



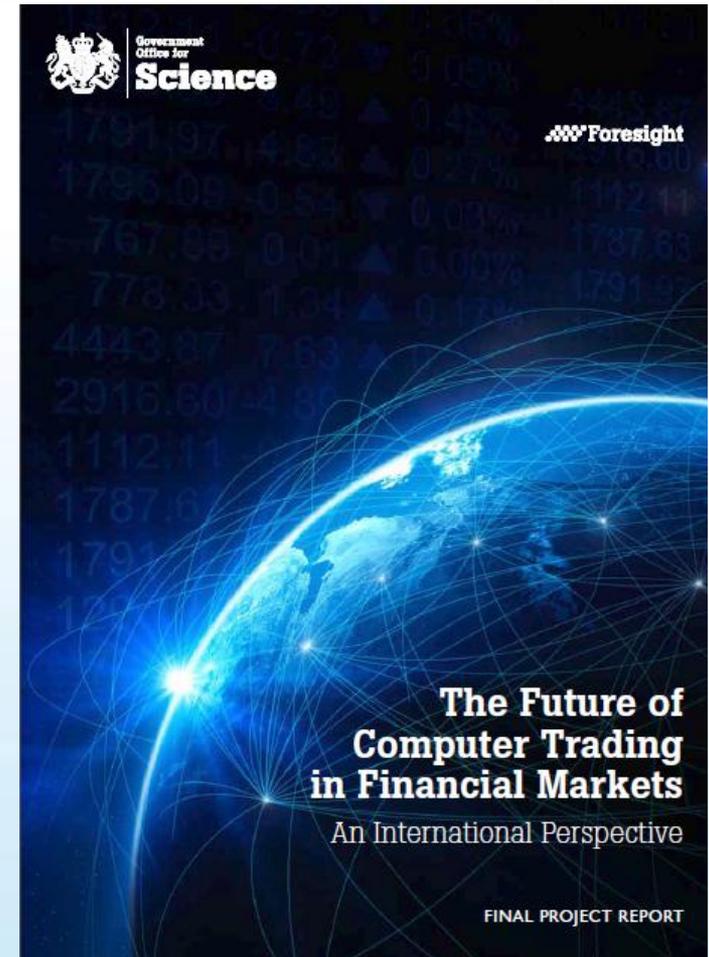
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 **Foresight**

Computers and complexity

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Chair, Chairman Rapid Addition





Three things about trading and technology

- (1) Speed has always mattered to traders
- (2) Technology has always increased speeds & reduced delays
- (3) In the past decade, trading technology has gone superhuman
- (4) Trend has continued and resulted in a two phase market



- Complexity is rising, CDS CDO etc. Move to exchange traded will reverse this, LEI will help.
- Trust is reducing
 - DR30
 - Kay Review
 - Anonymous trading at speeds people cannot interact at. Trust is a human attribute not a machine attribute
- Standards



- Little evidence on standards in financial sector
- So look at evidence from real economy
- Standards contribute 2.5 bln to UK GDP growth
 - Similar data from France, Germany, US etc
- Contribute to transparency, openness, trust and innovation
- Main studies 2000 and 2010, Prof G.M. Peter Swann, commission by UK Business Innovation and Skills department



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Standards in computer based trading

- A standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose.
- Interoperability is the aspect of a standard that allows devices or protocols to work together, enabling common connectivity and/or sharing of information or data through a common interface.
- “One example of interoperability is the single European standard for mobile phones to use micro-USB as their common charging interface. A group of ten of the world’s biggest mobile phone manufacturers agreed to use a common charger in 2009. This standard enables a single universal charger to work with a variety of manufacturers’ handsets, thus improving user convenience and vastly reducing the waste of discarded chargers.”



Standards in computer based trading

Areas and mechanisms

- Interoperability, Quality, Economies of scale, Measurement and Information, Innovation, Transparency, Growth, Network Externalities

Rationale for policy intervention

- Market failure
 - natural monopolies, Asymmetric Information, Externalities, Co-ordination problems
- Systems failure
 - Infrastructural failures, Institutional Failures, Interaction Failures, Transition Failures, Capability and Learning Failures

Areas for policy intervention

- Stakeholder engagement
- Process Reorganization
- Updating the Stock of Standards
- Education about standards
- Big Issues
- Better regulation through standards



Standards in computer based trading

- SWIFT
- FIX
- FpML
- XBRL

- Proprietary Standards NASDAQ OMX – ITCH and OUCH

- Proprietary Interfaces – BATS variants of ITCH and OUCH

- Pure proprietary interfaces



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Policy recommendations

- Governance
- Mapping exercise
- Time Stamps
- Common protocols
- Access for academics



- Beneficiaries
 - Private interests of banks and vendors
 - Public interest does not get implemented
- Stakeholder engagement
 - Public benefits
- Adoption
 - Openness
 - Credibility
- Undermining credibility
 - US Business Process Patents, Timing, Funding



- Systemic risk (H/M/L)
- Cost of broken/failing processes (US\$ amount)
- Number of broken/failing processes (number)
- Cost to fix (US\$ amount)

Life Cycle / Asset class	Equities		Fixed Income		Derivatives	
Pre Trade	300	1	600	2	600	2
	20	L	30	L	30	L
Trade	600	2	600	2	600	2
	30	L	30	H	30	L
Post Trade / Pre Settlement	400	3	600	2	100	1
	20	M	30	M		H
Settlement	1000	2	600	2	100	1
	30	M	30	L	10	H

Illustration only not real values



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Timestamps

- Common clock
GPS Satellite Systems
- Sufficient accuracy
10 microsecond



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Circuit Breakers

- Too illustrate common protocols

There is general support for these, particularly for those designed to limit periodic illiquidity induced by temporary imbalances in limit order books

- They are especially relevant to markets operating at high speed.
- In times of overall market stress there is a need for coordination of circuit breakers across markets, and this could be a mandate for regulatory involvement.
- New types of circuit breakers triggered by *ex ante* rather than *ex post* trading may be effective in dealing with periodic illiquidity.
- Need to establish how coordination could best be achieved in the prevailing market structure



Examining one recommendation

“New types of circuit breakers triggered by **ex ante** rather than **ex post** trading may be effective in dealing with periodic illiquidity.”

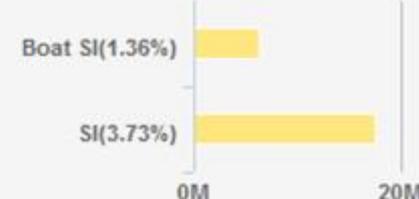
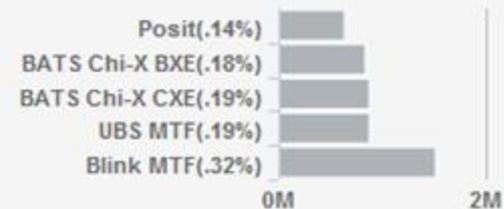
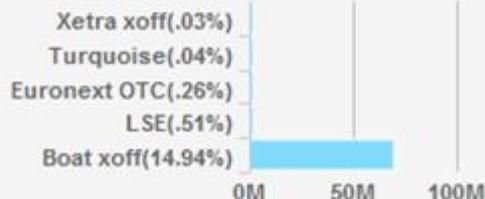
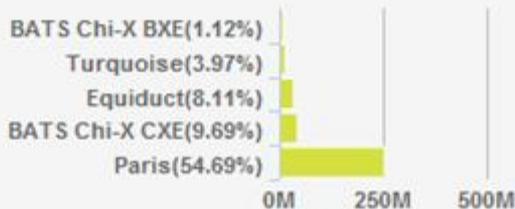
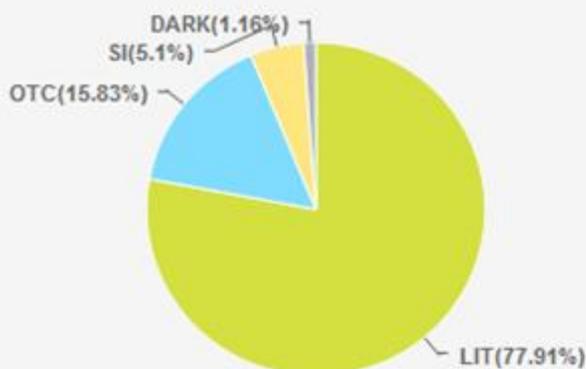
“In times of overall market stress there is a need for **coordination of circuit breakers across markets**, and this could be a mandate for regulatory involvement.”

Need to share all order books and / or all price information – for say: “Alcatel – Lucent”

ALCATEL-LUCENT

Monday, 2012 December 31 to Friday, 2013 January 04. View this in [Fragulator Live](#)

Market share





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Examining one recommendation

“New types of circuit breakers triggered by ***ex ante*** rather than ***ex post*** trading may be effective in dealing with periodic illiquidity.”

“In times of overall market stress there is a need for ***coordination of circuit breakers across markets***, and this could be a mandate for regulatory involvement.”

Need to share all order books and or price information – for say: “Alcatel – Lucent”

5 lit venues

5 dark venues

5 venues reporting OTC trades

2 Systematic Internalisers

To consider the full picture you need to connect to 17 sources, each with it's own proprietary interface!

How many do we consider?



Examining one recommendation using proprietary interfaces

Lit only

5 venues need access to each others order book in real time

With 5 individual proprietary interfaces – each exchange needs to build it's interface, and a test client 2 units of development work. 5×2 units = 10 units.

Plus each exchange has to build a client to each of the other interfaces 5×4 units of development work. 20 units.

General Case

Generalizing this n individual proprietary interfaces need $2n + n(n - 1)$ units (U) of development work. $n^2 + 2n - n = n^2 + n = U$

This is needed for each of n exchanges so total work = $n^2 + n$ units of development work.

For $n = 2, 4, 5, 10, 15$ and 17 we have

$n=2$ U=6; $n=3$ U=12; $n=4$ U=20; $n=5$ U=30; $n=10$ U=110; $n=15$ U=240; $n=17$ U= 306



Examining one recommendation using standard interfaces

Lit only

5 venues need access to each others order book in real time

With 1 standardized interfaces – each exchange needs to build it's interface, and they can share a single test client units of development work. $5 + 1$ units = 6 units.

Plus each exchange can potentially share the test client for it's connectivity to other order books

General Case

Generalizing this n individual proprietary interfaces need $n + 1$ units (U) of development work. $n + 1 = U$

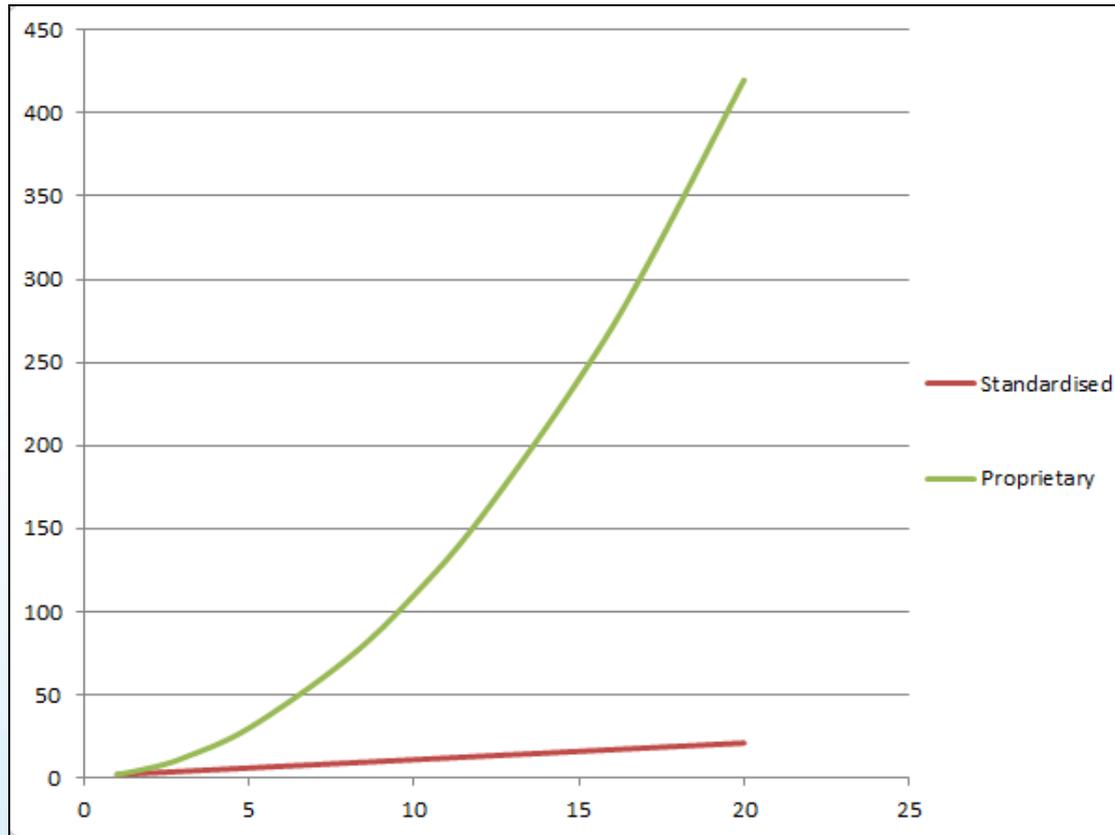
For $n = 2, 4, 5, 10, 15$ and 17 we have

$n=2$ $U=3$; $n=3$ $U=4$; $n=4$ $U=5$; $n=5$ $U=6$; $n=10$ $U=11$; $n=15$ $U=16$; $n=17$ $U= 18$

Saving factor = $(n^2 + n) / (n + 1) = n$ times as much effort!



Examining one recommendation using standard interfaces



Saving factor = $(n^2 + n) / (n + 1) = n$ times as much effort!



Examining one recommendation using standard interfaces

Market Place	Market Data Protocol	Order and Execution Protocol ¹⁷
Equities		
LSE	ITCH or FAST ⁴⁸	Proprietary
Eurex	EBS	ETS
BATS/Chi-X	PITCH	BOE

- 6 markets
- 10 or 11 protocols

Market Place	Market Data Protocol	Order and Execution Protocol ¹⁷
Futures and Options		
CME	FAST	FIX
CBOE	CSM	CMi2
ICE	Impact	FIX



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Access for Academics

- European Financial Data Center
- Data needs to be sufficiently detailed, time stamps, trader id's etc
- Qualified academics
- Privacy v's societal benefit