# THE CYBER REVOLUTION IN GLOBAL FINANCE

## Bridging The Silicon Fen and The City of London

**The Rustat Conferences, Jesus College, Cambridge**
in collaboration with
**Cyberspace Innovation Network**
**University of Cambridge Computer Laboratory**
An Academic Centre of Excellence in Cyber Security Research ACE - CSR

The global financial services sector is in the midst of a *cyber revolution*. Big Data, Bitcoin, Flash Crashes/Freezes, High Frequency Trading, Dark Pools, and Denial of Service Attacks are popular examples *fintech* (financial technology) enabled market disruptions. According to some experts the City of London's sustained status as a global financial hub will largely depend on how the UK navigates the future of fintech innovation in a turbulent economic environment of re-regulation and rising powers. University anchored high-tech clusters such as the Silicon Fen play a critical role in driving UK fintech innovation.

On 30 September and 1 October 2013, leading fintech stakeholders converged at Cambridge University for a cross-domain conversation about the future direction of British fintech innovation.

### RUSTAT CONFERENCE - JESUS COLLEGE CAMBRIDGE – 30 SEPTEMBER 2013

Entrepreneurs, bankers, technologists, academics, and government officials met at Jesus College to discuss the present and future of fintech in the City, the Silicon Fen and beyond.

### DISRUPTIVE TECHNOLOGY WORKSHOP – COMPUTER LAB – 1 OCTOBER 2013

Participants re-convened at ground zero of the Silicon Fen for a hands on look at disruptive technologies and business models driving innovation in the fintech sector.

### PARTICIPATING ORGANISATIONS

| | | | | |
|---|---|---|---|---|
| Bank of England | Standard Chartered Bank | BitPrice | OCSIA - Cabinet Office | BAE Systems - Detica |
| Financial Conduct Authority - FCA | Barclays | UBS | Warburg Pincus | Judge Business School Cambridge |
| Amadeus Capital Partners | IBM | RBS | Featurespace | Darktrace |
| Accenture | Level39 | AIG | Bromium | KCG Europe |
| The Institute for New Economic Thinking INET | Department for Business Innovation & Skills | Brocade Capital | Global Uncertainties Programme | Financial Computing Laboratory, UCL |
| London Stock Exchange | Digital Shadows | Lord North Street | Epsilon Partners | St John's Innovation Centre |
| IRM | University of Warwick | Solarflare | Foreign & Colonial Office FCO | Centre for Financial Research, Cambridge |
| Lockheed Martin | Consult Hyperion | Cisco | The Royal Society | Highland Capital Partners |

# THE CYBER REVOLUTION IN GLOBAL FINANCE

## Bridging The Silicon Fen and The City of London

## RUSTAT CONFERENCE AGENDA

Monday, 30 September 2013 - Jesus College, Cambridge

**08.30-09.15: REGISTRATION AND REFRESHMENTS - PRIORESS'S ROOM**

**Participants move to Upper Hall, Jesus College – venue for Rustat Conferences**

**09.15-09.30: WELCOME & INTRODUCTION - UPPER HALL**
**Chair Rustat Conferences: Prof Ian White** *Master, Jesus College, Van Eck Professor of Engineering*
**Prof Jon Crowcroft** *Marconi Professor of Communications, and Chair C.I.N, University of Cambridge*

**09.30-10.00: CONFERENCE KEYNOTE**
**CYBER FINANCE**
*Can The City of London retain its global financial hub status without a Cyber Innovation Strategy?*
**Dr William H. Janeway**
*Managing Director and Senior Advisor, Technology, Media & Telecommunications, Warburg Pincus; Hon Fellow, Pembroke College, Cambridge; co-founder The Institute for New Economic Thinking INET*

**10.00-10.50: SESSION 1**
**TAKING STOCK**
*What is the current state of cyber innovation in the UK financial services sector? How do we compare globally?*

**Chair: Samad Masood** *Programme Director, FinTech Innovation Lab London, Accenture*
**John Meakin** *Head of Security and Technology Risk - Markets & International Banking, RBS*
**Justin Lister** *Global Head Information Security, Standard Chartered Bank*
**Arvinder Mudhar** *Head of Technology, Barclays Wealth and Investment Management*

**10.50-11.10: BREAK - GALLERY, UPPER HALL**

**11.10-12.00: SESSION 2**
**THE FUTURE OF MONEY**
*Will the Bank of England be minting Cyber Cash by 2020?*
**Chair: Jonathan Luff** *Founder, Epsilon Partners*
**Dave Birch** *Global Ambassador, Consult Hyperion*
**Tom Robinson** *Founder, BitPrice*

## 12.00-13.00: SESSION 3
### TRADING IN CYBERSPACE
*How is cyber-trading transforming financial markets and what are the consequences for market stability?*

**Chair: Dr Chris Clack** *Founder, Financial Computing Laboratory, UCL*
**Rob Smith** *CEO, KCG Europe*
**Tony Chau** *Executive Director, UBS*

## 13.00-14.00: LUNCH - MASTER'S LODGE, JESUS COLLEGE

## 14.00-15.00: SESSION 4
### THE BANK OF ENGLAND, FCA & RESILIENCE OF THE SECTOR
*Will post-financial crisis re-regulation hold back innovation and growth in financial services?*

**Chair: Dr Simon Taylor** *Director, Masters in Finance Programme, Judge Business School*
**John Milne** *Head of Sector Resilience, Bank of England*
**Susanne Gahler** *Head of Equities Supervision - Markets Division, Financial Conduct Authority FCA*

## 15.00-15.15: BREAK - GALLERY, UPPER HALL

## 15.15-16.15: SESSION 5
### CYBER SECURITY INNOVATION: FROM FRAUD TO STATE-SPONSORED ATTACKS
*Countering advanced threats, mitigating business risk, and detecting abnormal behaviour*

**Chair:** *Jane Cannon, Executive in Residence, Amadeus Capital Partners*
**Steve Huxter** *Managing Director, Darktrace*
**Dr Steven Murdoch** *Computer Security Group, Computer Laboratory, University of Cambridge*
**David Excell** *CTO, Featurespace*

## 16.15-16.45: SESSION 6
### LOOKING FORWARD: THE CITY AND THE FEN
*Can the Silicon Fen help the The City of London in its bid to maintain its global financial status in the face of rising powers and disruptive technologies?*

**Chair: Dr Rex Hughes** *Co-Director, Cyberspace Innovation Network, University of Cambridge*
**Alex van Someren** *General Partner, Amadeus Capital Partners, co-founder nCipher*
**Samad Masood** *Programme Director, FinTech Innovation Lab London, Accenture*

## 16.45: CONFERENCE CLOSE
### CLOSING WORDS

**Prof Jon Crowcroft** *Marconi Professor of Communications, University of Cambridge*
**Prof Ian White** *Master, Jesus College, Van Eck Professor of Engineering, Chair, Rustat Conferences*

# THE CYBER REVOLUTION IN GLOBAL FINANCE

## BACKGROUND INFORMATION

### JESUS COLLEGE CAMBRIDGE & THE RUSTAT CONFERENCES

Jesus College is one of the leading colleges in the University of Cambridge. It was established between 1496 and 1516 on the site of the twelfth-century Benedictine nunnery of St Mary and St Radegund.

The Rustat Conferences of Jesus College, Cambridge are high level roundtable meetings which bring together by invitation c.50 senior decision makers and thought leaders from industry, government, and academia to discuss complex contemporary issues that benefit from cross domain expertise. The conferences are run on a not-for-profit basis and rely on sponsorship and membership fees. Visit www.Rustat.org for more information.

### THE CAMBRIDGE COMPUTER LABORATORY

The Computer Laboratory is an academic department within the University of Cambridge that encompasses Computer Science, along with many aspects of Engineering, Technology and Mathematics. The Lab undertakes research in a broad range of subjects within the disciplines of Computer Science, Engineering, Technology, and Mathematics. Research areas include: bioinformatics, computer architecture, computer vision, distributed systems, graphics and human-computer interaction, logic and semantics, machine learning, natural language processing, networking and wireless communication, operating systems and virtualization, programming, security, and sustainable computing.

### CAMBRIDGE CYBERSPACE INNOVATION NETWORK (C.I.N)

The Cyberspace Innovation Network (CIN) is an initiative of The Computer Laboratory, in collaboration with the Rustat Conferences Cyber series of Jesus College, that promotes engagement and collaboration between cyber researchers and entrepreneurs from the Silicon Fen and beyond for the purpose of advancing technological innovation and commercial implementation.

### CONFERENCE COMMITTEE

**Prof Ian White** *Master, Jesus College, Cambridge; Van Eck Professor of Engineering; Chair, Rustat Conferences*
**Prof Jon Crowcroft** *Marconi Professor of Communications, Computer Laboratory, University of Cambridge*
**Alex van Someren** *General Partner, Amadeus Capital Partners*
**Jonathan Cornwell** *Rustat Conferences, Jesus College, Cambridge; Cyber Innovation Network, University of Cambridge*
**Dr Rex Hughes** *Co-Director, Cyberspace Innovation Network, Computer Laboratory, University of Cambridge*
**Prof Peter Williamson** *Professor of International Management, Judge Business School, University of Cambridge*

### ACKNOWLEDGEMENTS

We thank our sponsors for their support**: Standard Chartered Bank, the Bank of England,** and **BAE Systems-Detica.**

We are grateful to the following for their support and advice: Dr William H. Janeway, Professor Jon Crowcroft and the Cambridge Computer Laboratory, Professor Peter Williamson, Dr Rex Hughes, Dr Tristram Riley-Smith, Alex van Someren, Jane Cannon, Dr Christopher Clack, Jonathan Luff, David Cazalet, Samad Masood, and Jonathan Millican.

# THE CYBER REVOLUTION IN GLOBAL FINANCE

## RUSTAT CONFERENCE

Monday, 30 September 2013 - Jesus College, Cambridge

## PARTICIPANTS

| | | |
|---|---|---|
| **Dr Mike Arnott** | *Cambridge Enterprise* | |
| **Professor Jean Bacon** | *Jesus College, and Computer Laboratory* | *University of Cambridge* |
| **Paul Betts** | *former European Business Editor, FT* | |
| **David Birch** | *Global Ambassador* | *Consult Hyperion* |
| **Martin Borrett** | *Director* | *IBM Institute for Advanced Security* |
| **Jamie Bouloux** | *Cyber Underwriting Manager* | *AIG* |
| **Rhys Bowen** | *Office for Cyber Security & Information Assurance OCSIA* | *Cabinet Office* |
| **Andy Broom** | *Director of Strategy* | *BAE Systems Detica* |
| **Elinor Buxton** | *Policy Adviser, Cyber Security* | *The Royal Society* |
| **Jane Cannon** | *Executive in Residence* | *Amadeus Capital Partners* |
| **Tomas Carruthers** | *Founder and former CEO* | *Interactive Investor plc* |
| **Grace Cassy** | *Co-Founder* | *Epsilon Advisory Partners* |
| **David Cazalet** | *Managing Partner* | *IRM* |
| **Tony Chau** | *Executive Director* | *UBS* |
| **Dr Christopher Clack** | *Founder, Financial Computing Laboratory* | *UCL* |
| **John Cornwell** | *Rustat Conferences* | *Jesus College, Cambridge* |
| **Michael Crawford** | *Cyber Adviser PWC; Special Adviser on the Middle East to Standard Chartered* | *PWC* |
| **Professor Jon Crowcroft** | *Marconi Professor of Communications, Computer Laboratory* | *University of Cambridge* |

| | | |
|---|---|---|
| **Professor Michael Dempster** | *Centre for Financial Research* | *University of Cambridge* |
| **David Excell** | *CTO* | *Featurespace* |
| **Susanne Gahler** | *Head of Equities Supervision - Markets Division* | *Financial Conduct Authority FCA* |
| **Professor Sanjeev Goval** | *Professor of Economics, Director INET Cambridge* | *University of Cambridge - INET* |
| **David Gill** | *Managing Director* | *St John's Innovation Centre* |
| **Dr Steve Hand** | *Computer Laboratory* | *University of Cambridge* |
| **Oliver Hoare** | *Cyber Security* | *Foreign & Commonwealth Office* |
| **Dr Rex Hughes** | *Co-Director, Cyberspace Innovation Network C.I.N* | *University of Cambridge* |
| **Steve Huxter** | *Managing Director* | *Darktrace* |
| **Dr William H. Janeway** | *Managing Director, Technology, Media & Telecommunications* | *Warburg Pincus* |
| **Dr Tudor Jenkins** | *Director* | *Wide Eyed Vision* |
| **Fraser Kyne** | *Director of Products* | *Bromium* |
| **Matthew Line** | *Alumni Advisory Council* | *Judge Business School* |
| **Justin Lister** | *Global Head Information Security* | *Standard Chartered Bank* |
| **Jonathan Luff** | *Director* | *Epsilon Advisory Partners* |
| **Andreas Markou** | *Rustat Conference Rapporteur* | *Judge Business School* |
| **Samad Masood** | *Programme Director, FinTech Innovation Lab London* | *Accenture* |
| **John Meakin** | *CISO - Head of Security and Technology Risk* | *RBS* |
| **Dr Elena Medova** | *Centre for Financial Research* | *University of Cambridge* |
| **Jonathan Millican** | *Winner, National Cyber Security Challenge* | *Jesus College, Cambridge* |
| **John Milne** | *Head of Sector Resilience* | *Bank of England* |
| **Arvinder Mudhar** | *Head of Technology, Barclays Wealth & Investment Management* | *Barclays* |
| **Dr Steven Murdoch** | *Computer Security Group, Computer Laboratory* | *University of Cambridge* |
| **Emily Orton** | *Senior Associate* | *Invoke Capital* |

| | | |
|---|---|---|
| **James Quinault** | *Director, Office for Cyber Security & Information Assurance - OCSIA* | *Cabinet Office* |
| **Dr Tristram Riley-Smith** | *External Champion* | *Global Uncertainties Programme* |
| **Dr David Riddoch** | *Chief Architect* | *Solarflare* |
| **Buck Rogers** | *Cyber Intelligence and Information Security* | *Bank of England* |
| **Michael Roberts** | *Office for Cyber Security & Information Assurance OCSIA* | *Cabinet Office* |
| **Gayle Robinson** | *Associate* | *Rustat Conferences* |
| **Tom Robinson** | *Director and Founder* | *BitPrice* |
| **Paul Simmonds** | *CEO* | *Global Identity Foundation* |
| **Rob Smith** | *CEO* | *KCG Europe Ltd* |
| **Dr Simon Taylor** | *Director, Master in Finance Programme* | *Judge Business School* |
| **Tolga Uzuner** | *Chief Investment Officer* | *Brocade Capital Management* |
| **Eric van der Kleij** | *Head* | *Level39* |
| **Alex van Someren** | *General Partner* | *Amadeus Capital Partners* |
| **Dr Robert Watson** | *Lecturer, Computer Laboratory* | *University of Cambridge* |
| **Adam Wethered** | *Director* | *Lord North St Ltd* |
| **Professor Ian White** | *Chair, Rustat Conferences and Master* | *Jesus College Cambridge* |
| **Professor Peter Williamson** | *Jesus College, and Professor of International Management* | *Judge Business School* |
| **David Willetts** | *Founder Member* | *Rustat Conferences* |
| **Paul Weatherley** | *Managing Director, LMUK IS&GS Security* | *Lockheed Martin UK* |

# THE CYBER REVOLUTION IN GLOBAL FINANCE

## Bridging The Silicon Fen and The City of London

## INTRODUCTION AND WELCOME

**Rustat Conferences Chair: Prof Ian White Master *Jesus College, Van Eck Professor of Engineering, University of Cambridge***
**Prof Jon Crowcroft**
***Marconi Professor of Communications, and Chair C.I.N, University of Cambridge***

Professor Ian White, Chair Rustat Conferences and Master, Jesus College, welcomed the audience members to the conference introducing the topic of cyber finance, an important issue with high level of interest which has also been discussed in previous Rustat Conference events on Cyber Security in Cambridge and London.

Prof Jon Crowcroft continued by saying that the conference is an exercise in stone turning : there is no fixed agenda but rather a very open agenda about the outcome of the conference whose objective is to find out if people have a shared vision, what the problems and solutions are and who should be working on solutions to problems.

He then proceeded by mentioning that the origin of cybernetics lies in ancient Greece when Charon would use a control system to steer boats to hell. More recently, the origin of *control theory* lies in 1868 in an essay written by Maxwell on rural society mentioning governors, regulators and control systems. The issues of **privacy** and **security** are important since on the one hand you don't want to reveal all your tricks to your competitors, but on the other hand you want to share information so that you don't get hurt by the same problems as your competitors. **Cooperation** is thus an issue to be discussed further in this conference.

Even though cyber security is something that many of the conference participants have focused recently, the conference's agenda, while including security, is now broader. We are interested in the threats to systems from attacks online, for example leaks of information through the use of banking phone applications and cash points, and attributing liability to which end is causing the problem in the transaction. This thinking applies to every level and time scale in the system.
As old business models have changed, we observe a change in rapidly being defrauded by new ways of doing business online. There are a lot of financial technology start-ups today but this new technology can disrupt things even at a global level.

Professor Crowcroft highlighted Cambridge as a centre of excellence in technology and supported by companies such as Microsoft. Moreover, a lot of start-ups exist in Cambridge supporting ultra-fast trading and ultra-fast, secure cloud storage, and computer security with a wide range of applications.

## CONFERENCE KEYNOTE

## *Doing Capitalism in the Cyber Finance Revolution*

**Dr William H. Janeway**

***Managing Director and Senior Advisor, Technology, Media & Telecom, Warburg Pincus, Chairman, Cambridge in America, and co-founder The Institute for New Economic Thinking***

Dr William H. Janeway commenced his talk by discussing the evolution of the banking industry since he joined Wall Street via Cambridge University in the early 1970s. Within 25 years, the banking sector has become the frontier where deeply innovative contributions to information technology have taken place to allow for the transaction intensive application, which in the early stages were entirely the job of software companies such as IBM.

As Dr Janeway explained, the shifts that developed over time - the paperwork crisis of the 1960s, the oil crisis of 1973, the elimination of fixed wage brokerage commissions, and the emergence of the commercial paper market - contributed to the transformation of the financial business model in the 1980s. The banking industry now acted as principals trading against their clients. Furthermore, the banks now became pioneer consumers for next generation information technology and consequently smarter, faster and far richer than their previous clients. This technological transformation was concentrated on capital markets where information technology was used to operationalise notions of modern finance theory.

Dr Janeway proceeded by noting the process of transformation for the consumer side of banking where the ATM is no longer the biggest change the industry has experienced. There is now a need and an opportunity for advanced information technology to change the relationship between financial services companies and retail customers. Dr Janeway proceeded by presenting three examples of companies in the Warburg Pincus portfolio that are developing technology in this field: 1) offering aggregation of all accounts a consumer has; 2) using speech recognition to access accounts and conduct transactions; and 3) offering deep transaction security support.

Dr Janeway continued by reflecting on the venture capital community. An earlier focus in the US on contributing to social media start-ups has now been replaced by infrastructure software and applications. However, the changing economic model compared to 25 years ago makes moving back to enterprise software in the current environment a challenging task. In the past, rich customers bought perpetual non-exclusive licenses of software code effectively taking equity risk in the business without any ownership. This resulted in venture capitalists having to invest a lower proportion of funds in these companies. However, nowadays there has been a shift to the world of software as a service model and the customer is effectively paying the derivative on the currently realised value of running the software. In turn, this has led to venture capitalists having to invest the entire capital needed for these companies.

Regarding the availability of high tech VC capital today, Dr Janeway mentioned that there is still a lot of venture capital available today in the US. Nevertheless, this capital is less than what was available during the bull market in 2001. However, the availability of European venture capital remains very limited.

Dr Janeway suggested that entrepreneurs today should focus on technology that is hard to develop such as speech recognition and mobile transaction security. Moreover, a significant challenge for a venture capitalist always remains the decision of when to sell the project. Similarly, established companies that are the acquirers of start-ups that transform culture and organisations face the challenge of absorbing and extending the value of the newly acquired technology.

As a conclusion to the session, the speaker offered a prominent lesson from his book *Doing Capitalism in the Innovation Economy: Markets, Speculation and the State*: progress at the frontier of innovation takes place after "trial and error and error and error". Additionally, achieving optimal allocation of resources based upon ranking projects on the net present value (NPV) of expected future cash flows defines a static frozen economy devoid of innovation. Those projects for which a NPV value cannot rationally be defined spread across all failures and will transform the environment and change the economy.

**Discussion**

Discussion that followed touched on the issue of funding for amateur innovative projects. Dr Janeway said that such projects can access retail money easily. This access has vastly expanded due to Internet enabled markets. The second question focused on what models work best for distribution and research and development. Dr Janeway answered that most successful venture capital is invested in biotechnology and information technology start-ups. Nowadays however, large biotechnology companies spend a lot of money on marketing which has compromised their ability to conduct fundamental research. Instead they rely on buying small start-ups. Google also relies on that model; for example, its Android operating system and maps applications were bought from outside. The challenge remains, though, on the buyer side to be able to absorb the benefit and to bring these innovations to the market successfully on an expanding scale.

## SESSION 1: TAKING STOCK-What is the current state of cyber innovation in the UK financial services sector? How do we compare globally?

***Chair: Samad Masood Programme Director, FinTech Innovation Lab London, Accenture;***
***John Meakin Head of Security and Technology Risk - Markets & International Banking, RBS;***
***Justin Lister Global Head Information Security, Standard Chartered Bank;***
***Arvinder Mudhar Head of Technology, Barclays Wealth and Investment Management***

The session chair Samad Masood laid the ground by asking panelists to comment: 1) If they were satisfied with the pace of innovation in their banking units; and 2) what the pace of these innovations may say about the UK approach to fintech innovation when contrasted with other regions.

Justin Lister spoke about the challenges banks face innovating on big things (e.g mobile applications) compared to innovating on small things. John Meakin remarked that UK banks are innovating, but what is disappointing is that they innovate mainly as a means of defending the status quo rather than growing new markets. This is worrying given the increasing pace of technology evolution and global competition. Mr Meakin also stressed the importance of having good quality, accurate data in today's digital banking world. Banks currently have volumes of data to mine but not enough data where accuracy is sufficient to make strategic decisions.

Arvinder Mudhar added to the discussion by saying that banks are huge software houses, but what is done with the data in-house really depends on the algorithm. The idea to use these data to extract strategic information quickly is also limited within the bureaucracy of the bank. As a result, banks outsource these ideas and data to entrepreneurial talent. Mr Lister raised the question whether finance should actually be "innovative"? An example is that being “boring” brought Standard Chartered through crises. They therefore expect innovation to come from outside big banks since big data comes with big risk.

Mr Masood continued the discussion by raising the point that millennials (digital natives) have a different perspective on risk than what we’d like them to have. Mr Meakin commented that banks’ ability to develop innovative risk methodologies is severely limited due to regulation. However there’s an opportunity to be innovative in order to manage risk more effectively. The move to the cloud is an opportunity to do bank risk control in a much better way because it recognises the source of most of the risk is coming (in the cloud). The best way to protect customers is not from the bank but from the cloud. Mr Meakin added that banks should try to build better indicators to prevent fraud. Regulators have also started realising that we need to do more with information sharing and understanding where payments come from.

Mr Masood subsequently mentioned that you cannot control how careful customers are with security. However, Mr Meakin noted that when fraud is committed regulatory expectation is that the bank has to pay for it. Mr Mudhar noted that there’s a cost to serve and it is difficult to make

money in this environment. Customers don't want to get charged for security but see it as the banks' responsibility. With high-net-worth clients the private banker does all the transactions, but the process is complex due to the high value of these transactions. In fact, a minor glitch in the system caused by one big payment can prevent thousands of smaller payments from being processed.

Mr Lister said that banks don't make money by providing people with internet banking. He also mentioned that consumers view extra authentication as a burden and that they tend to use the same passwords for all accounts. Therefore, when companies like Google and Twitter are compromised banks become increasingly worried.

Another question posed by Mr Masood was whether innovation shouldn't be the realm of the banks.Mr Meakin answered that the duty is for the banks to stimulate innovation which might happen in Google or elsewhere and will have a payback for the banks and their customers for reducing risk and improving service quality. Mr Masood added that innovation is a community activity you need to play a role in. Mr Lister commented that the cybercrime element is driving innovation. Additionally, businesses have limited resources and need to prioritise allocations by determining what is most important to the bottom line. Mr Mudhar said that virtually all banks have been outsourcing to India and Africa. He suggested that banks should see cheap labour countries not as a way of reducing costs but as a way of entering the market and learning what local customers really want. Mr Masood then concluded that innovation needs to be quite open and we should take an inclusive community approach.

Mr Masood subsequently asked the panel to express their view on how well the UK is doing and how it compares to the world of innovation in financial services. Mr Meakin mentioned that banks are way ahead in terms of collaboration compared to other industries such as oil and gas. However, banks are not particularly fast to innovative.

The session chair then asked why the UK did not create *yodlee* which is now working its way into the back offices of many banks. Mr Mudhar replied that most people in the UK have one bank account so there are not enough incentives by the market to innovate, even though this is changing. Moreover, even though people have lots of ISA and different pensions /mortgages they don't really want to put all these details together. Mr Meakin said that the message to people who want to approach the financial services sector with ideas is to do their homework first since the solution should fit the market context. Mr Lister gave the Asian perspective and mentioned that there is no compelling need at the moment being for yodlee adoption.

**Discussion**

One delegated mentioned that retail customers actually don't want banks to take risk and do innovative stuff with clients' money. Mr Mudhar suggested the excitement and capabilities are not necessarily to be found in retail banking; rather it is in capital markets that are driving innovation.

Another delegate commented that the problem now is that we are buying products we don't want, using credit we can't afford to impress people we don't like. We don't understand our consumption needs. She then asked the panel who they think can help us move into a new bank paradigm of managing money of people, not making money. Mr Meakin commented that innovating in the spirit of what the customer really wants is very difficult.

Mr Lister mentioned that cybercriminals are helping banks innovate. Banks need to get meaning out of all that data to understand client habits products.

Mr Masood then commented that people don't really want banks to be involved in their lives/help with their money - they just want to be able to access their money. Mr Mudhar replied that banking is a commodity and people can change banks easily. So how do you provide that level of service? Do banks become social services? Should banks extract information and try to sell products? The latter happens but banks need to make it appealing for clients to stay.

Mr Masood concluded by asking panelists to mention one thing that can be done fundamentally different to change the security paradigm and how the UK is going to differentiate in terms of financial services innovation?

Mr Meakin mentioned that the UK will flourish in the sharing of intelligence with regards to external threats to the banking system. He added that UK banks should stop managing the customers' identity but should recognise valid identities such as Google mail. Banks can be more secure in the electronic interaction with the customer if we avoid trying to solve the insolvable-managing millions of identities in our customer basis.

Mr Lister mentioned that banks should focus on trying to make it harder for criminals to access money rather than focusing on the losses as we are doing now. There are increasing efforts taking place on information around payment transactions in order to solve the issue, but the challenge remains on how we bring the information together.

Mr Mudhar then commented that offering security to clients is not cheap. A challenge for fintech innovation labs and the entrepreneurial community is to help the banks with this task.

## SESSION 2: THE FUTURE OF MONEY

***Will the Bank of England be minting cybercash by 2020?***

**Chair: Jonathan Luff *Founder, Epsilon Partners;***
**Dave Birch *Global Ambassador, Consult Hyperion;***
**Tom Robinson *Founder, BitPrice***

**Presentations**

The session Chair Jonathan Luff asked the pane to try locate Bitcoin in the innovation space. Dave Birch began by focusing on two main points:

1) Mobile phones have been transformative in many ways. When thinking of life in 25 years' time we need to consider whether any technology is going to be as disruptive as mobile phones *e.g* Bitcoin. Furthermore, is 3D printing going to be as popular in 25 years' time as have been sewing machines? If so, how will it change society and modes of business?
2) A petition for Canadian style currency innovation. Includes shifting to plastic banknotes and abolishing coins. For example, pennies cost two pennies to make and people don't use them a lot. Furthermore, the abolition of £50 pound note is proposed since higher value notes are not used for consumer transaction purposes. Instead, £50 pound notes are mostly used for criminal purposes.

Mr Birch also suggested thinking of the Royal Canadian Mint experiment. That is, if the UK is going to make plastic money in the future, the Mint should do that since money eventually will end up as public utility (*i.e.* difficult for private sector to produce low value coins and make a profit).

Tom Robinson continued the discussion by saying that during the past 30 years huge technological innovations have changed almost every industry on the planet. However, what has barely changed is how money works, how payments are made, valued, stored and transformed.

In the past few years people have been uneasy about financial institutions and the way they manage and protect our wealth. One recent financial innovation is Bitcoin, an open source digital decentralised currency launched in 2008. Bitcoin is revolutionary since no trusted intermediary is needed to make sure money is not spent twice. Bitcoin solves this issue by making all transactions public. These transactions are checked by 'miners', who undertake the role of intermediaries, to make sure the same Bitcoins haven't been pre-spent. Bitcoin is therefore three things:

1. A currency
2. A new network protocol for money
3. A new ecosystem financial innovation

Bitcoin shares properties of a currency and commodity. Like gold it cannot be forged and has fixed supply. It can also be easily transferred around the world with almost no transaction fee.

Furthermore, micro transactions are possible and its Internet-rich functionality has not been fully utilised so far (*e.g* possibility to write contracts). Other money protocols exist but Bitcoin has first mover advantage according to the speaker, as well as a large user base and traction. As an ecosystem it provides entrepreneurs with the huge opportunity of addressing the finance sector and people who don't have a bank account. It is also experiencing an exponential growth in acceptance by retailers and is heavily used for gambling.

Mr Robinson mentioned that he is currently trying to set up a virtual currency exchange BitPrice in the UK but there are two things holding him back:

1) Regulations on *minting* Bitcoins should not and cannot be regulated. But the *use* of Bitcoin can and should be regulated accordingly. Currently there is very little or no engagement at all in the UK, in contrast with other countries such as the US, Canada, Singapore where financial regulators have all issued guidance which also led to venture capital investment and Bitcoin start-ups. Not regulating Bitcoin is stifling innovation and is creating an uncertain regulatory environment that is driving away investment.
2) Banks: Someone with a virtual currency business cannot get a bank account since banks claim high money laundering risk. However, through regulation one can mitigate this risk. The speaker concluded that regulation needs to be addressed and either through regulation to mitigate the risk banks face or just simply compel the banks to provide these services.

**Discussion**

The session Chair, Mr Luff asked what it will take for ordinary people to embrace Bitcoin.

Mr Robinson answered that we are still at the early stages of Bitcoin. However, venture capital investment and people starting to build user-friendly interfaces for Bitcoin will help more people embrace the digital currency. Moreover, regulation is also important for people to accept and start using Bitcoin.

Mr Birch stressed the importance of regulation as a driver for innovation. He also mentioned the revised version of the European Payment Services Directive (PSD) will be issued in 2018 and is likely to be far friendlier to innovative start-ups.

A delegate asked if people would exchange their sterling pounds for Bitcoin, and suggested there are two things people would like to be sure of first: i) do I trust Bitcoin? and ii) how do I value Bitcoin? What is the exchange rate?

Mr Robinson replied that Bitcoin is a freely floating currency with, nevertheless, high volatility of exchange rate against US dollar. He also mentioned that you can trust Bitcoin itself as you can see all the transactions online. However the setup for exchanges is fairly amateurish at timebeing.

Mr Luff then asked if we expect the Bitcoin exchange rate with regards to the US dollar to eventually stabilise. Mr Robinson stated that stabilisation will take time because currently the infrastructure and liquidity are not there. For example, there is no derivative market to stabilise it.

Another delegate then asked what approximately the buy-sell spread is. Mr Robinson replied that it is a couple of percent at the moment. A further question addressed the point of limited supply of Bitcoins and how it can expand to meet demand if it's successful. Mr Birch replied that coins are divisible. However, he commented that a big chunk of Bitcoin fanbase are fans of not controlling money supply. Mr Robinson added that Bitcoin is not looking to replace traditional currencies but it should be seen as complementary technology.

A question from the audience asked, since Bitcoin is like gold, who stands behind it? Mr Robinson answered that what stands behind it is your trust in technology, your trust in mathematics and in the cryptography behind it. Personally he would trust that more than a politician or a central banker.

Mr Birch added that if people find Bitcoin a more efficient way of transacting, people don't really care about the mechanics behind it, they don't even see these.

Professor Jon Crowcroft then mentioned the use of Bitcoin for micro transactions and how it can lead to time efficiency for consumers *(e.g.* by getting rid of annoying ads). Mr Robinson added that a start-up company is already working on using Bitcoin for micro transactions (e.g watching online TV without any ads).

Another delegate asked how long it will take before Amazon accepts Bitcoins. Mr Birch replied that Amazon already has a virtual currency called *Amazon Coins*, which illustrates something about the future of money. Mr Birch also believed it is far more likely that we'll see more of these currencies if the underlying technology works and provides a more efficient and easy end-user experience.

## SESSION 3: TRADING IN CYBERSPACE

***How is cyber-trading transforming financial markets and what are the consequences for market stability?***

**Chair: Dr Chris Clack** ***Founder, Financial Computing Laboratory, UCL***
**Rob Smith** ***CEO, KCG Europe***
**Tony Chau** ***Executive Director, UBS***

Dr Chris Clack set the ground by stating that the session will focus on two issues:

1) How high frequency market making is reshaping financial markets;
2) How cyber trading is leading to increasing global financial instability.

He then explained the role of market makers as providers of liquidity in a market who then earn a profit from the spread. However, to make profit both bid and offer need to be executed - if only one is executed, inventory can increase and risk of loss increases - thus management of inventory risk is important. High frequency trading (HFT) causes a lot of volatility which is fundamentally changing what an order book is and how it works. Nevertheless, high frequency trading offers increasing liquidity and reduced spread (i.e. more efficient markets), the price we pay for these benefits being the added volatility.

The speaker also said that there have been many rapid instability events in markets recently *e.g.* 'flash crash' in May 2010. Some people attribute the cause of this crash to a fundamental Sell trade, but others claim the crash was due to high frequency trading. The approach of the research Dr Clack pursues at UCL adopts neither of the aforementioned approaches but focuses on endogenous feedback loops. Financial markets have built-in feedback loops *i.e.* the way computerised trading strategies might unwillingly and dynamically get coupled with other strategies. Two strategies together can become a system that oscillates which leads to instability. This is possible even with simple algorithms since instability depends on the interaction between algorithms rather than the complexity of algorithms. Dr Clack is currently trying to model these kinds of instabilities using market making algorithms and to analyse their effect on the market.

Rob Smith commented that this is a huge field. He proceeded to mention that market-making is indeed simple as fundamentally it comes down to valuation, managing order and risk. Today KCG Europe are focused on scalability and technical performance to try to lower operational risk. He mentioned that today we know something is going wrong, but we are not able to articulate this in computer code. Computerised trading is missing the ability to see what the other traders are going to do. Currently we haven't put all the right checks and balances in the systems that we are employing since it is really hard to know where the next risk is coming from. It is really difficult to conceive all these risks ahead of time. Traders also have a lot of sharp tools available in their toolbox, but they need to be careful how they use them.

He later commented that it is also very difficult to put proper regulation in place. The speaker said that the two most problematic regulation issues are first minimum holding time and second transaction tax. He questioned the ability of minimum resting times to clow down instability. He commented that if we need to slow down the market it won't change the technology race but will just change the tools you fight that war. For example instead of questioning how fast can I cancel the order now you are saying long precisely can I wait before I can cancel the order? Latency equals risk since valuation changes through time. The impact of this regulation is to lower liquidity in the market and widen out the spread. Similarly for transaction tax traders who have to widen out their spread in order to compensate for the tax. Consequently, it is long term investors such as pension funds who end up paying for that tax in the end. Dr Clack commented that his research has revealed that different proposed market protection mechanisms have almost zero effect on oscillation.

Dr Tony Chau continued the discussion by saying that these days markets are moving too fast and two emotions are driving the trading floor:

1) Greed which leads you to buy;
2) Fear which leads you to sell.

However, Dr Chau mentioned that it is difficult to address these concerns with computers despite the use of very sophisticated systems. Dr Chau also commented on the technical capabilities of banks, and he mentioned that for the US option market making business they have an extremely quick system with an Ethernet capability of 10GB per second, in practice though only 40% of that capability is used.

**Discussion**

A delegate asked whether banks see third parties trying to attack the trading system and create illegitimate trades. Dr Chau answered that they use a direct very fast connection with clients. Security is something banks take seriously so they use client side encrypted channels and also stringent limits on the amounts clients can trade with the banks.

Another delegate commented that there is a race against competitors to move faster but questions if banks also try to understand what other traders are doing? To what extend is this algorithmic competitiveness contributing to instability rather than other factors? Rob Smith answered that in reality banks don't do that because banks are not smart enough. Moreover, regulation should be focused on market making, not exacerbating volatility – it is really hard to reverse engineer algorithms. Dr Clack added that academic research on the interaction between algorithms is extremely small. His research team currently uses simple algorithms because they want to show the problem is coming from the interaction not the algorithm.

A member of the audience noted that NASDAQ was down recently for a few hours. Is there something about different market actions making the operation of security markets and derivatives fundamentally unstable? Rob Smith replied that the problem is not in the algorithm but is the complexity of infrastructure that is supporting electronic trading. There is an immense amount of technology, e,g in the telecommunications networks which don't get a lot of press

because they are boring. Dr Chau added that IT costs are the second largest cost for a bank after staff cost.

A delegate then asked how academics can simplify the current global trading architecture. Dr Clack replied that in their analytic model they are avoiding adopting a stochastic approach because they are trying to capture the level of exchange interaction at the very lowest detail, which helps to develop understanding. They are also testing the dynamic effect of an algorithm in a live set with many other algorithms, an additional way to test these things apart from static models. He then added that they are also just starting to look at interactions between banks through loan relationships.

Another delegate asked if Dr Clack's research can recommend anything at this stage. For example are there any sufficient and necessary conditions for oscillation? Dr Clack replied that results are initial at this stage. However they have found that in order for oscillation to occur between market making algorithms you need the phase-change in algorithms to happen at slightly different times and a feedback loop to exist between them so they then continue to have this change flipping. For market making algorithms three things have been identified so far:

1) Compliance quote. This translates into a hole in your algorithm and you can slip out through this gap and your inventory can grow leading to a phase change;
2) Information delay always leads to oscillation;
3) Adaptive soft limit on your inventory. If that soft limit dynamically varies according to the volatility in the market, then you may find that it goes below your current inventory and this can cause a phase change. Sometimes it causes but sometimes it can dampen oscillation.

## SESSION 4: THE BANK OF ENGLAND, FINANCIAL CONDUCT AUTHORITY, & SECTOR RESILIENCE

***Will post financial crisis re-regulation hold back innovation and growth in financial services?***

**Chair: Dr Simon Taylor** ***Director, Masters in Finance Programme, Judge Business School***
**John Milne** ***Head of Sector Resilience, Bank of England***
**Susanne Gahler** ***Head of Equities Supervision - Markets Division, Financial Conduct Authority FCA***

**Dr Simon Taylor** introduced the session by saying that most UK citizens would accept that optimal regulation is not zero or 100 percent. However, it is a tricky task to find how much it should be. Moreover, even though regulation has sometimes led to stimulus to get around it, some regulation is always necessary.

**John Milne** began his talk by saying that the Bank of England (BofE) cares deeply about cyber threats since it's the Bank's duty to promote financial stability and maintain confidence and support in the wider UK economy. He mentioned that cyber threats are becoming a bigger issue in discussions with UK financial services firms and so far the following steps have been taken:

1) **Cyber Scenarios:** The BofE initiated a series of cyber exercises to run through cyber scenarios collectively to try to assess the extent of efficiency in responding to cyber attacks. Historically regulators have been very good at regulating static risks but cyber threats are constantly evolving, dynamic. How do you therefore regulate something when you don't know what it will look like in a few years?

2) **Cyber Resilience:** The project conducted surveys of firms' cyber resilience to get a feel of how firms approach cyber risk. In some areas the results were surprising although more comparative analysis is needed.

The speaker mentioned that the UK needs to do more regarding the resilience of the financial sector to the global cyber threat. A step ahead has been taken by the Financial Policy Committee which since June 2013 issued a recommendation to HM Treasury to do something about *cyber risk*.

Mr Milne mentioned that there are four key plans to the above programs:

1) To understand more clearly the threat of risk and systemic potential either individually or through a combination of attacks;
2) To ensure that testing is done effectively across firms;
3) To articulate what cyber needs looks like as there is currently no standard on resilience;
4) To assess resilience in good firms in the industry sector ( *i.e* identify what good is and if there's a gap try to fill it).

The speaker also mentioned that the UK adopts a more high level approach compared to the US which follows thick rule books. However, whether the US is a better regulatory environment is still to be seen.

**Susanne Gahler** focused her remarks on the micro level approach financial regulators are taking. She mentioned that regulator interests are aligned with those of the banks, namely to encourage market confidence and integrity and protect the interest of financial consumer/participants. She said that her regulatory team is focusing on technical and operational risks and the extent to which these undermine the robustness of trading operations.

Ms Gahler also said that the FCA is encouraging entities to be preventive and integrate these measures in their IT and business strategies. Furthermore, she commented that even though it's not in a business's best interest for their systems to fail, maybe businesses are not investing enough in internal controls compared to increasing speed of trading. Additionally, regulators are trying to encourage businesses to shift responsibility from IT department to the senior department and board levels. Furthermore, UK regulators are trying to create incentives for trading venues to monitor their own members (e.g high speed traders).

Moreover, the Ms Gahler mentioned that even though 50% of exchanges have experienced some sort of cyber attack on their public Internet systems (*i.e.* corporate website), major trading operations have not been impacted thus far. A plan to develop a standard for best practice for trading venues to follow on cyber security is needed because cyber risk is a material threat. But more than simple compliance is needed for cyber risk to be fully integrated into the core business strategy. Of course, cyber threat is an interesting challenge for the FCA with cyber actors not well known and their motives not always clear in a mainly unregulated space. Basically we are trying to combat a threat we can't really define.

Ms Gahler also spoke of markets being intrinsically linked through data processors and information providers not currently regulated but an integral part of the market. Technology is driving this consolidation and we observe a major shift now since the client is not just offered trading services but an integrated system of services including access to data and post trading services. For regulators this is a significant challenge since technology is always going to be several steps ahead. National regulators are never going to be quite as quick and efficient as they would like to be, and we need substantial investment to develop our own surveillance systems to properly monitor the market. Since technological innovation is driving the future of trading, there are daily challenges clarifying to trading venues. How these innovations mesh with the regulatory structure needs to be developed even more.

**Discussion**

A Rustat delegate commented that regulation can hamper companies from moving quickly and aggressively by adopting a "ticking boxes" approach. Mr Milne replied that it is really difficult to get the right balance in "consistency and flexibility". Even though ticking boxes is the only consistent thing you can do, with cyber risk this would be fatal. A more dynamic structure is needed, different to the default regulatory approach to ticking boxes. The Chair, Dr Taylor, gave

the parallel example of US accounting regulation, which is very detailed yet completely failed in the case of Enron.

Another comment from the audience was that regulators may need to change emphasis from "too big to fail" and adopt a more post-modern approach. Mr Milne then replied that the problem is the concentration of entities which are non-competitive. Innovation is driven by competition - that is why retail banks rely now on inertia.

Ms Gahler then mentioned that the only way you can manage cyber risk is being alert to it and having near real-time information exchange between entities affected by incidents. You need to build it in your operational strategy so that you have systems in place to address incidents that happen with the least possible cost and damage.

The next comment was that British banks should outsource to different companies not only a few companies. Mr Milne mentioned that there is an issue with concentration in general, not only retail banking. This has been a regulatory failure since historically regulators have been focused at the micro level; today though they are also focusing on the macro aspect. The door is also now open for operational risk-- *i.e.* high frequency trading is an operational risk, because back-up mechanisms of exchanges are probably not as robust as they should be. Mr Milne also mentioned that regulators are worried about complex machine interaction between algorithms.

A Rustat participant then asked about the different sources of threats. Mr Milne answered that actors used to be distinct but now these actors are exchanging information either for money or for other proprietary information.

Another participant commented that the difficulty is in trying to set the rules when we don't know what the challenges are: "How do we recognise challenges?"

Mr Milne replied that regulators use *exercise programs* to understand what the industry thinks the key risks are. Industry knows the answer so the regulator's job is to get the industry to tell us the answer!

Ms Gahler then commented that large trading venues have significant controls and surveillance systems in place that mostly live up to regulator expectations. However, an interesting area we need to explore is what makes our market system unstable and the interdependencies in trading patterns that regulators and entities themselves can't see.

The next participant question regarded what role, if any, the UK should take to develop a secure financial services cloud, such as the one under development by the Government of Singapore? Or innovation for using a secure cloud.
Ms Gahler replied that using cloud services for financial operations is gaining ground in the UK and is really nothing else than just outsourcing IT services to another provider. But regulatory questions need to be addressed on how good outside providers are in terms of quality/reliability.

Mr Milne added that most big banks rely on 3rd party vendors for dealers' protection. This constitutes another national threat since there are very few such vendors and the question exists whether these vendors are capable of coping with simultaneous demand. Also higher protection leads to lower customer satisfaction and the question exists for firms whether to protect themselves or keep the customer happy. There are no efforts underway to develop a secure London financial services cloud at this time.

The final comment touched on the issue of information sharing. Mr Milne commented that we are not as good in information sharing, but we need to try to enhance these efforts since information sharing does generate economic value. Also, the key to good information sharing is what is happening now. Unfortunately, the UK is behind the curve compared to the US. And new regulations could indeed make information sharing more difficult.

## SESSION 5: CYBER SECURITY INNOVATION: FROM FRAUD TO STATE-SPONSORED ATTACKS

***Countering advanced threats, mitigating business risk, and detecting abnormal behaviour***

**Chair: Jane Cannon** ***Executive in Residence, Amadeus Capital Partners***
**Steve Huxter** ***Managing Director, Darktrace***
**Dr Steven Murdoch** ***Computer Security Group, Computer Laboratory, University of Cambridge and CTO Cronto***
**David Excell** ***CTO, Featurespace***

Jane Cannon laid the ground by stating that this session is cyber security innovation specific. She introduced herself as an expert helping clients with what they should do at the board level to be preparing and reacting proportionately to cyber security. “Businesses cannot keep spending money on cyber security, but when you do what should you spend it on?”

Cyber security is defined as a tier 1 risk to national security in the UK and part of the security strategy is to make UK the best country in Europe to do business in cyberspace. Ms Cannon stated that the panel represents three Silicon Fen firms that are contributing real innovation to UK cyber security innovation. The first two panellists focused on the human, behavioural aspects of technology.

Steve Huxter began his talk by stating that despite the down economy this is a great time to be innovating in the UK. The number of attackers are growing and getting better. However, according to Mr Huxter attackers’ methods of operating are changing we are not keeping up. Therefore a real opportunity exists in developing a new era of cyber defence going forward. We should nevertheless base innovation not on just reacting but rather taking concrete proactive steps since the gap is growing between what we can do defensively and the capabilities of attackers out there.

The assumptions upon which we base these solutions will also have to change. For example, we need to assume that people already in our network cannot be kept out and focus on mitigating risk that is going to exist permanently in the organisation (*e.g* high risk employees, people leaving, people holding important positions). Even though you cannot control everything, you can control risk for things you care about most.

We also need to realise that cyber risk is a real threat and that we are going to manage this risk over time. A defensive strategy looking at yesterday’s attacks therefore will not suffice. We instead need new technologies to find these unknown unknowns. Darktrace is working towards this goal by applying advanced mathematics to model people behaviour and understand what is normal and what is abnormal. This is the start of a new era where the government, academia and private sector have to work in partnership and together come up with sophisticated solutions.

David Excell continued the discussion by introducing the work done in Featurespace. A spin-off from the Cambridge University engineering department, Featurespace focuses on "modelling uncertainty". Featurespace uses technology that adaptively learns individual behaviour in real time we are able to spot when the consumer behaviour starts changing so that we can then react to that. This can lead to a host of different applications *e.g* prevent fraud but also analyse good behaviour to offer new applications and products. Applying Featurespace technology on Betfair allowed the company to reduce the number of false positives by 77%. The customers experience when interacting with the product streamlined as fraud based checks are only directed to those customers identified as being at risk. Also it reduced the cost of charge-backs so that operationally the company is much more proactive to stop fraud from taking place.

Furthermore, Featurespace worked with a large credit reference agency in the UK to understand if criminals are accessing the system. Generally, the aim of Featurespace technology is to understand whether that online customer interaction is part of risk or an opportunity to sell more products.

**Dr Steven Murdoch** started his remarks by stating the need for industry to begin focusing on the accuracy and evidential nature of data and role of security systems behaving properly and producing evidence that they are behaving properly. Mr Murdoch stated that things are changing with regards to retail banking and the way devices communicate with each other. Many parties now have access to computer systems, not just bank employees, and the Internet has had a huge impact on the types of transactions and location of customer. Additionally, the extent of outsourcing becoming part of the organisation is also growing. All these lead to more limited opportunities for trustworthy communication with customers. Computers talking to themselves may not perform checks properly. For example, you can trick a terminal that a wrong pin code is correct or even access a bank computer system by not entering a pin at all.

This raises the question of online transactions and what the bank is seeing in their systems. For instance, malware can make you think that you are paying your gas bill, but the bank thinks you are doing a much larger transaction via somewhere else. Dr Murdoch and his Computer Lab research team have produced an application that tries to improve this situation by authenticating who the user is and what he/she are doing. The mobile user can see the normal transaction details and his/her phone shows the bank's truth on his phone, the transaction details the bank thinks are going on. Hence, this technology provides the opportunity not only to reduce fraud but also actively to investigate fraud that does happen. Moreover, Dr Murdoch commented that bank systems have to be resilient and secure but also able to produce the correct evidence when they are challenged.

**Discussion**

Ms Cannon commented that innovation is a communal process and asked the panel what their customers can in using these products to improve their security. Mr Excell replied that as a small organisation it is hard to determine the exact need existing within a large organisation to use different types of technology. "We thus need to facilitate ways to make it easier for understanding the capability of the product to improve security and to start using the technology

within an organisation". Mr Huxter added that it is important to understand the scale of the threat and wanting to be honest of the issues that are there. Speed and agility are also important as it can't take 12 months to come up with answers to these issues. Dr Murdoch then stated that for small companies trying to get technology to the market, speed is important which can be challenging. It took his team four years from the point when the bank was convinced of its need, until the technology was accessible to customers. Paying staff for four years is expensive so moving faster makes it easier.

A participant then commented that big companies have a lot of technology problems and huge budgets. However, they only choose few projects to outsource. So how can you get in a company's top three projects? Mr Huxter commented that there is a false assurance that paying big companies big bills will lead to good results but in the end people are not getting anything from that at all. There is room for new ideas through smaller companies. Dr Murdoch also mentioned that many banks are uncomfortable dealing with a small company. However, we can convince them that sometimes, small companies can produce stuff better. Moreover, our products can be more user-friendly to customers.

Another delegate mentioned about the debate on privacy of data on employees and customers and how this can affect businesses going forward. Mr Huxter replied that there is an ongoing debate about protecting fundamental freedom and privacy but on the other hand organisations are protecting what's important for them. Here we are not protecting enough so there is a balance. Mr Excell commented that his company is using data that already exist. Organisations are making decision on data they already have, not new data.

An audience member then commented on the use of fingertips in the technology security space. Dr Murdoch replied that fingerprints can also be compromised. This is just an Apple biometric that is easier to use rather than more secure.

The following question concerned how the UK sits relative to other economies regarding developments in this space. Is this genuinely an area of global leadership for the UK? Dr Murdoch replied that the UK is in quite a good position regarding retail banking security. He mentioned that in the US it is not as advanced. Very few people use online payments so banks are not interested in the technology. Europe has a good history in development, but in terms of commercialising it this is more difficult since finance in the UK for start-ups is not as good as other countries. Mr Huxter added that the US is investing a lot and is willing to fail more compared to the UK. We therefore need to take risk in backing some technologies and we need to fight hard to change things here.

Another participant asked Mr Excell whether they have looked at match fixing in Betfair. Mr Excell replied that they are looking at a range of applications such as collusion and identity theft. The next question was whether banks should manage customer online identities. Dr Murdoch replied that people in the industry need to think where risk lies and whose responsibility it is. Identity management is difficult and costly. It can be outsourced but the question remains whether the 3rd party is willing to take the risk.

An audience member commented that identity is an individual thing, and it is really a question about giving responsibility of risk back to the individual rather than run by an industry that finds it very hard to make profits at the end of their business. So people in industry need to think where the risk lies and whose responsibility it is. Dr Murdoch replied that identity establishment is like risk management and that banks can get away with a weak, low risk, version of identity verification if they are not going to do very much with it. Another delegate commented that the reason we manage identities ourselves is because identity management is "crap", there is no standard for identity management.

The following question asked how the process was with the venture capitalists and what we can do at a national level to help early stage companies get funding. Mr Excell mentioned that it's about getting the technology out to the market and how you apply it in a commercial setting. It's about getting access to what are the real problems out there and access to the right people trying to bridge the gap between theory and practice. Mr Huxter added that there's not enough venture capital in this country compared to the US. However, there are various types of help you get from a venture capitalist such as deriving experience in marketing and developing a product quickly. Dr Murdoch commented that being close to Cambridge University was very important in allowing them to recruit staff and students. However, visa issues frequently proved an obstacle to hiring the best people because many Cambridge students are non-EU. He said that universities should be amenable to doing work with companies. Even though Cambridge is fairly good at doing business with companies there's a push now for universities to be very restrictive on how to deal with anything that might be viewed as intellectual property. This is in contrast to the US where you have fewer restrictions on how intellectual property developed at the university gets commercialised.

Ms Cannon commented that many clients would benefit from installing security equipment elsewhere in the business (*e.g* data leakage software that showed number of CVs sent to competitors not used in IT department but used in HR department).

Mr Excell commented that embedded technology can use the data for various applications, for example marketing and risk functions working together. Mr Huxter said that if you are a listed company and you have a security breach, the price goes down on average by 5% so this is a CEO level issue and it needs to be managed at that level. Dr Murdoch mentioned that they were dealing with security people that knew very well what customers wanted. Hence, it was easier to convince marketing people that customers are happy to use the product, not because they care about security but due to an easier to use banking interface.

## SESSION 6: LOOKING FORWARD: THE CITY AND THE FEN

***Can the Silicon Fen help the The City of London in its bid to maintain its global financial status in the face of rising powers and disruptive technologies?***

**Chair: Dr Rex Hughes** ***Co-Director, Cyber Innovation Network, University of Cambridge***
**Alex van Someren** ***General Partner, Amadeus Capital Partners, co-founder nCipher***
**Samad Masood** ***Programme Director, FinTech Innovation Lab London, Accenture***
**Jonathan Luff former advisor to the Prime Minister and** ***Founder, Epsilon Partners***

**Dr Rex Hughes** introduced the session as an opportunity to hear from senior practitioners involved in the FinTech innovation process in both London and the Silicon Fen. Dr Hughes stated that the panel was also intended to be a segue to the Day 2 Disruptive Technology Workshop at the Computer Lab. Dr Hughes opened the session by asking panelists how we can build a stronger "Fen-City innovation bridge" that best supports the aspirations of the UK fintech innovation sector?

Samad Masood started by explaining how the Accenture London FinTech Innovation Lab works. Even though an accelerator in nature, it does not follow the traditional venture capital model of funding. Specifically, the FinTech Innovation Lab brings together a whole industry (CIOs from global investment banks including Bank of America, Barclays, Citi, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, Lloyds, RBS, Morgan Stanley, UBS, as well as the Business Growth Fund - BGF, and Euclid Opportunities.) to meet a selection of UK fintech start-ups (BehavioSec, Calltrunk, Digital Shadows, Growth Intelligence, Kiboo, Open Bank Project, Waratek).

Mr Masood stated that via a competition scheme a number of these start-ups is then chosen by the CIOs to go through a three month mentoring scheme with the banks. Unlike other accelerators the aim of this program is to build a traditional business and try to get the companies to sell something, rather than looking for a traditional exit. An important aspect of the programme is that the banks work on board. In order to achieve this, the start-ups are placed in the City in close proximity to the banks. Furthermore, this program can potentially be applied in other industries such as telecoms even though it is sometimes challenging to keep corporate interest.

Alex van Someren mentioned that Amadeus Capital Partners engage in venture capital investing trying to fill the equity gap of start-ups by providing funding for the first £250,000 to £750000 up to £2 million. They are particularly interested in businesses that i) already have developed a minimum viable product and got something in the marketplace and ii) coming from academic innovation laboratories.

With regards to fintech, Mr van Someren stated that there exists a great opportunity for Fen-City collaboration given that there is strong demand for improved product and better security. Moreover, contrary to earlier comments in the day regarding limited capital funding available in

Europe, he mentioned that the ability today to form businesses for smaller amounts of capital is better than previous periods but it's essential to have a good product.

Furthermore, successful investors need to carefully choose their investments and a great deal of exploration is required before you write the cheque. Specifically, over the last 17 years Amadeus Capital Partners have funded only 88 out of 8500 business plans. However, a venture capitalist not only offers monetary funding but also provides close support and mentoring aspring start-ups.

Mr van Someren also stressed the importance of funding from other sources such as angel investors. Such funding however doesn't typically last long since this class of investors do not keep money reserves and provide all the funding needed at once, in contrast to venture capitalists who think about funding reserves more scientifically. Amadeus understands the importance of the Fen-City arc which is why it operates in both cities. However, Mr van Someren believes there is much work to be done to make the Fen-City arc a reliable capital-innovation circuit.

Jonathan Luff spoke about his experience at No. 10 as a tech advisor to Prime Minister David Cameron and offered advice on how the Cambridge Cyber Innovation Network can best strengthen City-Fen collaboration in the UK fintech sector. In his remarks Mr Luff stressed the importance of having external champions and the power of brands. In the case of the TechCity Silicon Roundabout, the Prime Minister shaped Governmental action by "talking up" the virtues of a London tech innovation zone - Mr Luff credited Rohan Silva, former government advisor, with playing a key role in this process. A similar strategy can and should be applied to fintech, given the importance of the UK financial services sector to the national economy. Currently, the UK has one of the best centres in cyber security in the world which can lead to massive potential to link these indigenous capacities to evolving sectors such as fintech.

**Discussion**

Dr Hughes asked the panel what we should be doing on the research front to obtain a more precise measurement of the fintech opportunity sphere as there are currently very few hard numbers on the actual size and scope of the UK market. Mr Masood replied that there are research opportunities that the Cyber Innovation Network could target. He sees three strands in the industry, and a starting point is to understand these strands:

1) Fintech banks use for banking related activities
2) Fintech banks and other large corporates use. This is generally proprietary in-house IT but becoming a smaller and smaller proportion of their IT budget that is mostly used for keeping 'old stuff' running.
3) Disruptive technologies – technologies attempting to do banking without the banks.

However, Mr Masood agreed that trying to put a figure on these strands is difficult. Mr Luff mentioned that this number could be as big as 20% for the UK, broadly speaking since that is the percentage contribution that financial services contribute to UK GDP. Mr Luff also noted that

the health of the financial services sector is directly tied to UK national economic security. This is an important point that could be emphasised by the Cyber Innovation Network.

A participant then asked Mr van Someren if increased availability of market detail and data would give more assurance on what the future potential is for fintech, thus leading to venture capitalists plugging any funding gaps in the market. Mr van Someren responded that he doesn't make decisions, as a market priority, on the basis of any quantified market size. Instead, he mentioned that he first looks at how likely the team is to succeed, then how big the market opportunity is and finally how the technology works. Quality of people is the most important aspect in his decision-making. He also mentioned Cambridge University's excellence in computer science, maths and security, all of which are the key threads to its intellectual property contribution to the technology.

Another delegate asked Mr van Someren how many business plans he regrets rejecting. The answer offered was that Amadeus Capital Partners track down the performance of every possible deal publicised. Similar to other venture capitalists, what happens is that out of 10 bets they will have two to three failures, a lot of average success bets and one very big success which covers up for all the others. Additionally, Amadeus Capital Partners prefers to invest in business-to-business (B2B) rather than business to consumer (B2C) start-ups since B2B ventures are more robust in the long run and are generally more resilient to market upsets.

---------- END ----------