Digital Trading

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16 September 1997

Abstract: **The state of Digital Trading on the Internet is surveyed with the assistance of case studies of high-profile service providers. These providers use the Internet for delivery of trading instructions, and IPO data, and some hope to build exchanges based on Internet access. The efficiencies so far demonstrated indicate dramatic structural change.**

An alternative technical approach of digital certificate trading is described, and lessons learnt in early trials are explored.

It is proposed that the future financial system will be built on open, direct access of all to the markets, that trades will be costless and that settlement will be immediate. This is based on the prediction that digital certificate technology provides for this promise, and will either supplant existing techniques, or force alternates that perform at least as well.

1. Introduction

This paper seeks to do three things:

- Show where the existing innovations have taken the digital trading world by looking at The State of the Art . Several case studies are used to concentrate on the biggest lessons so far.
- Describe the Internet trading trials of the author's company, Systemics Ltd. Experiences in Digital Trading shows that this approach offers a new structure to the industry, and more dramatic savings for Digital Trading.
- Using our most optimistic guesses and the lessons from current work and cases, an attempt is made to map out what the What the Future Holds for the financial system.

In Concluding Remarks attention is focused back on more immediate implications: how participants are going to be effected, and what we can reliably say about future changes.

2. The State of the Art

A lot of time and money has already been invested into trading on the Internet. The industry, if it can be so labelled, is well advanced in some segments, and still in the early phases of experimentation and search for workable models in others.

In this section, we look at what the Internet claims to be able to do. We then look at what has been done so far. The state of the art is best shown by three cases:

- Internet broking by E*TRADE,
- the Direct Public Offering of The Spring Street Brewery, and
- the investment bank and exchange of Wit Capital Corp

These cases allow us to test against the claims and draw conclusions.

2.1 Distribution of Information

The simplest uses of the Internet are the distribution of information that is currently dominated by the physical paper & postal methods.

The Web has an ability to present non-technical users with enormous quantities of well ordered information, and all at a marginal cost that is, to all intents and purposes, zero. With a bit shoe-horning, it can be made to accept simple information. Combined, this power that has made it the second *killer app* of the Internet [Email].

We can disseminate all non-critical information using a combination of the Web and email, in both directions. The following processes can be automated:

- Data feeds of prices [ESI].
- Opening of trading account.
- Settlement instructions.
- Research (web, email and mailgroup delivery) [ISI].
- User communities (chat groups, message boards) [HemmingtonScott].
- Formal notices (email).
- Prospectus and Multimedia Roadshows [DSM].

An ability to deliver this sort of information over the net is both obvious and of a technically difficulty within the capabilities of a good www design house.

2.2 Interactive Financial Applications

Financial Web sites, as Euromoney says, are no longer little more than electronic advertisements [Webb1]. As more familiarity with the scope of Internet communications develop, institutions are beginning to experiment with:

- Pricing Models and Portfolio Risk Analysis.
- Portfolio Accounting.
- Databases of Trading Information.
- Inventory Level.

This list constitutes a major fraction of the activities of the institutions. The conclusion that should be drawn here is not that security and bandwidth problems abound, but that all of the informational aspects of financial systems can, in theory, be put onto the Internet. The questions of when and how are technicalities, if, as is claimed by the supporters, the Internet delivers vastly improved economics for informational systems.

2.3 The Online Trade

With the use of SSL, a protocol to protect browsing from hackers, it is possible to securely request identities and passwords, and to achieve a high degree of confidence that the user is an authorised person [Treuhaft]. With sufficient information, that user can instruct a Web-based service with a similar level of confidence as over the telephone or fax.

Once we achieve this level of confidence, high value instructions can be issued, such as trading and movement of funds. This is the method used by many brokers to accept trade instructions.

As one regulator says, this is not an exciting a development in and of itself. Fundamentally, the Web trade adds a new method to transmit the order instruction to the broker; and alongside the telephone and the fax, this represents simply a new way to cut costs on mundane information transmission [Wallman].

Regardless of one's skepticism for the apparent simplicity of the new model, cost savings have been dramatic. Brokers such as Datek Online are now offering trades for $9.99. [Datek]. Cost reductions of this nature - an order of magnitude less than full service brokers - can signal dramatic change in the industry by themselves.

2.4 The Online Exchange

If net broking is successful, and generates sufficient interest in net trading as a normal investor activity, the next step might be the possibility of crossing orders within the broker.

The rational for an Internet Stock Exchange is apparent to those outside the club, at least. Consider this list by Duncan Goldie-Scot of the Virtual Investor [Goldie-Scot1]:

- existing exchanges are parochial - the Internet is global
- regulatory barriers rob small and cross-border IPOs of much of their market
- existing markets are too expensive - lacklustre competition makes for lacklustre service, and pricing that only pleases the incumbents.
- lop-sided information flows are common - between professional analysts and ordinary investors, between so-called *sophisticated* investors and ordinary investors,
- they are simply inefficient at raising capital for the small entrepreneur.

Indeed, a survey conducted by Alan Majer asked whether an Internet stock exchange would have any advantage, and 88% felt it would, with 12% undecided [Majer]. With this heady mixture of opportunities, the idea of an Internet exchange bears serious consideration.

2.5 Case Study: E*TRADE

Any one of the suggested advantages of Internet brokering represents good news for the individual, as they signal price reductions in an overweight industry.

In contrast to the view that a net broker simply bypasses the telephone, it is when the effect of all of the above innovations are together in one place that the full impact occurs. At this stage, the reader should jump on to the Web and go to http://www.etrade.com/visitor/demo/ to see the E*TRADE demo. Bear in

mind that this is a demo of working systems for the customer of services, not a prototype for the venture capitalist.

The above demo and further readings on E*TRADE's site allow us to make some general comments:

- You can put all of the power of any number of screens from Reuters, Bloombergs, etc, all onto the Web. And thence to the individual trader.
- The only necessary non-Internet access by the user is to send in the payment with the application, and to request mailing of payments.
- One Web site covers an enourmous user base. From a variety of sources, E*TRADE has 145,000 active accounts [DowJones], is doing 20,000 trades per day [Schmerken], and is moving 7.8 million shares daily (that's roughly 1.5% of NYSE) [Byron].
- Brokering is now an IT business [Executive Team].
- Brokering is now a Web business [Leaders].
- Brokering is no longer a geographically concentrated business although it has yet to take on the international flavour of the Internet [InstInvest].

2.6 Case Study: The Spring Street Brewery

All of the above is concerned with the secondary market - the market for shares already traded on an exchange. The possibilities of using the Internet as a primary market for new issues was not really predicted until The Spring Street Brewery actually achieved it by using a combination of Internet marketing and information distribution, advertising on the product, and new regulations on small Initial Public Offerings.

The story starts at Christmas of 1992, when Andrew Klein quit his job as a lawyer with Manhattan law firm Cravath, Swaine & Moore in order to start a *microbrewery* that produced Belgian *Wit* beer [Wit7].

In the US Securities Act of 1993, reforms permitted non-public companies to sell up to five million in company equity direct to the public [Boyce]. Whilst not evidently successful at the time, Klein understood in 1995 that combined with product marketing and the spread and cost-effectiveness of the Internet, he could reach a large enough base of small investors to float his company, effectively on Internet.

Klein prepared the formal documents of an IPO to float shares in The Spring Street Brewery in the normal way: by submitting documents to the Securities and Exchange Commission and state regulators. However, when it came to marketing his issue, the stock was advertised on the net and on the product, his prospectus was downloadable, and email was used to communicate with the interested investors. In the net-surfing beer-drinking investor community around Manhattan, ready demand for an innovative launch was found.

The float was launched in February of 1996, and the company raised $1.6 million by selling 844,581 shares to 3,500 individuals at $1.85 each [Wit6].

The company also built a simple bulletin-board style of Web page where investors could express interest in buying or selling. It is not known what the SEC originally thought of this move. However, they very quickly hit Klein with an eleven lawyer conference call [Zgodzinksi], and he agreed to "voluntarily suspend Wit-Trade" pending further discussions.

The SEC is a great advocate of innovation, and in this case, after 3 weeks of deliberations, a preliminary letter was issued allowing trading to continue with a number of changes, the chief of which was the outsourcing of the settlement to a registered broker [Boyce].

Let's summarize the salient points of the floatation:

- Klein did the floatation himself.
- The stock was advertised on his own product, which was a widely marketed, popular consumer product.
- Significant savings were made in Internet delivery of documents as well as advertising on the Web.
- A significant *hype* premium was placed on his stock, with some 2,000 news stories and a "What's cool" listing on Netscape's site [Bloom].
- A simple Web bulletin board enabled stock holders to post expressions of interest and prices for trading of stock.

Klein did his own filings, but it is suggested that this was a unique desire of his own, rather than a cold-hearted economically-efficient task. Also, it should be born in mind that Klein is an investment lawyer and MBA by training, with previous experience in Regulation A listings.

Since that first offering, there have been many other offerings. In most of the similar DPO cases to date, the activity has been led by experienced legal and financial people helping with a small, locally quoted stock [DPO-Council] [Investor Guide];

A major amount of work was incurred in going through the SEC formal procedure: it is appropriate to recognise that the DPO process is cheaper, but does not appear significantly less lengthy than conventional IPOs. In time, this should reduce, due perhaps to computer software such as CapScape that automate the preparation of SEC documents [Borrow_et_al], and perhaps to further efforts by regulators to align the paper-work burden with the size of the offering.

Another innovation took much of the credit. Putting a bulletin board style of trading board on the Web was quite an achievement for a brewer of beers or an investment lawyer, but it is not anything beyond the average Internet Web specialist software house. Having shown that this is now possible, this can now be a competitive offering by brokers, advisers and the like.

However, the major effect of the flotation was to highlight that it was something that could have been offered as a service by conventional investment banks, but wasn't. Realistically, we can conclude that this is a new segment of financial advice, blessed with a new name, the Direct Public Offering (and new acronym, DPO).

There is now a developing DPO advisor segment to fill that gap, and renewed interest by investment banks and brokers in this area, although it remains to be seen which supplier can best provide a model for future DPOs. The analysis of the SEC supports this: In recognising that the process had simplified, but not removed, the interface to the financial system, they insisted that settlement be via some other firm (e.g., a

broker).

None of this is to degenerate the achievement of the floatation. It required breadth of imagination to combine the aspects, and enourmous perseverance, and Klein has been justly lauded by the press and venture capitalists alike.

Klein's achievement is thus levelling the playing field significantly; as advocates of the *perfect market* should note, the cost of a floatation has been extended downwards by an order of magnitude, from a floor of, say, $500,000 to a potential lowest fees outgoings of $50,000 [Borrow_et_al2], [Mamis].

2.7 Case Study: Wit Capital

What Klein did next is even more interesting. In the fallout from the hype and the 500 desperate phone calls seeking advice [Zgodzinksi], at some stage the demand for this sort of service struck home. Klein had discovered an untapped segment of the market for financial services, so he launched a financial services firm called Wit Capital Corp.

The original plan was to set up a company and offer the Internet floatation services as experience with Spring Street, coupled with an array of other appropriate financial services. From the notion of offering the Internet IPO as a service, and the obvious economies of scale wrought by the bulletin board market for own stock, the idea of setting up a complete Internet stock exchange is an obvious next step.

By posting the bids and offers, and arranging for some order matching software to match, or cross, the orders, it remains to just issue instructions to settle the payment. Settlement of a trade is a relatively humble task, and one that is simple enough when both parties hold settlement accounts co-located with the trade (and a provided service when not).

Having solved the technical issues, at least on paper, we can see that the marketing game becomes one of acquiring lots of user accounts. This then feeds into demand for more IPOs, which enables the building of a market place or stock exchange.

As a plan, it worked well enough for Wit Capital to acquire lots of capital [Wit1]. In tackling the challenge of building the world's first Internet investment bank and stock exchange, Wit Capital have done the following [Wit News] [Duffy]:

- Partnered with a Web and marketing house to gain access to Internet technology and marketing.
- Acquired stock exchange technology from the team that worked with the Chicago and New York stock exchanges.
- Boosted the board with finance experience.
- Acquired brokering technology from brokerage software firms.
- Signed up a deal with a settlement house.
- Applied to the NASD for a license.

And so Wit Capital have assembled all the pieces to build their own financial system of lenders, exchange and issuers. Or have they?

This plan is flawed, as evidenced by apparently slow progress of a decade of Internet time [I-years] since inception to the launching of their first service (Internet brokering to the markets) [WitOpen]. Why? It comes down to these factors:

- User base.

  Wit Capital's efforts to register users in advance of having something to sell them is insufficient [Goldie-Scot2]. Doing your own DPO is very different to selling DPOs as a service. And being lauded by the press and financial community for having discovered a new segment is not the same as having a client base of either borrowers or lenders within that segment.

- Lack of Uniqueness.

  Wit Capital are not unique in wanting to build a user base of lenders and a reputation for pushing out DPOs. As well as half a dozen direct copies (ensuring some useful diversity) there is no reason why any investment bank or brokerage in Wall Street or anywhere else can't copy their plans.

  Worse, if Wit Capital succeed in even a small way, this represents a proven, high-exposure, model for large players, *with client bases*, to copy and migrate themselves into the new Internet financial system.

- Breadth of activity.

  The breadth of the challenge is too extensive. By attempting to create an investment bank, a brokerage, and a stock exchange, Wit Capital is taking on nearly the whole industry. It is not so much the arrogance that is at issue here, but the number of regulators and the size of the systems that they now have to cope with. As each different aspect comes into play, a new group of specialists emerges, and a new set of lawyers calls in on the conference call.

- Wrong Target.

  Picking on the exchange is exciting from a journalistic point of view, but ultimately illusory.

  The purpose of a stock exchange, as evidenced by its structure, is to allow a cartel of brokers (the *seats*) to monopolise the activity and force trades to pass through them. Over time, the stock exchanges have begrudgingly become reasonably competitive due to tight control by their owners, changes in rules, or simple competition with other exchanges. In contrast, the brokerages have grown fat off the success of the cartel arrangement.

  Notwithstanding the apparently low-valued profitability of exchanges, indeed, it would seem that this sector is somewhat crowded with the SEC finding in excess of 140 *alternative matching markets* operated by brokerages and other operations. [SEC].

  Further, stock exchanges need to be big in order to provide liquidity, and generally only a few of them make the grade. Klein recognises this, by saying "This is not something we're going to try to do on a small scale," [Wells], but simply recognising the scale of the challenge does not make it strategically viable.

- Beat Them Then Join Them.

  Any start-up gets one chance at launching a surprise attack. Klein used up his when he set up the Wit-Trade bulletin board for trading shares. As well as earning him the respect of the SEC for the innovation, it has also earned him permanent oversight by the regulator and the rest of the financial community.

  In other aspects, such as the buy-out of the programming team responsible for two exchanges, and the board being stacked with financial members, Wit Capital has joined the community. In fact, it looks as if an external player has used takeovers and financial weight to muscle into the industry, so rather than innovation, conformance is a more likely strategy.

In contrast, E*TRADE took on the brokerages: a part of the industry where small and large players compete, so a small player can try something new and grow unmolested. It's also the part that had the most fat, not the least, earning E*TRADE significant marginal difference in fees.

Further, online brokers such as E*TRADE and Charles Schwab's e.Schwab are far better positioned to move into the DPO and exchange business: with both the user base and the pass-through trading systems in place, the addition of new stock marketing and internal crossing of orders is far less daunting [Goldie-Scot2].

This activity is already occuring, with both E*TRADE and e.Schwab signalling their desire to join the distribution lists of large IPOs [E*TRADE1]. At the Internet exchange level, the SEC has issued a request for comment on a number of issues relating to the regulation of what it calls the 'alternative matching markets.'

3. Experiences in Digital Certificate Trading

Euromoney cautiously suggests that "perhaps even real-time trading" is to come [Webb1]. This section describes experiences in real time digital trading conducted by the small startup company of the author, Systemics Ltd. It remains, as far as we are aware, the first and only digital certificate trading system in existance.

3.1 Background: The Structure of Trading Systems

Before describing our experiences, some background will help to set the context of Systemics' view of the world.

What is a modern financial system? Delving deeply into this question seems rather difficult, as latter day examples are more complex than many, including those at Systemics, can cope with, and the details quickly slide into mundanity.

Notwithstanding, there appear to be some common elements in all financial systems, whether that of Amsterdam in the first years of financing voyages to the new territories or the International markets of today:

- a medium of exchange, a.k.a. a payment system, or more simply, money
- a means of transforming lending into fungible instruments (debt and equity as certificates or book-entry systems)
- a place for trading financial instruments (exchanging money for loans)
- a system of settlement to complete trades
- many borrowers and many lenders

We could also mention more sophisticated additions such as reputation, regulation, and intermediaries. However, these are not considered here.

Astute historians will also recall that in early systems there was no distinct settlement, as all instruments took the form of paper certificates carried and presented at the market place. This method suffered difficulties when the invention of the telegraph allowed instructions to outstrip paper delivery, thus causing the separation of trading into instruction followed by settlement.

Let us now assume that the system of trading, as perceived by the external trader, is made of core structure of three components,

- the exchange,
- the settlement or clearing house, and
- the broker,

Now, a standard analysis of the cost components within the price of a trade passed onto the trader by the broker reveals that there are two major components, and one minor:

- The fee for a trade on stock exchange is quite low, in the order of $2 [Fees1].
- The fee for a settlement from the clearing houses is in the order of $10 to $30, plus interest on debits [Morgenson].
- The fee for a broker trade is anywhere from $10 to over $100, stretching from a Web broker such as Datek to a full service broker. [Fees2].

The trade itself, as crossed by the exchange, is simply not an attractive target. In contrast, the broker component and the clearance component are both attractive in terms of the costs locked up in the processes [Fees3].

This can be seen from a cursory examination of the processes: a trade is only briefly in the exchange before being passed over to the settlement process. No money or stock ever enters a modern exchange, and the pure exchange takes on no great risk (as counterparty substitution is generally conducted by the clearing house). A trade passing through an exchange is a far less complex process than the trade passing through the settlement house.

In construction of the Systemics' view of the Geodesic Financial System [Hettinga1], the technology of digital certificates was employed to develop digital financial instruments that could settle immediately. This enabled the trade instruction from a trader to a market to include the instruments themselves, and resulted in the re-combination of the trading process into one, atomic action.

The normal approach of digital trading has been to speed up the process of issuing the instruction, and look to other informational process for secondary savings. In contrast, the approach of Systemics was to eliminate the settlement process as an expensive component of the trade. This approach reverses the separation of settlement and instruction that began when the the invention of the telegraph allowed instructions to move faster than paper certificates.

3.2 What We Did

Systemics operated an "internal" market in digital certificate bonds that were distributed amongst investors in the company. This represented a trial or prototype to test the concepts and operation of software. It was also integrated into a straight retail system, in that the payment system was the same [Howland].

The system consisted of Issuers of digital certificates and a market for trading them. Digital certificates were issued that represented several currencies and various debt instruments. The value trial was conducted over a period of a year with $10 zero-coupon bonds traded against a US dollars currency.

The following sections tries to draw general lessons from the experiences.

3.3 Micro-Trading

The objective of the Exchange was to usher in a new era of micro-trading in the Geodesic Financial System, based on the purported savings of digital certificate trading in eliminating the settlement process.

The system design was intended to work well at small numbers, as eliminating costs meant that smaller trades than previously envisaged were made possible. This resulted in a number of effects:

- The dollar currency sliced down to tenths of cents (a.k.a. *mils*). As a micro payments system, it worked well, but in reality nobody was interested. Once traders and (traditional) retailers had gone to the trouble of hooking up the system to do *any* transactions, they were simply not interested in 1000 trades that earned them $10 in revenues.

- For the prices of trades, we chose to use decimal pricing and consequently found a number of rounding errors creeping into the system. As the essence of the systems design was to avoid any possibility of loss, the market always won the ’salami slice’ by ensuring that rounding errors were in its favour.

  This came under challenge when we started receiving international support calls from irate investors who had lost fractions of mils (i.e., less than 0.05 of a cent). In retrospect, it would have been more profitable to award any salami to any investor who owns a calculator.

- Digital Certificates Trading is cheap. Calculations on the cost of each trade at the Exchange came in at from a cent to a dollar, depending on turnover and how the variable costs were split up.

  In fact it was so cheap that it could be ignored, until a support call arrived. As support is an event that generates costs in the hundreds of dollars, each support call wipes out the potential profits for many thousands of other trades.

In effect, the limiting cost of the transaction was support, and the conclusion to be drawn is that digital certificate trading will be as cheap as the support can make it. We have a number of models to reduce support, but it is question of more experimentation whether these costs can reach sub-dollar levels and enable true micro-trading [support].

3.4 Innovation Versus Reliability

Digital certificate trading is an innovatory technique, but this gives it no special dispensation in being reliable. In contrast, it has to be more reliable than normal trading, due to the support and security aspects of the design.

The first implementation was unreliable, in that, theoretical failure modes existed that had severe support implications. This unreliability proved unsustainable in the long run, and had to be replaced with newer versions of protocols and servers that are 100% reliable.

In retrospect, this was a necessary step, and anecdotal evidence suggests that this experience was incurred by other developers of similar Internet payment systems.

It was impossible to appreciate the view without having first taken the journey. Only at the end of the first trading month was it possible to sit back and map out the terrain covered: hardware, programming, distribution, support, programming, finances, and to then develop robust systems for the future.

3.5 The Team

How many disciplines are required to build a financial system? These are the ones that we identified:

- Accountancy and Auditing.
- Programming.
- Systems Architecture.
- Cryptography.
- Economics.
- Internet and Security.
- Finance and Banking.
- Risk.
- Marketing and Distribution.
- Central Banking.

A cursory examination of any financial system confirms this, and perhaps if such forward planning had been conducted, the team would have been convinced ahead of time to try another project. As it was, team members made do by picking up the disciplines as required; future startups are encouraged to put together multidisciplinary team in advance.

3.6 Integration I

As a technical issue, it was shown that it was possible for one team or group or company to be able to run all the components. As mentioned above, there was a strain on the number of disciplines required, but once the software was written and the procedures were in place, economies of scope helped to make it possible to build a financial system in a box [Hardware].

Whilst achievable and achieved, the one-stop shop was not necessarily the most appropriate strategy for a small team to aim for. It became clear that even highly trusting partners would balk at placing large sums into the hands of programmers, no matter how many financial acronyms were mentioned.

As a principle, a financial system spreads responsibilities amongst different parties, with different specialisations for dispute resolution (the courts), escrow (the banks), operations (the programmers), and trading (the markets) [Hettinga2].

Spreading the responsibilities becomes efficient once the complexity of the system is increased such that it is no longer transparent to the average player. Rather than each player being required to learn all aspects of how to trace and resolve problems, a player learns the half-dozen major blocks, and how each block interacts with the others to form a reliable, functioning system.

As it turns out, the point at which these efficiencies develop occurs very quickly. Indeed, for Systemics' markets, this occurred about the same time as interesting transactions were being demonstrated.

The separation of responsibilities can then be proposed as a more general rule, which is a useful learning result of the experiences, but possibly an obvious fact to the reader. Unfortunately, this leaves us with the future task of needing to develop a system of cooperating institutions, which has become perhaps a greater stumbling block than developing the software in the first place.

3.7 Integration II

In contrast to the need to separate out responsibilities, it was found that the distinction between money and financial instruments was largely artificial, once placed in a technical context.

An early assumption, mirrored by the current set of technologies, was that money (or *payment systems*) was distinct to financial applications. Systemics' early plans were to espouse the crowded field of electronic commerce, and concentrate on digital trading. For that reason, systems were designed to allow traders to integrate the money of other payment systems with the stocks and bonds managed by our software.

In one sense the application of financial cryptographic techniques to digital certificate trading is simply an innovation that happens to use a lot of cash. Once early prototypes were up and working, however, it was found that there is far more in similarity than there ever was in difference between cash and instruments.

By issuing cash as a financial instrument, and by making some minor changes to reflect this versatility, a major component was removed from the system (resulting in significant savings at all stages of the chain).

Furthermore, we found that the system of digital trading was unified in a way that opened up new possibilities: Systemics found itself in the electronic commerce business, as well as in loyalty systems and casinos.

We found that cash is simply a financial instrument of a particular flavour. Internet payment systems are thus simply financial instrument management tools that have only been applied to retail-like sales transactions. In contrast the financial system is a giant holistic network of transactions and relationships, and payment systems should reflect the conceptual basis of financial transactions, not the underlying assumptions of the designers.

4. What the Future Holds

In this section, an attempt is made to map out a plausible future for the financial world.

4.1 Imagine a World in Which...

Gary Hamel and C.K. Prahalad suggest that we should search for major discontinuities, and imagine world where these come to pass [Hamel & Prahalad].

The major discontinuities are:

- The Internet: free and open access by all individuals to information and activity.
- Globalisation and Regionalisation: the shift away from national economies to regional blocs within a global trading environment.
- Financial Cryptography: the development of a series of techniques that allow secure electronic transactions over insecure networks such as the Internet.

Let's imagine a future where digital trading is the norm. A trade costs nothing, it takes no time to settle, and it is secure. Anybody can trade, all have direct access to the market with no intermediaries, just like all surfers have access to the Web page, all businesses use email.

4.2 Back to the Future

Actually, to be fair, we have already shown that this is all technically possible, so it is not really stretching us as Hamel and Prahalad suggest. But it is good enough for the current exercise, as deployment is not a proven affair.

Further, it is not the first time that something like this has happened. To see how trading used to be free, with universal access, and immediate settlement, we need to go back several hundred years to the earliest stock exchanges:

> *" Historically, stock exchanges were open to all buyers and sellers, and exchanges (like the Paris Bourse) were built at public expense. The market was wide open. In New York, the colonial capitalists gathered under the big buttonwood tree down by the "wall" and traded stock in new ventures. "* [Zgodzinksi].

Traders stood around with portfolios of notes representing shares in trading ventures. To trade, you simply had to be there. The trade was between the buyer and seller, and settlement was generally immediate: cash for certificate. Reliability was good, at least in good weather. Security relied on a measure of trust and paid security, much the same as now.

Of course, to see this in the current context we have had to assume away much of the detail, such as distance. Security relied very much on gentlemanly behaviour. Costs were low, but one still had to hire a boy to carry the portfolio of certificates. And there was the ever-present danger of succumbing to natural monopoly pressures:

> *" In May of 1792, the exchange was formally opened with 24 brokers joining forces. All buying and selling had to be done through one of these intermediaries. For almost 200 years .... this price fixing effectively had thwarted competition between the members of this exclusive club. "* [Zgodzinksi].

4.3 Markets

Without the ability to control trades, large centralised institutions such as the London and New York exchanges are not workable structures.

However, liquidity is still required, so large somethings are still on the planning list. What is left is a global market of individual stock holders that is organised according to a set of protocols. The current day model would be NASDAQ, where the market is a collection of screens showing market makers interested in quoting prices on stock.

How farfetched is this? The Web already matches this organisation, as the Web is simply a collection of links that point to currently interesting places.

The Internet has already shown that a community of disparate, far-flung technocrats can come together in a mesh of coordination that defies understanding in the conventional world of commercialism or state intervention. Building the Geodesic Financial System might simply be a matter of writing the RFCs [IETF].

4.4 Software Firms

Money is mostly made on value added services, but to add value a brokerage or a clearing house must have something to add to. Stripped of the trade, brokerages will search for the only other link into the users pocket: the software. Likewise, clearing houses that have been stripped of the settlement will be competing for the same software.

Trader software is highly sophisticated and costly. Users will be searching for a painless way to get access to good software that manages their trading activities. One-off purchasing is prohibitively clumsy, and not valid in the intensively competitive world of trading. Freeware solutions will do the basics, but give no help on decision making, and provide support of a variable nature.

Brokers will evolve into services that provide the software, and in the final analysis will become software firms: both as authors of trading software and as operators of networking installations. Likewise, as the clearing and settlement functions are eliminated, firms specialising in the back-office process will also migrate to the same segment.

On this foundation, many new software operations will attempt to sell added services such as markets, issuance of financial instruments and funds. But they will face an intensely competitive market where any small player can conduct all of these operations by simply downloading the basic protocol components of the software and running it.

Investment banks will still have a role in IPOs, but the role will be much more of a technical one, with the provision of financial instrument issuance as a central plank.

Small brokers as intermediaries will disappear, to be replaced by funds management selling pure knowledge wrapped up into specialised financial instruments. The economies of scale in Internet brokering are much higher, due to the complexity of trading software, than they ever were with current day brokering. Many brokers will not be able to maintain their customer base whilst meeting the demanding software investment.

Again this is not farfetched, as much of the movement is already being seen: information providers such as Reuters and clearing houses such as Bear, Sterns & Co, are now competing to provide the software and operations for small brokers [Schmerken].

4.5 Investor Protection

In the Internet market, protection of the investor raises difficult questions [Lee]:

- Which investors is a state regulator to protect, and from whom?
- Is it neccessary to protect foreign investors from local crooks, or locals from the foreigners?
- How does jurisdiction get determined in the first place?
- Is there a distinction between Internet information and a prospectus?
- How can the regulator see the information passed along private channels in the first place?

In a world where an investor can be an anonymous and stateless *netizen*, where private access to channels is the norm, where all rules are bent for rich foreigners, and poor locals get a better deal by emailing another country, it is difficult to imagine a strong investor protection scenario on the Internet.

The answer is individual responsibility and education: all investors are promoted to what the SEC calls *sophisticated investors* and are thus considered responsible for themselves by their very entry into the system. Then, the role of the investor protection agency migrates to include:

1. Providing general education on trading.
2. Promoting minimum standards for disclosure.
3. Selling certification on a voluntary basis.
4. Providing a central point for fraud watch.

As institutions are regulated primarily for investor protection, then a world of responsible investors limits useful control of the institution as well. This transformation has already happened to a large extent in the banking world. Many central banks use their powers to audit the procedures of the banks, but refrained from directing a bank to do things in an approved way; their role is one of parental guidance from the privileged position of sharing the secrets of all the opponents. Likewise, it has been recognised for some time that rescuing failed banks is self-defeating.

4.6 The Market for Reputation

Even the above role by regulators is likely to be a temporary way station, as there are obvious similarities between this set of activities and the activities carried out by companies such as Dun & Bradstreet and Standard & Poor's.

In the absence of some formal indication of security, how is any individual supposed to know who is reliable? Reputation will be a prized asset, raising the marketing component in any intermediary's budget. For example, E*TRADE spends about a quarter of its revenues on marketing [E*TRADE2]

Rating services will become more prevalent, and more normally consulted for all reputational purposes.

4.7 Private Law

In a complex international situation, how do you settle disputes, once reputation (or the threat to one's good reputation) has failed to resolve them?

If the participants have agreed to draw contracts in a given jurisdiction, then there is a potential to resolve disputes in front of the courts in that place. However, this is likely to be extremely expensive, if we assume that some or all of the parties are not actually based in that place.

A more likely occurrence is the evolution of private law services such as arbitration. These services already exist for some disputes, and can probably migrate to full Internet dispute resolution far faster than any legal system [Kohn]. These services are likely to be drawn from accountancy and law firms or arbitration associations such as the American Arbitration Association.

5. Concluding Remarks

The above future is one based on predictions of an eventual economic structure, and is of course no more than a sum of predictions. Whilst it is not possible to have a lot of confidence in predictions about the eventual structure of the GFS, it is possible to look more reliably at the next few years.

These conclusions attempt to draw out the predictions, in the opinion of the author, that will indeed come to pass.

5.1 Rapid Structural Change

It might be thought that the innovations discussed in this paper represent welcome efficiency boosts for an industry used to only marginally improving service year by year. That is true, but only hints at the structural change that will sweep through the industry over the next few years.

These changes include:

- Access to markets will be primarily over the Internet. The retail battle is won [Brooks], the primary distribution battle is looming [Goldie-Scot2] and the institutional market will inevitably face a fight [Webb2]

- Retail trading is a commoditised business with individuals getting direct access to the markets on the same basis as institutions, as well as all informational advantages as well.

- With commoditisation comes the waxing of the IT and marketing stars, and the waning of the financial and legal skills.

- Economies of scale are rapidly climbing, meaning both that large operations will be the norm, and large investments will be needed to survive in the industry. Pressure to invest will will squeeze out small brokers, and will push larger brokers and clearance houses into each other's arms, resulting in the convergance of these two segments into one.

- As larger operations become the norm, the distinction between the liquidity available at the exchange and the liquidity available within one operation will diminish. The future of exchanges is also threatened by the more aggressive competition of a many-to-many network of traders accessing over public systems such as the Internet [Warner]

5.2 Benchmark Rather than Certainty

Will the future consist of a costless transaction base, a truly open market for trading, and a borderless economy that allows all equal access?

It is quite clear that the possibility exists; it has been demonstrated, and it is thought to be theoretically sound. For the moment, there are some technical, structural, and commercial issues that prevent widespread deployment, however entrepreneurs are working around the world to eliminate these issues.

If we assume that entrepreneurs could make this world a reality, and due to the nature of the cost advantage of digital certificate trading, it would be expected that only an equally costless and equally open alternative would succeed.

Then, if not reality, the digital certificate model is a benchmark. If the trading systems of any institution or company, or the economy of any nation-state or trading region are not improving against the digital certificate benchmark, then they can expect to be bypassed.

So the challenge remains the same: business and political leaders everywhere should be preparing their charges for this world, whether or not they subscribe to the precise mechanics of how it is accomplished.

5.3 US versus the Rest

This paper is rather US-centric, and this is a simple reflection of the US leadership in digital trading. Indeed, the US is so far ahead that players in other countries have little need to think, they can simply copy the best from the US.

What is perhaps more concerning is that there is little hope that non-US markets can catch up at this late stage. The worse case might be for national markets to suffer an Americanisation over the next decade, as the far better trading opportunities available on the US markets pull investors in, and companies follow looking for liquidity.

5.4 To the Victor, the Spoils

We have seen how usage of the Internet to improve the efficiency of the Financial System can deliver great gains. By using the new medium for information dissemination, transaction instructions, and as a basis for the marketing of lesser capitalised firms, we can eliminate many of the warts of the existing system. The result is more than a face-lift, it represents savings of an order of magnitude that portend dramatic structural change.

In contrast we have also shown an alternate world, a new financial system that will arise where the *entire process* can take place on the Internet. This promises transaction costs further orders of magnitude lower than the existing system, even in its new, Internet-enhanced, mode.

The nature of the competition between the two can be predicted, although precise details will elude. It is the existing infrastructure against the the sweeping digital winds of change. The victors will be those corporations that with the one foot stand firm and defend the institutions that have endured for so long, but with the other foot take their place in the new world with experimental gusto.

6. References

Version This paper is ***$Revision: 1.1 $***. It was presented at Digital Money, London 7-8 October 1997, and is to appear in a forthcoming issue of *Virtual Finance Report*. Original source of this paper is at http://www.iang.org/papers/digital_trading.html or digital_trading.ps for postscript. Back.

Author Ian Grigg, a founder of Systemics Ltd, can be reached at iang@systemics.com Back.

Systemics Ltd A company founded by Ian Grigg and Gary Howland, Systemics is a pioneer in the emerging field of financial cryptography. Back.

Credits For much of the work in designing a financial system for the Internet, I am indebted to Gary Howland and Mike Wynn.

I am also indebted to two reviewers who wish to remain anonymous, but have provided in-depth critiques based on industry expertise. Back.

The State of The Art

Email The first *killer app* of the Internet is email. Back.

ESI A well publicised case was that of ESI, the net broker of Sharelink. Back.

ISI For example, look at Internet Securities, Inc, a provider of emerging markets information. Back.

HemmingtonScott A good one is at Hemmington Scott. In this author's view, free dynamic chat sessions such as that at Yahoo! Chat are useless due to noise. Back.

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DPO-Council The DPO-Council appears a useful non-profit site that lists consultants and research into the segment. Back.

Investor Guide The Investor Guide - IPOs is another site that lists consultants and new DPOs, with a more commercial flavour than the DPO-Council, above. Back.

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Mamis Robert A. Mamis, *Inc. Online*, "Interview with Andrew Klein," July 1996 Back.

Wit1 Press Release, *Wit Capital Group*, "Wit Capital Corporation," 2 April 1996. Back.

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I-years Time in Internet evolutionary terms is considered to be similar to dog-years, to whit, there are 7 I-years to every calender year. Back.

Wit Open In a series of emails to registered interested parties, *Wit Capital* announced that the "Wit Capital is open for business and ready to accept your Membership." 16 September 1997 Back.

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Experiences in Digital Certificate Trading

Fees1 LSX recently cut prices (perhaps due to competition with Tradepoint) A £50k trade now costs £2.35 (outside order book) or £3.00 (new order book), with sliding charges down to a minimum of £0.25.

In contrast to the author's proposition, Bolsa de Madrid charges nothing for less than 5000 pesetas (about £20) ? and thereafter up to 2250 (about £8) for 50 million pesetas (£250k). However, settlement fees range from only 15 to 250 pesetas (about £1). Could this be the result of the monopoly position by SLC, and fee sharing being a centralised decision?

CBOT is about $1.50 (from memory).

Needs more research. http://www.tse.or.jp/eb/ebc.html shows a settlement diagram.

Back.

Morgenson Gretchen Morgenson *Forbes Today*, "Sleazy doings in Wall Street," 24 February 1997. Note however that Morgenson's estimates appear not to consider the trading costs of Web brokers such as Datek or E*TRADE that potentially charge the same or less for the entire trade. Back.

Fees2 Datek are advertising $9.99 (it is not known how much they pay for settlement).

Sharelink's Frequent Trader Club charge £16.50 to members.

E*TRADE advertise $20.

Business Week Article? Back.

Fees3 The broker and clearing components are obviously coming down very quickly. The historical difference is disappearing as Web brokers put downward pressure on the clearing houses to match the deals, and the exchange may become an important element in the future. Thus, the conclusions of this analysis might be weakened or even reversed in the future. Back.

Hettinga1 Robert Hettinga (1997 1), *e$ Rants*, "What's a Geodesic Economy?," 6 June 1997. Hettinga uses the term *Geodesic Economy* deriving from Peter Huber's work on telecommunications. Back

Howland Technical details on the payment system, SOX, can be found in Gary Howland (1996), "Development of an Open and Flexible Payment System" August - November 1996.

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SOX remains one of the few open source-published strong-crypto payments systems available. Back.

Support For those hoping for a more economic model, the cost of trading is thus:

```
profit = n * x(p) - n * p(s) * c(s)
```

assuming zero profits we can drop the number of transactions term, *n*, and the cost per transaction function, *x(p)*, can be shown to be simply a function of the probability of support, *p(s)*, and the cost of each support call, *c(s)* :

```
x(p) = p(s) * c(s)
  = cost per support call / number of transactions per support call
```

In other words, drive down the support call frequency and cost. Of course, this assumes away development as sunk costs, and ignores marketing. Back.

Hardware For those interested in details, all servers ran on a single Pentium 100 MHz machine running Unix. Single payments complete within about 5 seconds, and trades are settled within about 20 seconds. Back

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Webb2 Perhaps a forerunner of this is Andy Webb (2), *Wall Street & Technology*, "Transcending Cross Platform Conflicts," July 1997, pp 120. Back

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