how to make a robust variant of an operational research problem?
2. Identifying critical infrastructures, e.g., using AND/OR graph models
3. Analysing concrete vulnerabilities, e.g., potential weaknesses of Internet Banking
4. Anti-jamming networks and constructing resilient data networks

- Publications at: COCOON 2005, ICITS 2011, IPL 2011, ISORA 2005

6 Other

- Results achieved on:

1. Privacy in social networks, e.g., privacy in Facebook versus Google+
2. Efficient and proven secure hybrid encryption
3. Efficient key stream authentication using combinatorics
4. Key distribution, e.g., for conferences using pairing based cryptography, or non-malleable while robust against active adversaries
5. Cryptanalytic study, e.g., of E0, Luffa, Rabbit Shannon Cipher

- Publications at: CANS 2008, CCS 2011 (poster), Crypto 2004, FC 2007 & 2008, ICISC 2010, Inscrypt 2010, IPL 2005, ISC 2006 & 2010, Journal of Cryptology 2010, ProvSec 2008, RSA 2007

*Funded by EPSRC EP/C538285/1 and BT