Capital Markets:
Taking Stock
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Three defining characteristics of the new architecture prevalent in capital markets today are new rules on best execution, multilateral trading, and the elimination of age-old concentration laws. With customers demanding identity protection and reduced trading costs, and regulators establishing fresh benchmarks for trading, we find that traditional market forces are blurring.

Markets have made significant progress in the past few years, improving infrastructure and products. In this issue of Channel, we walk you through some of the major changes anticipated in the markets, as also assess their likely influence on market transactions.

2006 is being heralded as the year of the service-oriented enterprise in the financial services industry. More institutions will begin to follow a common development standard, regardless of the underlying technology choices they make. Faced with the need to innovate, improve technological efficiency, and manage risks effectively, organisations will pursue greater STP and voluntarily adopt more rigorous compliance norms.

Pre- and post-trade compliance is set to be one of the most active global compliance initiatives this year. New transparency requirements will affect providers and users of equity trade data and, therefore, heads of technology, trading, operations and compliance will have to work together in understanding its scope.

Repeated financial losses owing to lacunae in the information supply chain are compelling financial institutions to look at optimum solutions for reference data management.

Recognising the need for capitalising on accurate and trendy information, traders and investment managers will, we believe, create in-house, centralised reference data environments with turnkey software solutions.

Algorithmic trading streamed in a new concept in the markets last year. It is soon expected to affect new trade classes and change the dynamics between the sell-side and the buy-side.

Our research explores the breadth and strength of the new integrated capital markets and leaves you with a fair estimate of the fluidity in the current market structure. Are the markets witnessing a transitional phase or a permanent change? How valuable is a business that delivers superior market insight and transparency but, maybe, declining profits? How will technology enhance market connectivity? Read on…

Anjana Srikanth
Editor
Capital Markets – A Source for Innovation and Opportunity

Capital markets are witnessing an incredibly challenging business environment today. Market liberalisation, the introduction of new asset classes, increased scale and complexity of multinational entities, enhanced cross-border trading, emergence of hedge funds, changes in regulation, and a consolidated market infrastructure are rapidly transforming the sector, along with advancements in technology. The dynamism of financial markets rests on investor confidence – and, investors are attracted by the depth, quality and integrity of markets, besides expecting valuable returns. With the extensive usage of technology, investors are now able to access a wider range of investment opportunities across countries and continents.

The eagerness to deploy new technology has always differentiated capital markets from other sectors. Innovative design and development tools are ushering in virtual markets, new financial instruments, and sophisticated systems and network infrastructure for processing transactions. For instance, hedge funds – currently holding around USD one trillion – are using the most highly-developed technology to connect operations across the globe. More importantly, with increased competition between investment banking firms, technology is being leveraged as a tool to differentiate offerings and improve brand recall.

The scale and diversity of risk in the securities markets continues to grow rapidly. Risk management instruments such as derivatives, including OTC derivatives and structured products, are gaining importance in the new market. Securities market entities are constantly looking for technology upgrades and additional processing power to cope with growing complexity, as also to improve efficiency levels. Concurrently, the industry is also witnessing:

- structural changes driven by regulatory requirements
- consolidation among market infrastructure providers due to increased electronic trading and direct market access
- demand for faster execution tools to execute sophisticated trading strategies; low latency network connectivity, and in-depth, real-time market data
- emergence of hedge funds as significant influencers in the global securities and investment market
- increased complexity of financial instruments, products and services; significant growth in transactional data volumes, coupled with declining average trade size
- increase in market data sources and providers, with rapid growth in market data flow
- improved standardisation
- expansion in execution venues, with the objectives of offering multi-asset trading on a single electronic platform
- commoditisation of technology infrastructure, and the growth of grid computing

In this race towards technological prowess and efficiency, the markets are being influenced by new developments such as:
Regulatory reforms: Changing regulatory requirements in advanced markets like Europe and USA will soon begin to affect the manner in which market players operate. Predominantly, MiFID and Regulation NMS are emphasising the need for “best execution”, “connectivity” and “wider access to markets” for investors. Living up to these requirements would necessitate new IT initiatives, including a reassessment of applications used by broker-dealers, fund managers, prime brokers, mutual funds, exchanges, MTFs, and systematic internalisers. Achieving best execution in the face of increased transparency demands will definitely pose enormous challenges, particularly, for securities firms that operate across borders and in dynamically evolving regulatory environments.

Process-oriented architecture: Process automation has reduced settlement cycles to a significant extent. However, securities firms, recognising that it may not be cost-effective to approach process automation on an ad-hoc basis, are re-examining their architecture, paving the way for component-based solutions. This has also led to the creation of generic systems governed by workflow automation, rules engines, and standardised interfaces (for instance, in messaging).

Processes that explicitly require the extensive use of rules engines and workflows are exception management and corporate actions automation – critical areas for any securities firm today. Adopting these new methods would mean realigning systems towards an open architecture that can interface with multiple, disparate applications. Another prerequisite for open-architecture adoption is standardisation. Standardised messaging and reference data create open, interoperable applications – one of the reasons why SWIFT-based 15022 messages and reference data standards have been flourishing so far.

Business process management: Securities firms and investment banks are in the process of scrutinising existing operations and reorienting their business models.

Business models would need to interface with complex external systems such as ECNs (Electronic Communication Networks), clearing and settlement systems, MTFs (Multilateral Trading Facilities), compliance reporting systems, amongst others. Faced with the need for interoperability, firms are beginning to adopt rules engines and workflow automation tools. Significant plans on automation and process re-engineering are being made based on these requirements. An excellent example of how rules engines maximise efficiency is seen in algorithmic trading, where trading rules are defined by users, and systems trade according to these rules.

Consolidation of market infrastructure: With increased cross-border trading and the need to reduce processing time and costs, market infrastructure entities like stock exchanges, clearing corporations and depositories are consolidating their businesses to achieve economies of scale. Noteworthy among these mergers are: the proposed acquisition of Euronext by NYSE Group, the takeover by Archipelago of the New York Stock Exchange, Nasdaq increasing its holding in London Stock Exchange, and the union of the London Clearing House with Clearnet. With acquisitions occurring across continents, we are seeing a move towards the creation of a truly global marketplace. Any change in market structure directly impacts the functioning of securities entities and, this in turn, would influence systems and operational processes.

Transparency requirements: The most pressing issue for the markets today is not if but how they manage data. Investors demand information updates on a real-time basis and, simultaneously, expect to be offered the best deal under any circumstance. Securities firms, therefore, are faced with the critical need for a unified data management framework that would take care of data aggregation, dissemination and replay, eventually affording them with high accountability and enhanced market integrity.

This then, is a sketch of the outlook for global financial market players. The thrust areas will be in offering business value and architectural vision. This edition of Channel offers global perspectives and examines best practices and new initiatives that are expected to shape the capital markets in the coming years.

Vijay Sharma
Head, i-flex Consulting
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Navigating the Capital Markets with Octavio Marenzi

Channel presents the Chief Executive Officer and founder of Celent, Octavio Marenzi, in a conversation with Vijay Sharma – Head, i-flex Consulting, and R. Vaidyanath – Practice Head, Capital Markets, at the i-flex solutions office in Bangalore, India. In this interview, he shares his thoughts on developments in the global capital markets, especially, the wide-ranging effects of transparency in the face of the new regulatory environment.
Octavio describes Bangalore as a place pulsating with energy, very much in keeping with its popular label of being the IT capital of India. From discussing the indigenous characteristics of any globalised city, we moved onto an insightful session on the global capital markets.

R Vaidyanath and Vijay Sharma: Capital markets worldwide are undergoing a major transformation, most of which is being driven by new regulations aimed at enhancing transparency and providing a higher degree of market integrity. What significant challenges would investment firms and market centres face under such circumstances?

Octavio Marenzi: Two regulations are significant for markets today – Regulation NMS in the USA, which goes into effect a few months from now, and MiFID in Europe in the year 2007 or later. Broadly speaking, the Europeans are allowing markets to regulate themselves implying that regulators are not particularly good at dictating what market microstructure should be, and, therefore, leaving the markets to decide for themselves. Regulation diktats in the USA tend to be descriptive and granular in detail, outlining the inherent aspects of micromarkets. The impact of both these rules on investment firms would be felt in how they plan to use them.

VS & RV: How will market centres, investment banks and broker-dealers meet the stipulated deadline of June 29, 2006, for Regulation NMS? What areas of investment banks are likely to be affected by Regulation NMS?

OM: Regulation NMS encloses four proposals on market structure: the sub-penny quoting rule, the order access rule, the trade-through rule and the market data rules. The market data rules change how revenue generation in market data is divided amongst exchanges. This is not a fundamental change in that sense except for the fact that until now market data revenue was divided by the number of trades reported. A by-product of this division in revenues is that some firms tend to shred trades and increase their numbers. For instance, they could take a 50,000 share order from a client and divide it into 500 orders of hundred shares each and sell them to the exchange. The sub-penny rule in Regulation NMS says that you cannot quote orders in increments lesser than a penny, while the order access or order protection rule requires firms to send orders to markets that display the best price and not merely to a faster market centre. We wouldn’t see too many changes in the way investment firms operate because they would still be able to send orders to the market centre, and the market centre itself would be responsible for sending orders to the best execution venue. The responsibility of obtaining the best price lies with the investment firm, though.

MiFID, although less descriptive than Regulation NMS, is far more fundamental in terms of the changes it promises to bring. In the UK and in most other countries, trades which take place off-exchange have to be reported to the exchange within a certain time delay after which the market disseminates and sells this data. MiFID says that you no longer have to report trades on the exchange. Instead, an exchange/alternative trading system, or a third-party or proprietary system would also serve the purpose. The only specification is that the trade needs to be available to the market on a reasonable commercial basis and then be consolidated, thereby, offering firms the freedom of choice.

MiFID introduces pre- and post-trade transparency for trading equities on three types of execution venues — regulated markets covering stock exchanges, multilateral trading facilities covering alternative trading venues, and over-the-counter trading venues.
on three types of execution venues – regulated markets covering stock exchanges, multilateral trading facilities covering alternative trading venues, and over-the-counter (OTC) trading venues.

The most significant tenet of MiFID is the “best execution” requirement, which implies that firms will now have to demonstrate their execution policies across multiple execution venues, and describe how they went about achieving best execution.

VS & RV: Will business models in the capital markets landscape undergo any restructuring due to Regulation NMS and MiFID?

OM: Certain markets in Europe enforce concentration rules that require investment firms to send their orders to the national exchange for execution, with the assumption that this would lead to the best price, and improve transparency and liquidity. MiFID removes these barriers and introduces a completely new transparency regime for investment firms that are systematic internalisers in shares. Through internalisation, exchange trades can be sent off the exchange. This opens up a range of trading opportunities; most importantly, that of the system internaliser. MiFID stipulates that internalisers post real-time quotes as an indication of the prices at which they will internalise their orders. At the moment, an investment firm has the option of routing an order to an exchange or internalising it. With MiFID, investment firms will have to publish and disseminate prices in real-time. This would mean that new market data sources have to be accounted for and, then, consolidated.

Germany does not follow any post-trade requirements at present; half the trades take place off the exchange and are not visible to the market. MiFID will make these hidden orders transparent. Further, MiFID will increase market data, post- and pre-trade data volumes, and, in the process, complicate order execution to a certain extent.

The most significant tenet of MiFID is the “best execution” requirement which implies that firms will now have to demonstrate their execution policies across multiple execution venues, and describe how they went about achieving best execution. Best execution is a fact of life in equity trading. With MiFID, the non-equities markets including OTC products, derivatives, fixed-income products and swaps fall under the umbrella of best execution. The fixed income market is a deal-driven market. For instance, when you approach a particular bank to buy bonds, you are buying out their inventory or principal, and the bank is playing the role of a broker-dealer. What best execution means in such a scenario is difficult to understand.
The way the market currently works is that if someone is interested in buying bonds, they would compare prices from multiple banks and send orders towards the best quote. The bank is under no obligation to make sure that its price conforms to the best price in the market. MiFID changes this process by stipulating that banks substantiate best execution through data validation. The effect of the best execution rule on the non-equities market would be more dramatic than on the equities market.

**VS & RV:** Will market centres, investment banks, and broker-dealers be in a position to meet the stipulated deadline of June 29 for Regulation NMS? How would this affect investment banks, especially, in the investments they would have to make towards compliance? Will the quality of execution in the equities market in the USA change?

**OM:** Regulation NMS does not affect investment banks to a large extent except that they may have to modify their trading strategy while selecting best venues for execution.

At the moment, market data revenue is strictly divided by the number of trades recorded. Under Regulation NMS, only half the data revenue would be based on the post-trade side; the size of the order would start to come into play, and the other half of the revenue would depend on how frequently the inside quote in the market is opposed. So, if you are posting your quotes through an exchange and you are the inside market, or posting the best bid or offer for a particular issue for a certain percentage of the day, you receive a higher percentage of the market data revenues allocated to you. In other words, there would be a bias towards smaller stocks.

The downside of this is that some investment firms may refer to the inside quote for stocks with the objective of capturing a share of market data revenue, and may not be interested in trading at all. So, we may observe firms involved in some manipulation at the boundary, but for the vast majority who don’t engage in these activities, it won’t be any different. Market centres themselves have already established connectivity with each other, implying that no additional investment would be needed. But, as market data network providers would have to divide revenue based on complicated formulae, there may be a certain amount of expenditure involved here. The overall investment related to Regulation NMS would be restricted; and, yes, it should arrive in late June as stipulated.

**VS & RV:** As access to capital markets around the world becomes commonplace for individual investors and multinational institutions, the race is on to attract foreign investment capital. Apart from the USA and EU, which markets, do you think, would emerge as major drivers for change?

**OM:** The Indian and Chinese markets are high on this list due to their sheer size and scale. The stock exchanges in the Middle East are attractive in terms of investment despite the rough times they may have faced in the past few months. As far as trading volumes are concerned, the European Union and the USA would act as major influencers; and, so also, would the Tokyo stock exchange.

**VS & RV:** The hedge funds industry has attracted considerable attention recently, with its business environs being in a constant state of flux. How will the industry meet future performance expectations? And, what do you see as the emerging role for technology?

**OM:** One of the major issues that firms face, particularly, on the hedge funds side is that the trading of derivatives and underlying instruments takes place on different platforms and technologies, and across multiple interfaces. This creates a problem because many hedge fund strategies are predicated on the idea that the derivative is traded against the underlying bond, taking advantage of arbitrage opportunities, and with movements that are correlated or should be correlated. Technology would simplify trading of multiple asset classes. Credit derivatives and the underlying bond would be traded on the same platform with the same order, and with the assurance of a certain price for a specific instrument.

**VS & RV:** What, in your view, is fuelling the growth of derivatives in global markets?
Going forward, where do you see the market heading?

OM: In certain markets, the preferential tax treatment meted out to derivatives has ensured that they have seen stupendous growth, even more than underlying instruments. Equities markets in the UK have certain stamp duties attached to the trading conducted on the exchange. As instruments are not subject to the same set of levies, volumes driven into contracts can differ, but they would provide the same payout as equities, with varied tax implications. This is another area propelling growth in the derivatives market.

VS & RV: Do you see a move from the OTC derivatives market to a more structured exchange-traded derivatives contract? We are observing some exchanges initiating standardised contracts, although, the OTC market is more of an institutional-driven market.

OM: The exchange is good at providing basic standardised products, while the OTC market specialises in exotic, complex and flexible products. For instance, for a foreign exchange option trading at an exchange in, say Chicago, you would look for an option in an international exchange whose expiration date coincides with the one you are trading. Now, if you have a risk exposure that does not correspond with these dates, you would look for an option at the OTC market that has the same expiration date. This is the reason OTC markets continue to survive. Exchanges are not flexible enough in terms of introducing new kinds of products. They could play a larger role in flexible options, futures and derivatives and, thereby, open up numerous untapped opportunities.

VS & RV: Regulatory requirements are never far from the mind of any financial institution, regardless of its size, location or domain. However, there is a need for banks and corporates to consider compliance as a route towards improving their business rather than it proving to be a burden. What are your views on compliance and its benefits?

OM: Well, I think, one could use compliance systems and related data in a more resourceful manner. For instance, in the case of anti-money laundering, transactional history could be used to cross-sell solutions or understand customers better. In reality, banks may have embarked on these initiatives even without the shadow of compliance hovering over them. I’ve spoken to many chief compliance officers in the past and their general opinion is that compliance on its own is a burden. They feel that Sarbanes-Oxley maybe ill-conceived as it hasn’t helped them improve their internal processes.

However, if money has to be invested in compliance, an organisation should make the best of these initiatives and reuse information in a creative and beneficial manner. Most firms tend to view compliance as costly, with no tangible benefits, which is unfortunate.

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Preparing for MiFID

The Markets in Financial Instruments Directive (MiFID) aims to standardise trading rules, improve transparency and protect investors. The MiFID Joint Working Group was created to examine the influence of MiFID and make recommendations to help the industry prepare for and manage these implications.
MiFID’s fundamental premise is “best execution” for the investor. It stipulates that investment firms provide the best quality of service to their customers. This would logically increase competition levels in the market, a fact that the European Commission had made clear while drafting MiFID.
on an order-by-order basis, to be the best venue for execution, firms are expected to look elsewhere to trade. Yes, investment firms will drive competition in the post-MiFID era.

**RV: Looking at the kind of research that has gone into the cost of settlements in Europe in the past, which in itself is an area of concern for regulators, do you perceive any consolidation on the settlement side?**

**CP:** Yes, the settlement industry in Europe is witnessing major upheaval in this context. MiFID itself addresses the settlement environment by separating venues where an instrument is traded from those where the settlement has to occur. There has been a trend amongst exchanges in Europe towards combining the national securities depository with the exchange itself, thereby creating a single operation that would permit trading and settlement within the same unit. Exchanges, as a result of MiFID, are most likely to come under pressure to separate their settlement business from their trading business. Regulators and governments will not be able to say that the settlement of a domestic equity has to happen by law on a domestic securities depository. Taking away barriers to competition will naturally increase competition. We are already seeing announcements in the press about the European Commission demanding structural changes in the securities industry – and, threatening to introduce new directives if it doesn’t comply. A competitive environment can be created only if there is more than one securities depository.

Another aspect to this is that with Europe comprising 42 countries, 25 of which belong to the EU, and with many others considering joining the EU in a few years, securities depositories are bound to decrease in number.

**RV: Do you see a consolidation in execution venues and market players? Or will existing players reinvent themselves and transform into dominant forces in the market?**

**CP:** The future of the London Stock Exchange has to be a fundamental question here because the principle has already been established that it is up for sale. What people are now negotiating is the price. Apparently, bids are being rejected because they are not high enough. Between multiple stock exchanges in Europe, there still is a potential for consolidation, but it does not necessarily mean that investment firms would agree with this train of thought. We are now at a stage where a small number of investment firms control the majority of order flow across Europe. If 17 firms in London control 75 percent of the order flow, what’s stopping them from trading with each other? The stock exchange does not bring liquidity – that comes from order flow. Instead, it ushers in transparency. When people used to meet on the stock exchange floor in the past, the only way that you could see what was happening in a market as a whole was by being on the floor of the exchange. The trading world has changed today with the introduction of electronic trading and new technology that make the entire process transparent.

Our expectation of how transparent the world is today is totally different from what it was twelve years ago. Two significant happenings in the European market in 1993 were the introduction of the European Union’s Investment Services Directive and the advent of the commercial Web. We’ve come from a point where the Web was purely academic to the point where now it is everyone’s window on the world. Can a stock exchange develop better trading software than an investment firm? Can it build a better online network? Unlikely. Investment firms are larger than individual stock exchanges and can trade directly with each other today. Of the 21 stock exchanges in the EU, if 20 percent of the investment firms controlled 75 percent of order flows, why would they need to trade through 21 exchanges? Wouldn’t it be easy for them to just trade with each other instead?

**RV: With the changing role that securities firms now have to play in Europe, will risk control, self-assessment and compliance form a significant portion of this transformed identity? How can a securities firm evaluate and redefine**
its operating model based on emerging policies, procedures, architecture, and data requirements that have been stipulated in the Level 2 draft of the directive?

CP: Obviously, with the November 2007 deadline, some of the areas of focus are self-assessment and future compliance initiatives. There are about 2,000 investment firms that are members of stock exchanges across the European Union. Each one of them may have to review their reason for existence in the future as competition increases. Self-assessment will begin with compliance and risk control, followed by profitability. I think in terms of evaluating operating models, the first step would be to look at the fundamentals of the business that these firms are in. Are they in a business which is non-profitable, marginal, or non-sustainable, and would the business rely on the technology used? Data architecture, networks and sharing capabilities are some of the vital areas that may require reassessment.

RV: The last MiFID readiness survey suggests that 80 percent of respondents are unsure about their strategy and plans to meet the stipulated deadline. How will investment firms comply with the tight deadline?

CP: Smaller firms, forming the majority of investment firms in Europe, may face greater difficulty in meeting the deadline, while larger firms will evidently be more equipped monetarily to make any changes required. But, the question being debated is whether MiFID itself will be punctual and stick to its November 2007 deadline. Will regulators be lenient and provide some leeway as far as implementation goes? The significant concern here is that this directive is aimed at protecting investors, and if MiFID is not implemented on time, investors would be left in the dark. It is time that investment firms begin identifying the right solutions and ensure that they are ready for this transformation. This is one of the largest projects that investment firms would be undertaking since 1993, and it necessitates an early start.

RV: Do you see a phenomenal increase in cross-border trading across Europe post-MiFID? What data requirements would investment firms face in terms of pre- and post-trade data? How would they endeavour towards achieving superior transparency?

CP: Cross-border trading will change in many ways. Some firms trade foreign shares with domestic firms. Any chain of trading ends in its original country because that’s where stocks held by investors are based. Rather than cross-border trading occurring on the home exchange of a particular equity, it will transpire through major investment firms that themselves are members of the numerous exchanges in Europe. Instead of the investor having to visit 20 different venues, a single venue, which could be an investment firm, can lay off trades against other brokers and exchanges in the market. MiFID would
increase cross-border trading in the sense that it seeks to remove the barriers to cross-border trading that exist today. Pre- and post-trade data requirements would themselves pose a great challenge. Publishing pre-trade quotes in equity markets and having to publish OTC quotes that people can actually trade against are activities that firms have not had to do before. Equally, on the post-trade side, people have not published post-trade OTC prices because, typically, they are not supposed to be trading OTC equities in any case. They must find a way of doing it. The implications for the technology that will help them publish this data now assume significant importance.

So, we are faced with an industry that lacks the infrastructure for data publication and consolidation. Firms will soon be forced to comply with publishing requirements by building the necessary infrastructure. They will have to work with data distributors, exchanges and software providers. Vendors have more of an idea about where problems lie, and unless investment firms start talking to them soon, they will be asking vendors to provide a solution that vendors don’t understand.

An investment firm can operate in three different modes concurrently – as a normal broker, systematic internaliser, or as a multilateral trading facility (MTF), and it can offer all these services to the same client simultaneously.

RV: An intriguing area, that has been debated about immensely, is the transformation in the data vending industry, especially, concerning the publication of market data. Will vendors be forced to cooperate and ensure that this data is available across investment firms across Europe? Do you see an industry effort to cooperate in this area?

CP: The MiFID Joint Working Group has compiled a white paper on post-trade data publication and MiFID. It believes that cooperation is something that the market data industry should definitely be looking at. For example, major stock exchanges like London, Frankfurt or Paris deliver prices to around 150 companies that have market data distribution contracts with them. These could be large vendors like Reuters, Bloomberg or Thompson, all the way down to the local newspapers. Evidently, making investment firms publish their OTC equity data across 50 spaghetti networks is not the solution. Most data vendors will need to cooperate to gather all the data that needs to be published.

RV: What is a systematic internaliser, and how should systematic internalisers model their businesses post-MiFID?

CP: Level 1 describes a systematic internaliser as an organisation that internalises client orders on a systematic basis. Large banks in Germany, Austria and other parts of the EU have been brokers and members of stock exchanges for more than 60 years. For those banks that enjoy a large retail clientele, their client order flow is adequate to justify matching buy and sell orders internally. If, for example, one customer wants to buy 100 Daimler Chrysler while another intends selling 100 Daimler Chrysler, the bank can internalise that deal without necessarily going to an exchange or, equally, can generate order flow by publishing quotes to attract this flow.

Systematic internalisers systematically conduct business on their own platforms, and in turn compete head-to-head against an exchange. A systematic internaliser is only one of the
Best execution is about providing the best overall result taking into account all costs and not the trading price alone. In principle, it becomes a regulatory issue that involves not just analysing trading costs on behalf of clients but also providing best overall execution.

To provide best execution, firms would need to understand the investment profile of clients and make decisions about their investment portfolios. Firms tend to draw up a contractual service agreement with their clients, and these contracts are written in the context of the national law at the time the contract was signed. But, with changes in legislation as a result of MiFID, firms may have to modify client contracts to comply with MiFID. What’s more, these contracts will have to be signed by clients. Only appropriate contracts would help investment firms protect themselves from lawsuits.

RV: Would best execution be defined in terms of clients and multiple instruments, amongst others? Do you think this will give rise to a new approach towards trading in Europe?

CP: Best execution is first defined by the law. We are talking about client protection being the primary responsibility of an investment firm. Europe, being an influential market,
does set a benchmark for other regions to follow. The idea of client profiling or KYC (Know Your Customer) is now extended beyond mere anti-money laundering, as is presently established in the USA, and is moving to cover the kind of investments clients would want to make based on their respective profiles. Managing client data effectively will now not merely refer to the way a business is run but involve all interactions with clients in the market.

**RV:** Do you see a trend towards systematic trading in terms of predefined logic for each customer for specific types of instruments?

**CP:** The trend is towards algorithmic trading. With MiFID, it would be vital for investment firms to document processes for best execution, and algorithmic trading provides the necessary technological support for implementing these processes. The ability to adapt to algorithmic trading is probably the key to the life of an investment firm in the future.

**RV:** Another area that I feel requires more elaboration is the impact of MiFID on IT expenditure and new IT initiatives. There has already been a lot of debate on the amount of spending that is going to happen even before the Level 2 regulations.

**CP:** The IT architecture for managing, storing and distributing data would be a singular area that will witness significant spends in the near future. We are talking about firms re-architecting the way they conduct their business. Sharing facilities and infrastructure, applying data standards, and managing reference data would require a complete revisit. I know that it might sound strange, but I think that people are facing problems today because they haven’t paid adequate attention to data management and storage issues in the past.

**RV:** Post-MiFID, will we see a quote-driven market or an order-driven market prevail, or would we see a balance between both these markets?

**CP:** These two market structures run in parallel today. Continental Europe has been more of an order-driven market so far, while the London markets are driven by quotes. A quote-driven market offers a level of immediacy in trading and, therefore, allows people to get in and out of instruments with maximum speed, while an order-driven market is dependent on the matches coming out of the market. The two systems correspond to different needs. However, there would be occasions where people would want to trade immediately, and that’s where a quote-driven market would have an edge over the order-driven market – particularly, in securities that are not highly liquid.

**RV:** We have discussed the kind of strategies that investment firms would need to adopt. Would you recommend a generic or customised approach?

**CP:** A customised approach is ideal as no two investment firms would follow the same business model. Firms first need to identify areas that require generic solutions and follow it up with a mix of customised and generic methods.

**RV:** Given the different levels of maturity across multiple markets – UK, Western and Eastern Europe and emerging markets – how can MiFID achieve the main challenge of integration?

**CP:** Integration is a major challenge, with a crucial element being market transparency. Even though most firms are household names in their respective countries, the challenge lies in making them known to investors across Europe. As investment firms are making less money per trade and are trading twice as much every year to maintain the existing rates of profitability, it would be in their interest to make people aware of what stocks they can buy and sell. Transparency is now fundamental to the successful integration of the markets in the future, which is why MiFID is important because of the way it addresses transparency.
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The launch of the EMU has seen the emergence of an integrated and securitised financial system in Europe. Technological advancement and market growth created a wider range of financial products and services in addition to increasing cross-border trading and settlement activity.

The introduction of the euro produced a marked demand for foreign securities within the EU. However, transactions across members of the EU were hindered on account of a number of barriers, prominent among them being the national difference in market practices, legal systems and tax procedures, higher transaction costs for cross-border trading and settlement, inefficient regulatory systems, and inconsistencies in the treatment of similar businesses.

The need to access multiple clearing and settlement systems coupled with the use of intermediaries increased the risks and costs for a cross-border investor. Consequently, the pattern of securities trading witnessed in Europe remained largely restricted to national lines. A major component of Europe’s plans to transform into an economic powerhouse is to achieve a single, integrated
financial market. Such a move would envisage a comprehensive restructuring of all financial market activities.

Now, with the planned integration of financial markets, Europe will see reduced capital costs, greater employment opportunities, and the elimination of regulatory and market barriers that encourage the free flow of finance within Europe. MiFID is one such directive in this direction. This paper explores the ramifications of MiFID in greater depth.

MiFID forms one of the cornerstones of the EU’s securities regulatory regime, and proposes to deliver an effective “single passport” that will allow investment firms and regulated markets to operate under a set of rules that will enhance investor protection across Europe. MiFID is being adopted using a legislative approach known as the “Lamfalussy Process”.*

Under Level 1 of MiFID, legislative acts concentrating on the core political principles of each directive or regulation were adopted in April 2004. In June 2004, the European Parliament authorised the Committee of European Securities Regulators to provide technical advice for Level 2 measures.

In February 2006, based on the advice from the Committee of European Securities Regulators (CESR) and industry representatives, the European Commission tabled formal draft Level 2 proposals on implementation measures and submitted them to the European Parliament and the European Securities Committee (ESC) for approval. Under Level 2, the European Commission, after consulting a new European Securities Committee (made up of representatives of the European Commission and member states), would request advice from the new ESC (with advisory functions) on the rapid and detailed implementation of Level 1 directives or regulations.

Under Level 3, the European Securities Regulators Committee would work on joint interpretation and common standards in order to ensure consistent implementation and application of Level 1 and Level 2 legislation. Under Level 4, the European Commission would verify whether member states were in compliance with the EU. MiFID contains 73 articles and applies to all investment firms and impacts nearly all asset classes. It would permit investment firms to operate throughout Europe on the basis of home country-supervision.

The directive lays down the standards expected of investment firms in various areas, which are:

- best execution
- investment advice
- business continuity
- classification, agreements, disclosures and reporting and asset protection for customers
- compliance obligations
- conflict of interests
- transaction reporting, derivatives trading, execution-only services
- information disclosure, internal systems, outsourcing
- pre- and post-trade transparency
- documentation

Initially, the provisions are applicable to only equities, with all asset classes likely to be brought under its coverage over a period of time. The provisions under the directive can be broadly classified under three areas.

a) Managing and protecting clients

Article 29, 30 and 31 prescribe that investment firms will have to provide their customers (and potential customers) with information specific to their firms, the services they provide, and the financial instruments that are the object of these services. Article 48 and 49 have specific provision relating to the fiduciary duty of investment.
firms to their clients concerning aggregation and allocation of orders and transactions.

Investment advice has been brought within the scope of the regulation. Therefore, firms have to undertake a suitability test to assess the appropriateness of the range of services, products or transactions offered to ensure that they meet all client needs.

Investment firms have to notify customers about their re-classification into categories such as retail, professional and counterparty and, subsequently, inform them about the resultant impact of this classification. This categorisation is performed based on the level of the knowledge and sophistication of the client. In addition, investment firms are required to provide customers with:

- fair and proper information relating to the risks of investment services and products
- periodic reports, which could be daily, monthly or semi-annually, providing information on firm identification; trading day, time, and venue; nature of the order/transaction, quantity and unit price; and, total consideration and details of commissions and expenses charged
- details of safe-keeping of funds and instruments belonging to customers and the resultant risks, including the extent to which any of these have been subject to securities financing transactions

Firms are required to prove having undertaken best execution on behalf of clients, and maintain detailed records supporting the same.

b) Managing conflict of interests

The directive requires member firms to establish and implement a conflict of interest policy, defining the circumstances that would constitute a conflict of interest for their various services, and describing any risk mitigation measures that would be adopted for managing the same.

Investment firms would be required to:

- implement procedures to prevent or restrict exchange of information
- ensure segregation of activities
- enforce adequate supervision of relevant people
- put in place systems for the disclosure of conflict of interests to clients, especially, for those situations where personal transactions, nature of duties undertaken, acceptance of inducement or non-monetary benefits by financial analysts and relevant persons engaged in investment research.

c) Delivering market integrity and transparency

MiFID will eliminate the concentration rules practised in certain EU member states (France, Italy and Spain), and ensure that investors and investment firms can undertake cross-border trading freely across EU member states in an efficient and cost-effective manner. It also brings within its ambit multilateral trading facilities like ECNs (Electronic Communication Networks) and ATSS (Alternative Trading Systems), with a stipulation for publishing pre-trade bid/offer prices and post-trade details of transactions such as price, volume and time. Article 21 decrees the manner in which client orders must be executed and mandates that investment firms establish and implement effective arrangements for complying with the provisions of the article. With stringent pre- and post-trade disclosures, MiFID

The directive requires member firms to establish and implement a conflict of interest policy, defining the circumstances that would constitute a conflict of interest for their various services, and describing any risk mitigation measures that would be adopted.

measures adopted by the firm fail to prevent the risk of damage to clients

The directive has detailed provisions as regards investment research undertaken by investment firms, prohibition on
requires systematic internalisers to publish firm pre-trade quotes and disseminate the same to the public on a regular and continuous basis, coupled with post-trade reporting of volume, price and time of trade, near to real-time.

Investment firms that need to satisfy the best execution requirement under the directive would now need to consider, among others, the following factors:

- speed of execution
- likelihood of execution and settlement
- size of the order
- nature of the order
- market impact costs
- opportunity costs (also referred to as implementation shortfall)
- timing

Investment firms need to ensure best execution for customers, keeping in mind customer characteristics, nature of orders, attributes of financial instruments and execution venues where the order can be directed, without discriminating between execution venues by structuring their commissions or charges.

Investment firms would have to undertake an annual review of the execution policy and their order execution arrangements and disclose the relative importance of factors that affect the quality of execution, such as details of execution venues, and any other information that they rely on to ensure best execution. With the multitude of execution venues available, firms will find this area a major challenge. It would place firms with the onerous task to define best execution policy for each client depending on various client characteristics and the nature of the financial product to be transacted.

Investment firms under the directive would be required to store detailed price movements for each financial instrument from various execution venues, and provide a complete transaction cost analysis for each venue. Investment firms and asset management companies would need to procure data, or face a situation where an incomplete view of the market can impact their competitive strength, along with interconnected compliance issues. It is here that data vendors would play a significant role. It would necessitate that firms review existing IT systems and processes in the pre-trade and post-trade area apart from storing voluminous data that needs to be accessible at real time. Records have to be retained for a minimum period of five years with a provision for the firm to reconstitute each vital stage of transaction processing.

Investment firms would be required to maintain an effective and independent compliance function, an internal audit function, and establish a comprehensive risk management and outsourcing policy (where applicable) commensurate with the nature, scale and complexity of services and activities undertaken by the firm.

MiFID will impact the functioning of firms who are currently subject to the ISD. Some of these important entities include exchanges, multilateral trading facilities like ECNs and ATS, issuers, investment banks, portfolio managers, stock brokers and broker dealers, corporate finance firms, futures and options firms, commodities firms, firms operating collective investment schemes, hedge funds and private equity funds,
occupational pension scheme firms, life companies and friendly societies, financial advisers and authorised professional firms.

Challenges Ahead

The implementation of MiFID poses serious challenges to both regulators as well as entities that need to comply. As far as the EC and CESR are concerned, the challenge lies in the uniform implementation of Level 3 across various member states and the coordination between 30 different regulators across multiple geographies. Data would have to be aggregated at various levels in the absence of uniform data standards and security identifiers. MiFID’s stipulation on “best execution” throws up significant challenges for the sell-side, specifically, with respect to demands for increased data storage and bandwidth. In short, MiFD will bring about a complete change in market structure and pricing.

Under Level 4 of the Lamfalussy Committee Report, the EC would be required to monitor compliance of member states as regards implementation of the directive and initiate measures aimed at improving consistency in the implementation and execution of securities legislation across the EU. This would imply that investment firms and other entities, which flourished under the earlier national regime with concentration rules, would now be obliged to operate in a competitive landscape.

Data management, in terms of data consolidation, dissemination and publication, is likely to throw up a major challenge for execution venues such as regulated exchanges, multilateral trading facilities and systematic internalisers.

The provisions relating to best execution could also see an increased use of algorithmic trading in Europe, thereby ushering in real-time, multi-asset class, low-latency, and non-stop trading across multiple execution venues. The level and complexity of IT systems needed to support best execution and transaction reporting requirements would be considerably high.

Nearly 45 percent of records pertaining to trade data used across the front, middle and back office would now be influenced by the increase in cross-border trading due to MiFID. Managing reference data will prove to be an additional challenge.

Some of the industry initiatives in this regard include the formation of a MiFID Joint Working Group by four major industry associations to identify compliance requirements and the need for new standards.

MiFID would also force securities firms to re-engineer and realign their business processes. Realigning systems would impact operational procedures, some of which may need modification. Given this scenario, firms need to draw up plans on how to achieve compliance by the prescribed deadline. MiFID opens immense business opportunities for investment firms for the development of new and innovative products and services for an EU-wide market.

It looks like securities firms across Europe will be burning the midnight oil for months to come. And, the reason for that would be, henceforth, the “Investor is going to be King”.

* The “Lamfalussy Committee” was appointed in July 2000 to identify administrative, regulatory, and other types of obstacles that impede trans-border securities transactions and suggest suitable measures to remedy the situation and meet the objectives of FSAP. The committee submitted its report proposing a four-level approach for the regulation of the European Securities Market. The report also led to the creation of the Committee of European Securities Regulators (CESR), which is now empowered to speed up the adoption of common rules for the working of the securities markets. Over 42 new directives are likely to be implemented till 2008, and almost all of them have an impact on investment firms.
Preserving Reference Data Integrity

Capital markets need to drive costs out on a macro level if it they are to continue to be a key influencer of economic growth around the world. Data management is critical to current performance and a prerequisite for achieving industry growth and efficiency.
Financial institutions worldwide have learnt the hard way that operational efficiency is largely dependent on the relevance and quality of data available. Tower Group recently attributed 45 percent of trade failures to incomplete or inaccurate data such as trade-specific information, standing information regarding settlements, and client identifiers and corporate actions, amongst many others. High failure rates convert to soaring trading costs and operational inefficiencies, and the lack of standardised, clean data increases operational, settlement, and counterparty risks.

The need for accurate and comprehensive reference data has become a pressing concern as the entire securities industry moves towards straight-through-processing (STP). Reference data has been identified as one of the important factors for successful STP. Manual intervention becomes unavoidable when the accuracy of data formats and identifiers are questioned, leading to an increased probability of failure and higher operational risk. This vicious cycle can be avoided with the aggregation of accurate and comprehensive reference data.

In broad terms, reference data is used to categorise, classify, or otherwise qualify or constrain transaction data and related company information.

So what is reference data? In broad terms, reference data is used to categorise, classify, or otherwise qualify or constrain transaction data and related company information. Reference data, for a financial institution, generally consists of constant values such as counterparty codes, company codes, FX rates, general values like currency, country and classification codes not contained in databases, and values based on certain business rules.

Reference Data Classes

Reference data is collected from various exchanges and dealers, amongst many other sources. This data is used for processing different lifecycles of a transaction.

Any trading process encompasses the following types of reference data:

- securities and instrument identifiers
- ISIN, CUSIP, fixed-income attributes, index data, historical pricing data, and country, depository or exchange codes
- client or counterparty identifiers for participants in a trade like BIC code, clearing house code, legal entities, amongst others
- static reference data such as holidays, tax rates, fees
- corporate actions data comprising name changes, bonus issues, dividends, mergers, redemptions and class actions

Standardising Data

Corporate actions such as stock split and dividend information form the most important areas for reference data management. As these services are shared with other vendors or institutions, a standard for data formats and messaging needs to be evolved before corporate actions data are calculated and stored in the system. Corporate actions also have a serious impact on derivatives instruments. Most organisations do not possess automated systems to manage changes in strike prices and contract sizes, and prices in the event of a corporate action like a bonus issue.

Identifiers provide complete information and attributes about the security or instrument that they set out to define. Security and instrument identifier sources are external and, therefore, predisposed towards complexity. Consistent usage of industry standards in data can help avoid unnecessary cleansing and massaging of data with appropriate business rules to obtain unique identifiers.

Client or counterparty data, which is usually available in disparate systems, again requires categorisation, cleansing and maintenance.

Static reference data like holidays
are more or less stable data and can be easily maintained except in the cases of exceptional holidays. But, fees and tax information need to be stored keeping in mind the regulatory framework of a particular country, which is invariably dynamic and evolving.

**Maintaining Data Integrity**

Organisations can reap the benefits of reference data integrity through:

- enhanced customer service levels by improving reports and trade automation
- reduced costs as a result of decreased manual intervention
- effective control of activities like corporate actions, thereby, reducing operational risks
- straight-through-processing (STP) and T+1 goals

**Paying a Heavy Price**

As 45 percent of trade records are composed of reference data and used in multiple systems across front, middle and back offices, it becomes imperative that this data is cleaned, updated and maintained regularly. Moreover, maintaining data integrity when the sources are external can be even more complicated.

There are many reasons as to why a reference data problem exists. Most firms have developed systems independently, with very limited or,
no integration at all. This can lead to multiple identifiers of data, for instance, customer data for any transaction. Cross referencing data can help surmount this problem to some extent, but, eventually, maintaining individual references and updating each one of them regularly can throw up an enormous challenge. This implies that all additional data needs to be cross-referenced and updated. With the lack of a unique security identifier across multiple exchanges, data is usually received from multiple identifiers, compounding the problem even further. This predicament is intensified with the introduction of new financial products.

The absence of common standards in data formats and delivery mechanisms, in both external and internal data, poses added difficulties. Details of places of listing and trading exchanges fall under information normally expected from every security and instrument identifier but, surprisingly, this information is not easily available today.

When a financial institution deals in more than one exchange for a particular customer, its internal system has to cater to multiple identifiers, along with associated closing prices from each exchange, and settle these transactions with respective clearing houses, depositories and clearing banks in a seamless manner. Besides this, the financial institution has to interact with various internal or external systems including broker-dealers, fund managers, issuers, corporate clients, custodians, exchanges, and trading, settlement, and clearing systems. In short, institutions are faced with the byzantine task of maintaining and managing all these complex interactions across varied systems.

Industry coalitions like the Reference Data User Groups (RDUG) are working towards a possible solution to address these concerns today.

**Gauging Benefits and ROI**

The primary benefits of a smoothly flowing data pipeline are avoidance of loss and improved revenue opportunities.

Most organisations have formed in-house teams geared towards a minimum level of data cleansing and management. With numerous choices available today – build, buy, or a combination of build and buy – whether or not to outsource part or all data management is the burning question.

Here are few essential steps that need to be crossed on the path towards data integrity:

1. It is natural that a reference data solution be planned and tailored to the business needs of an organisation. Once the consumers of reference data, and their requirements, are identified, a solution can be developed for these specific needs, and, subsequently, extrapolated to an enterprise-wide solution. The benefits of such an approach are risk mitigation, reduced timelines and improved ROI. Prioritisation of business consumers will depend on those areas where reference data solutions will have maximum impact, such as efficiency and costs. The implementation would involve prioritising the instrument/security identifiers and client/counterparty data for settlement systems and, consequently, progressing towards corporate actions data. The next step would be integrating front-office data with additional data like pricing.
2. The classification of data sources for security or instrument identifiers, client or counterparty identifiers from within disparate systems in the organisation is followed up by the identification of interfaces and formats for data acquisition from these systems. A centralised data administrative approach, keeping in mind any organisational structure changes, will help rationalise costs.

3. The decision to "buy" versus "build" is a complex one. Buying a third-party solution would entail extensive customisation, thereby, increasing costs significantly. Building a solution from scratch is not a viable option as the system may not lend itself to easy modification. Leveraging the best of both options should help develop the most effective solution. This would require identifying modules that can be leveraged from existing solutions or developed in-house, and looking at third party-solutions for the residual areas.

Client/counterparty data and legal entity data, being very organisation-specific, will need to be internally developed by the organisation. For those companies not owning an internal system catering to instrument or product data, a third-party solution is recommended.

Industry standard data formats can be applied to the source systems to obtain desired data. Data transformation and error resolution functions can be managed by adopting an industry-recognised solution.

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**Reference Data Systems**

**No Systems in Place**

- Evaluate MRDS vendor options
- **All data to be outsourced?**
  - No
  - Identify data to be outsourced like instrument/security data
  - Build/buy data system which is not outsourced, and integrate with outsourced, data system
- Yes
  - Identify vendor
  - Negotiate contact

**Some Systems in Place**

- Identify data like client/counterparty data that cannot be outsourced
- **Can existing systems be leveraged for this data?**
  - No
  - Build this data system
  - Identify vendor for outsourcing the remaining data
  - Integrate the outsourced data and internal data
  - Buy an off-the-shelf system
  - Yes

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*Figure 2*
Data delivery mechanisms or interfaces that receive data are a critical area that may envisage extensive planning. It is advisable to use industry standards such as SWIFT and FIX and XML while designing these interfaces.

Managed Services – the Future for Reference Data?

Outsourcing and providing reference data processing in the form of managed services is a viable and growing trend that is becoming the future of reference data for the industry. Managed Reference Data Services (MRDS) achieves the goals of standardisation, centralisation and transparency of the business rules in a multi-source configuration, so data quality and consistency almost always improve measurably.

Many MRDS vendors provide the entire service from data sourcing and scrubbing to delivery. Financial institutions are now moving towards a centralised operating model and sharing information among themselves, and, in some cases, even with a third-party intermediary.

A contemporary approach would be to build systems for organisation-specific data such as client or counterparty data. Instrument or securities data can be bought from external vendors, while data transformation and error resolution functions are outsourced to external vendors. Lately, a hybrid approach has come into existence wherein data acquisition, cleaning and transformation are managed by external vendors, and the organisation receives this data and stores it for further processing.

Even as there is an increased interest in this hybrid approach, organisations are wary about third-party capabilities. Some organisations are adopting a policy of outsourcing certain types of data – instrument and security data, price and market data, and corporate actions data – and using an in-house or custom made solution for client or counterparty data.

Cleansing, error resolution and production support are also increasingly being outsourced, resulting in lowering investment and risks associated in developing a reference data system, as specialised MRDS vendors are enabling more standards across organisations. Ideally, the right outsourced provider should seamlessly bridge all three participants – financial institutions, data vendors, and custodians.

How will Reference Data Management Tie-in with Overall Data Management across the Enterprise?

Managing reference data in-house is a drain on valuable resources. A financial institution’s ability to achieve a more efficient, higher-quality integrated data management solution will determine how well it succeeds at addressing the ongoing flow of regulatory and industry mandates.

Regulations Influencing Reference Data

The industry is witnessing the advent of regulations such as MiFID and Regulation NMS that are aimed at promoting “best execution” and fair and equitable access to best quotations, amongst a host of other policies. MiFID is bound to have a sizeable impact on financial institutions in Europe. The technological effect of MiFID would be felt in the following areas:

- customer databases will have to conform to client re-classification regulations
- front-office systems will have to obtain incoming market data from new execution venues and deal with increasing volumes of information
- order and trade routing would have to follow “best execution” objectives
- regulatory and customer reporting would increase

MiFID stipulates that firms source data from various sources, and record and retain five years’ worth of data to prove that they are adhering to published regulations.
best-execution policies. The obligation to report transactions at the end of each day will affect reference data systems considerably.

The biggest drawback is that the industry has information distributed across multiple systems. If market participants do not agree to common standards, there is a greater likelihood of transmitting inaccurate data. Financial institutions will have to factor in the impact of these new regulatory developments on existing reference data systems, and ensure that they manage data effectively and efficiently.

**Moving Towards MRDS and Outsourcing…**

1. In the absence of a reference data solution, an organisation would have to evaluate options for MRDS. Prior to this, decisions on what data to outsource (client or counterparty data) and how to integrate outsourced and internally managed data need to be made. This approach shifts the burden of technology and staffing to an outsourced environment, allowing the institution to focus on its core business competencies.

2. As reference data has been in existence for some time now, it is understandable that many organisations would have previously developed systems which can be leveraged in a useful manner. Decisions on what data to outsource can be made after evaluating the efficiency and effectiveness of these systems.

3. Organisations that have an extensive reference data system in place can outsource data cleansing and exception management to external vendors, thereby, reducing the costs associated in maintaining the system.

With integrated data management being one of the top challenges for financial institutions, the ability to integrate reference, market and transaction data to create a holistic view of data is the key to growth.

The challenge financial institutions now face will be in implementing data management in an environment of non-communicative legacy systems that have evolved over time, in many cases through mergers and acquisitions.

**A financial institution’s ability to achieve a more efficient, higher-quality integrated data management solution will determine how well it succeeds at addressing the ongoing flow of regulatory and industry mandates.**

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Managing the New Trading Regime – Order Management Systems

In a technology-driven market, executing orders efficiently at minimum costs and at the right price is as important as, if not more than, an investment decision. Considering the advances in technology and the increase in number of avenues through which orders can be routed, order execution can prove to be an extremely challenging task.
Reduced settlement cycles, emphasis on internal and external STP (straight-through processing), stringent regulatory guidelines such as Regulation NMS (Regulation National Market System) and MiFID (Market in Financial Instruments Directive), stress on reducing transaction costs, and increasing global trade volumes have made it imperative for every market player to have an automated trade order management system (TOMS) in place.

With an efficient TOMS, organisations can improve asset management dramatically and direct trade to the right destination – thereby, providing the right price for the given quantity to be traded, with least impact in costs. Besides this, a TOMS shortens the time gap in trading, making a big difference in volatile markets.

This paper explores trade order management systems from an institutional viewpoint.

Emerging Trade Order Management Systems

Traditionally, TOMSs create and route orders and help comply with pre-trade requirements. In the last few years, however, the TOMS functionality has evolved from humdrum clerical functionalities to collecting fills, performing trade allocations and running compliance screens. Apart from order creation and routing, executing and allocating orders, analysing transaction costs, reporting and auditing, a host of contemporary features are part of the new trade order management system emerging today.

This TOMS can interface with market destinations such as exchanges, market makers, ECNs (Electronic Communication Networks) and ATSs (Alternative Trading Systems) for order execution either directly or through a broker-dealer. Internally, an TOMS can be tightly coupled with a back-office portfolio management system to provide transaction data.

Why is Implementing a TOMS So Critical?

A TOMS would minimise risks and transaction costs; improve trading strategies; help attain best execution; streamline workflow; control investment management processes; increase operational efficiencies; record comprehensive audit trails; conduct accurate and timely processing; connect to external execution and settlement systems for true straight-through processing (STP); and report on regulatory compliance directly.

In recent times, the TOMS functionality has grown to encompass:
- advanced portfolio analysis and modelling
- FIX connectivity to brokers
- connectivity to crossing networks, access to ECNs, and direct access to markets or partnerships sponsored by vendors and brokers
- access to algorithmic trading
- comprehensive trading cost analysis
- workflow capabilities
- advanced trade blotter functionality
- enhanced audit trail logging and reporting
- dashboard metrics for cost, execution strategies, regulatory data and business processes

TOMS implementation is rated to be one of the top-five initiatives underway in asset management firms. A Celent survey has revealed that IT spending on

![Figure 1: Technology spending on trade order management systems in the next few years](Source: Celent communications)
Drivers Behind The Need for a TOMS:

Integration of multiple asset classes
Most asset management firms today are moving from disparate order management systems for multiple asset classes and regions to enterprise-wide integrated order execution platforms, which are common across multiple asset classes (equities, fixed income, derivatives, swaps, other OTC products) and regions. Integrated IT solutions provide a common interface across multiple liquidity pools and counterparties across front- and back-office operations and, thereby, control operations irrespective of asset class or geographical market.

Increased focus on compliance
Post the stock market correction of 2000, compliance in the investment industry has received more attention than at any time since the great depression. Conflict of interests between research and investment banking functions at top Wall Street firms have led to record fines and major operational changes. In addition to stricter interpretation and enforcement of regulations, a host of new regulations and amendments like Regulation NMS and Sarbanes-Oxley Act (SOX) were introduced to update requirements governing records retention and correspondence monitoring.

A TOMS would be able to monitor pre-trade, post-trade and portfolio-level compliance checks on a global level and help investment firms automate their compliance processes and optimise productivity.

Regulation NMS (National Market System)
Proposed rules from the Securities Exchange Commission (SEC), USA, now apply to any purchase or sale of securities during regular trading hours at NYSE, American Exchange, as well as NASDAQ (NMS Stocks), both for broker-dealer and customer accounts. Inter alia, it states that orders of NMS stocks may not be executed at a price lower than the best bid or higher than the best offer of any order execution facility, except if pursuant to the proposed rule’s two exceptions to the basic requirement, which encompass 1) permitting customers (and broker-dealers acting on their own account) to provide informed consent to have their orders executed in a market without regard to prices in other markets; and, 2) allowing an automated market to trade through a non-automated market up to a certain amount.

Four key technology components that firms would need to comply with as part of Regulation NMS are: connectivity to multiple execution venues; low-latency streaming market data applications to handle high-frequency ticker data; sophisticated order-routing software; and, compliance tools. Firms would need to shore up on compliance infrastructure to store order-routing decisions and actions for longer periods to prove that they are complying with Regulation NMS.

MiFID
The arrival of MiFID will empower financial institutions to provide services throughout Europe as a single market, on the basis of home-country supervision. MiFID is seeking to achieve a high level of investor protection by ensuring quality execution of transactions by imposing an explicit “best execution” obligation. Under MiFID, institutions would have to publish “firm” quotes during trading hours, and publish traded prices in all the quoted securities that they deal in. The idea is to reduce the “price improvement” game and encourage (force) institutions to reflect “real” tradable prices.

In effect, institutions would act as mini stock exchanges, which would mean that larger volumes of data would be published into the market and the approach to “best execution” would assume a quantitative rather than a
integrating with virtual matching utilities (VMUs). The OMS would match trade details with counterparties after execution, and send post-trade instructions such as settlement details and allocations, along with the trade tickets, to custodians.

The Most Suitable Route
While it is easy to evaluate a TOMS from a milieu of capabilities such as asset-class coverage, connectivity to execution venues, order routing and execution, workflow and auditing, SWIFT, FIX and ISO15022 support, compliance, integration with back-office systems, and access to algorithmic trading and transaction cost analysis, selecting the right OMS is not simple and depends on many other factors, including costs. The evaluation could begin with an assessment of “build” or “buy” options; expected changes in business processes; new focus areas such as compliance and best execution; integration with legacy systems; trends in the market, spending budgets, vendor reliability, ROI, implementation issues, amongst a host of other factors.

Cross-border trading
With the advent of new technology, and trading developing into a multi-zone, 24-hour activity, the volume of cross-border trades has increased at a rapid pace leading to trades and positions being created at a global level. In such a scenario, ensuring best execution and managing and settling positions becomes an enormous challenge. A TOMS can track, generate, route and manage orders at a global level, while simultaneously attending to local regulatory and compliance needs.

Achieving STP
Shortening trade lifecycles and the resultant thrust on STP have made it imperative for investment firms to streamline their operations from start to finish. This would involve more than mere process automation. Without the integration of all processes, and in real time, the onerous task of achieving STP cannot be completed. The industry is witnessing process automation and disengaging of legacy systems to some extent but, despite these efforts, there are many loose ends in the chain. This is where a TOMS comes in handy and plays a vital role in achieving true STP. By placing several intra-firm processes under a single application, multiple and previously discreet processes would be able to morph into one entity. Besides streamlined trade execution, an OMS would facilitate STP by actively data. A TCA component, for example, may depend on real-time data, but a third-party TCA would depend on data disclosed by buy- and sell-side firms and may, therefore, not be the optimum solution. Above all these considerations, these third-party components would have to integrate with existing systems in a seamless manner.

An ASP or transaction-based model could very well serve firms who require the aforementioned features, but do not wish to own maintenance and service costs. These systems can be delivered via the Web, packaged with real-time market data, cover direct market access, and interface with prime brokers. Eventually, trade volumes and the specific, required functionality would be the final deciding factors.

A few other points of consideration while buying an OMS are, its:

- messaging-based architecture
- link to compliance
- new features being available as components, and which do not necessitate rewriting the system
- ability to manage enormous volumes of FIX messages and transactions
- broker neutrality
- abilities to perform TCA in-house or through a broker or a third-party system
- provision for transaction fees being charged by buy-side order management system providers

Finally, any OMS today has to, preferably, be the system for equities, fixed income and FX, connect to
electronic venues, be easily customisable, and offer a plug-and-play on the FIX protocol.

In keeping with the dynamic requirements of trading, a trade order management system would have to offer the following significant features.

**Portfolio Analysis and Modelling**

Portfolio analysis and modelling help fund managers generate orders by studying existing portfolio structure and:

- rebalancing or modelling a portfolio as per a flexible model; this can be used as a benchmark, or a representative portfolio or subgroup of portfolios
- running “what if” scenarios to show risks or liquidity effects of possible changes
- rebalancing accounts or groups of accounts for new contributions or deductions
• allocating trade by amount or percentage
• advanced modelling for different asset classes; for instance, fixed income modelling by duration, maturity buckets, amongst others
• generating trades for full liquidation of accounts
• swapping securities, viewing and selecting specific tax lots, forecasting cash
• generating and routing of orders to the trading desk
• saving models for future use

An OMS would help balance a portfolio as per rules set by clients, fund managers or regulators.

**Pre-trade Compliance**

Before an order is sent to an execution venue, pre-set compliance rules are applied to check for any violations. These rules automate monitoring and adherence to client, regulatory and asset manager investment guidelines.

An OMS would set up workflows for exception handling and provide a documented trail of action. Its metrics dashboard would track various regulations like Sarbanes-Oxley, or SEC guidelines, and provide real-time data (transaction and account data) across the enterprise, spanning multiple geographical offices and asset classes.

**Order Routing and Execution**

Once an order is generated and cleared for compliance, the order router in the OMS would decide where to route this order for execution. There are multiple reasons for this – for instance, liquidity, costs, impact costs and prices offered by the venue. In the light of regulations like SEC Rules 11AC1-5 and 11AC1-6 (Rules 5 and 6), which demand that brokers and exchanges, amongst other items, produce statistical data on their execution quality in comparison to the NBBO, rules set in the TOMS for routing have become more critical from a compliance viewpoint.

An OMS’s rule-setting feature allows systems to automatically direct majority of orders to different venues for execution. With workflow facilities, orders are routed through traders and senior traders for approvals as per set rules. There can also be internal order crossing, known as internalisation, wherein the institution or the broker matches the orders in its order book before sending them to the exchange or external network.

Execution strategies are vital when
minimising the market impact of larger institutional orders. This can be achieved by “slicing and dicing” larger trades into small limits or market orders. These orders are submitted to, and cancelled from, the market in response to a number of real-time considerations including price movement, width of spread, market depth information and the passage of time. Randomisation, both in respect of the size of the order and the time of its submission, may also be used to disguise trading activity so that orders are not too easily “read” by the market.

Best execution is achieved by efficient order management and routing capabilities such as:

- flexibility in setting up rules for order routing and execution
- real-time execution reporting and market data to assist in monitoring the progression of each trade
- access to multiple pools of liquidity at the same time
- sorting and filtering functionality embedded in an electronic trade blotter to quickly locate and attend to problematic trades in real-time
- an indication of interest (IOI) blotter to aid in locating liquidity
- ability to place single orders with multiple execution venues
- ability to set up soft commissions as per agreement with the broker
- advanced trade blotter functionality to provide tighter control over trade execution
- providing a “FIX” engine needed to send information to brokers, or through a “FIX” provider’s pipes directly to a market centre

- a single staging platform used to access alternative trading venues such as algorithms, crossing networks, and ECNs through “FIX” technology
- pre-trade cost analysis tools to aid in choosing the appropriate execution strategy
- capturing higher quality trade cost analysis data that can be utilised to refine trading strategies and improve execution quality

Order State Management and Trade Allocation

A TOMS would manage the status of orders right from origination to the pre-settlement stage. It would track whether the order has been acknowledged by a trader, or a trader in another location, or the exchange, or the broker-dealer where the order has been routed to. Once the order is acknowledged, the system would track the position of fills and update the status as “partially” or “completely filled” or “cancelled”, as the case may be. It would also take care of modifications in orders. For orders that have restricted time conditions like “good till date”, orders become “live” the next day, while orders with ”good till day” condition are automatically cancelled at the end of the day if they are not filled.

Following execution, trades are allocated as per the requirement between heterogeneous mixes of portfolios based on a defined set of rules. After allocation, trades are sent to the back office for settlement.

Algorithmic Trading

Many large brokerage houses in the USA are offering access to algorithmic trading platforms for their customers. As per a survey, more than 40 percent of the volumes generated on exchanges are through algorithmic trading. Speculators, hedge fund managers and short-term traders are increasingly using these facilities.

Algorithmic trading systems utilise mathematical models to beat a particular trading benchmark. Presently, some of the most popular algorithmic trading benchmarks include: VWAP (Volume Weighted Average Price), TWAP (Time Weighted Average Price), arrival price, market on close, market on open, implementation shortfall, and algorithms set to trade in line with a specific percentage of the daily volume.

Extension of coverage beyond equities is also gaining ground as buy-side traders find themselves trading in multiple asset classes. Over the next two years, as per projections from Celent, traditional buy-side firms will make up the largest segment of growth with a CAGR of nearly 30 percent.

Buy-side traders are benefited by algorithmic trading in the form of lower commissions and market impact, cost-effectiveness, convenience, anonymity, concentration on difficult trades, and in forestalling conflict of interest with sell-side firms. A TOMS should ideally interface with algorithmic trading.
Transaction Cost Analysis

There is an emphasis on increased disclosure and transparency, compelling asset management firms to generate transaction cost analysis data – another area where an OMS can play a significant role. The transaction cost analysis functionality would encompass:

- provision of detailed transactional data and audit
- time-stamping routines
- provision of peer comparison reviews against institutional trading data
- comparison of trading costs across multiple execution venues
- breaking up of costs across trading cycles
- comprehensive analysis of total portfolio transaction costs; commissions, fees and market impact in various countries
- analysis and tracking of soft dollars
- proxies and benchmark analysis to justify execution strategies
- interfaces with independent transaction cost analysis vendors
- data for fulfilling fiduciary responsibility towards customers in monitoring their trading costs

Reporting

A TOMS should generate multiple reports based on execution, trades by portfolio, orders and fills, commission, regulatory compliance, and order venues.

To sum up: fragmentation, increased focus on costs, pressure to achieve STP, best price execution, and the implementation of new regulations are some of the primary areas of concern in traders’ minds today. The future would see:

- trading evolve into even more of a technological issue, with integration, speed and connectivity assuming an ever-increasing role for asset managers.
- a new generation of trading and portfolio management systems that would be multi-product and multi-asset based, with emphasis on connectivity.
- managers and traders having some form of electronic access to the market.
- more regional exchanges considering creating their own Automated Trading Systems (ATS). With the increase in the number of choices, locating the true market centre would become an arduous task.
- Regulation NMS making the existing trading environment even tougher for buy-side traders to execute large block trades with minimum market impact. As a result, buy-side firms would increasingly turn to private block trading platforms to get fills.
- firms, in order to comply with Regulation NMS, relying on electronic trading (DMA, programme trading, algorithmic trading, etc.). It is therefore a certainty that there would be more development in algorithmic trading or smart order placement, thereby, minimising the problems of fragmentation and regulation.
- institutions utilising robust electronic order and trade execution systems to publish prices and manage best execution.
- increased market centre connectivity. Regulation NMS would encourage slicing and dicing of large orders, which in turn would increase allocation and confirmation messages, and impose a greater burden on reconciliation and validation processes.

It would therefore be imperative for most firms to have a logical integration of an order management system and an execution management system, and the technology that would deal with these new challenges. Speed, cost and regulatory pressures would drive firms towards seeking advanced TOMS that rise above providing basic functionalities and help achieve a lot more through seamlessly integrated desktop applications.
Every business day sees approximately USD 1.8 trillion worth of trades remaining outstanding and unsettled globally, contributing a significant credit and operational risk exposure to the trading participants. Still again, the standard settlement period for equities in the USA is T+3; in Germany it is T+2; in the UK, T+5; and in Japan, T+3. How do we explain the differences in settlement periods between one market and another? Why is there a gap between the day a trade is completed and the day the cash and securities actually change hands? This is at the core of the whole debate engulfing trade management.
The pause between trade agreement and trade settlement, is in many respects, the most critical part of the whole investment process. The longer the trade remains outstanding, the greater the likelihood of something going wrong with it. One of the trade counterparties might default – and this is the most obvious risk the trade could run into. This is all the more upsetting if the default occurs after the deal is partly settled. It is an accepted fact that the profitability of a securities firm will be significantly improved or impaired by what transpires post the acceptance execution of a deal.

Perceiving the Process Flow in the Trade Execution Cycle

Technological advances, coupled with protocols such as FIX and SWIFT make it easier for us to trade across borders and time zones. To cope with an ever-increasing cross-border transaction flow, many securities firms now operate on a 24-hour basis, passing their positions and orders amongst different global locations. For them, the fine distinction between cross-border and domestic trades is passé: after all a trade is a trade. Some of the largest securities firms are beginning to perceive this new wired world order. What they do know, and care for, is that each trade comprises some unique elements, namely price, securities identifications, amount, buy or sell decisions, and the account (on whose behalf the trade is done).

However, transacting business so swiftly becomes irrelevant if the back-office continues to operate at the speed of carrier pigeons. With growing complexity and sheer volumes of global trading, traders are acutely aware of the need for significantly advanced technologies that can support and manage their transactions and portfolios. Accurate, real-time information on trade status is inseparable from risk.

![Figure 1: Institutional processing model of the Securities Industry Association (SIA)](Source: www.sia.com)
management. To obtain requisite data, trade support systems need to be better, faster, and smarter. What’s more, they need to be linked to the front office and everyone else in the processing chain, such as counterparties and custodians. It has become imperative to re-engineer the way securities trades are handled, all the way from execution to settlement.

A solution to back-office concerns lies in establishing a direct, real-time linkage between the order management system (that maintains details of outstanding and executed trades), and portfolio management and accounting systems (that the back-office uses). This is, perhaps, the first step in straight-through processing. This way all that the trader does is automatically fed from front to back office without the need for re-keying.

Volumes have grown exponentially. And, the administration costs rise as more trades fail. Pulling these two strands together, we end up with a substantially heightened risk profile for both the market and individual players. A popular market reaction to this uncomfortable scenario has been to shorten the settlement cycle. This was one of the recommendations of the Group of 30 in 1989. The Group urged all markets to adopt a rolling settlement cycle of T+3 (i.e., settling the trade three business days after it is executed) by 1992. A better proposition is, certainly, T+1.

It is estimated that annually about USD 12 billion is being wiped off the bottom lines of brokers, dealers, fund managers and custodians – the fallout of non-standard transactions. This is quite a large bill and it is hardly surprising, therefore, that there is industry-wide concern about the inefficiency of the trade processing regimen. Institutional investors and their counterparties and custodians no longer see trade and its processing as separate entities. They realise that these are inalienable elements of an entire event chain leading from execution to settlement. Also, they feel that time is money, and that undoing mistakes could be painfully expensive.

Manual repair represents a huge drag on the cost base of the securities industry. Estimates from the SIA (Securities Industry Association) say the number of trade exceptions will exceed the total number of trades processed five years ago. In STP, from the point a trade is executed to the point it is finally settled, all communications between interested parties is structured such that it sails through processing systems without any need for repair. This industry initiative aims to identify and focus on exceptions, so as to dramatically limit the resources typically committed to manual processing. STP’s instant appeal is quite understandable: by eliminating the need for manually re-keying information, the transaction is processed more quickly, with less probability of human error. Hence, STP may be defined as “the processing of a trade, whose data is compliant with internal and external requirements, through systems from post-execution through settlement without manual intervention”.

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readying their processes and systems so that by end-2005 or early 2006, they should be in a position to implement the changes related to straight-through-processing (STP).

A T+1 scenario mandates instant confirmation of the trade details, real-time updates and management of databases, online links between all interested parties, and standard message formats. The trade is processed at top speed through the system, with various entities adding data and readying it for settlement the following day. This effort would need to drive up operational efficiencies. An increasing number of intermediaries, including investment managers, portfolio managers, prime brokerages, mutual funds, brokers and dealers now offer investment and securities processing services. Such disparate entities perceive the need to offer differentiable services to customers and higher returns to investors. Also, they need to be T+1 compliant to reduce their settlement risk. With competition gathering steam, ensuring higher returns is all-important. Investment and asset industry participants will help them shrink settlement times from T+3 to T+1. STP has resulted in streamlining back-office processes and systems, reducing errors and omissions, adding customer value, improving operational efficiency and lowering transaction costs. Adopting an STP initiative necessarily means implementing a framework that assesses and rationalises the existing processes, systems and applications to meet deadlines. It automates the entire information and transaction flow right from the front-office through mid-office to the back-office. Achieving T+1 compliance is more a business necessity rather than a mere regulatory compulsion. We turn the spotlight on some of the major initiatives by the securities industry.

To rationalise shortcomings in data quality, firms are embracing data definition and management frameworks. They are also creating systems that can centralise data repositories and interface with multiple systems for efficient transaction processing. These systems enhance the enterprise’s competitive edge and flexibility by making available real-time data (for real-time analytics) and improving customer service.

is rendered complex and difficult with trade counterparties operating right across the world. The securities market is under pressure to transform and achieve T+1 settlement. With the adoption of T+1 settlement cycles, the securities industry managers are diversifying into different markets, product-types and asset classes, increasing cross-border trades.

Achieving T+1 settlement is the single most important factor for the industry to adopt STP initiatives. Increasing the efficiency of securities
The problem is compounded when corporate actions relating to the stock need to be defined in both systems. Rationalising the data management process would result in a common definition process for both applications, which enhances operational efficiency and ease of reconciliation.

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**Automating Corporate Actions**

Corporate actions processing is a manual operation that any securities organisation typically undertakes. Corporate actions are normally the handiwork of specialised staff. Securities firms and custodians are presently directing efforts to automate corporate actions processes. The roadblocks they face include the lack of standardised messaging, hassles in reconciling internal records, inability to mitigate exceptions (i.e., handling exceptions, receiving information from several sources and data vendors, and the absence of a standardised framework and processes thereof). All the same, a significant amount of automation is being achieved with respect to corporate actions with the industry adopting SWIFT 15022 message standards, automating exceptions management, implementing reference data aggregation policy and developing applications (designed to process corporate actions based on the pre-conditions set by the users).

**Managing Exceptions Effectively**

Exceptions handling occurs when the systems or processes indicate instances requiring some correction or intervention. Much of exception management is performed manually.

It is critically important for securities firms to handle exceptions effectively in order to meet T+1 settlement timelines. The life cycle of a typical security transaction comprises:
1. ordering quotation;
2. negotiating the terms and conditions;
3. monitoring limits and exposures;
4. executing order and generation trade;
5. generating deal slips and contract notes;
6. accounting the trade or transaction; and,
7. settling the trade or transaction.

Exceptions existing between multiple processes and systems (that handle such exceptions) need to be addressed effectively, if the transaction is to follow the complete life cycle defined by the T+1 time framework.

Securities firms are looking at ways to automate the exception management process by cataloguing exceptions broadly as: exceptions that can be managed by automation; and, exceptions requiring manual intervention.

**Managing Exceptions Through Automation**

Firms identify exceptions that can be automatically resolved by applying a logic devised for the purpose. The exceptions can be categorised and then queued, depending on their urgency for resolution. Post the resolution, the trade moves to the next logical step in the trade life cycle.

**Intervening Manually to Manage Exceptions**

Firms identify exceptions that require manual intervention. Next, they categorise exceptions, depending on their urgency for resolution. Post the resolution, the trade moves to the next logical step in the trade life cycle.

Exceptions management systems may be implemented in stages. In every stage, firms identify applications based on the urgency for resolution and, then, automate the processes required to settle them. Over time, exceptions management can be undertaken for other systems.

**Performing Reconciliation**

Reconciliation management is sometimes interwoven with exceptions management systems, especially, for exceptions resulting from failed reconciliation. Usually, reconciliation management is undertaken for cash, securities, inter-system reconciliation, etc. Most
reconciliation processes are manual. Firms stand to make significant headway by categorising processes into automatically-reconciliable and manually-reconciliable ones.

Automated reconciliation reduces the scope for errors and, hence, the scope for exceptions. Besides this, it can be performed more frequently unlike manual processes and this upgrades data quality over time.

**Architecting the Messaging Infrastructure**

Securities industry players acquire systems and applications based on requirement. Messaging becomes hugely important in addressing STP issues by enabling internal and external systems to interface. Existing systems typically employ proprietary messages, which need to be customised before they can communicate with other applications. The industry did foresee the question of message compatibility: FIX and SWIFT 15022 evolved over time from that foresight as the most acceptable message standards. These message standards are XML-based and hence easily adopted. With the T+1 deadline in sight, many securities firms and related entities have been investing in the requisite message-ware to make systems open, interoperable and inter-faceable.

However, the relevant messaging infrastructure is not easily architected. As a starting point, we need to clearly define the:

- information that is sought to be exchanged
- information exchange process
- system interface requirements:
  - e.g., should the systems interface from point to point?
  - should a message server be acquired to collect and route the relevant messages to entities or systems (requiring such messages)?
  - how would one map the data elements of the legacy applications to the new message data field?
  - would such mapping take an application-specific or a data dictionary approach?

These are questions which firms would need to pause and ask themselves even as they go about implementing the relevant solution. Also, they need to make the inevitable choice of message standardisation sooner for better results.

**Matching and Allocating Trades Virtually**

Global markets have been opening up, presenting investors with opportunities to invest in them. Consequently, there is a rise in cross-border trades. With the advent of T+1 settlement, the trade confirmation and allocation process for cross-border trades need to be rushed. Virtual matching utilities (VMU) come into play at this juncture. VMUs are post-trade matching engines for confirmation and allocation. These are designed to match the details of such trades and confirm the same to custodians, clearing banks and accounting agents, enabling them to process the trades. (The securities industry had also initiated its own service called Global Straight-Through-Processing Association. However, it was disbanded after it failed to commence live operations.)

Most securities firms are gradually resorting to VMUs to confirm the trade and allocation details before settling them. Securities firms now aim to automate their legacy applications in order that they link directly and send relevant instructions to the VMU concerned. Consider a trade being accounted for in the books of the investment manager. In that case, post its automation, the legacy application can automatically send a message to
the VMU for trade allocation. Securities firms are also exploring opportunities where the automation for increased operational efficiency is event-based.

**Looking Ahead**

The industry is set to adopt the initiatives we have discussed by late 2005 or early 2006. However, these changes have far-reaching implications for securities firms. Adopting STP initiatives translates into operational efficiency, enabling firms to process large-volume trades, scale up and lower transaction costs. Firms could be reasonably expected to pass on some of the benefits they reap to their clients. Additionally, in such a scenario, firms would learn to differentiate themselves from competition by offering value-added services that will help retain and, further, expand their customer base.

We define some of the broad STP trends that have surfaced in the recent times.

- **Redesigning business processes**
  
  With increased automation and operational efficiency, firms would need to re-look at existing processes. Other incentives urging firms into business process re-design include changing regulations, the need for product innovation and competitive pricing. Many processes have to be realigned or redesigned for efficiency. The redesign exercise may not fit every organisation through and through. Ultimately, based on business volumes and scale, it is for the organisation to decide if redesign is indeed its way forward.

- **Working with workflow engines**
  
  To drive up operational efficiency, securities firms have already undertaken automation exercises at various levels. However, there should be a provision to realign automation processes on a continuous basis, if they are to integrate, maintain and manage processes and data and information flow efficiently. To this end, users and securities firms should themselves be able to define process flows; the rules that apply to these process flows; and, the logic for the automation. Whereas process flows should be event-based and dependent on the occurrence of an event, the systems should be intelligent enough to adopt a certain workflow pattern.

  Event-based processing is arguably an intense and challenging exercise. Nonetheless, a certain degree of automation can help make event-based processing a reality. The adoption of workflow engines, with the power to define their own business rules, is a critical component in establishing event-based processing. In addition, the data definition and management activity could also adopt a similar framework wherein data definition, data cleansing or further data processing and enriching could be rules-based. This improves data quality, apart from reducing manual intervention.

  Take the case of an investment bank or a prime brokerage with a client base spanning geographies and asset classes. Each instrument could have a unique style of trading and settlement. Likewise, each client might have specific requirements in terms of expected rates (returns), settlement modes, markets, instruments, etc. Cross-border trades could also form part of the gamut of operations that investment banks and prime brokerages undertake to customise rules and regulations applying to different markets.

  The investment bank and prime brokerage needs to monitor exposure and risks across geographies, clients, instruments, currencies, etc. To undertake these activities successfully and with minimal risks, it would be beneficial for the organisation to define a framework (containing the rules) based on the validation of the rules and events being initiated. Events are actions, which are currently performed manually, but which could be automated. For example, if a rule is defined to the effect that the settlement of trades executed on the London Stock Exchange would be in pounds, the client needs to have an adequate balance a day prior to settlement. If such a balance is not available, the client would have to be given an interim finance facility. To that extent, a rule could be defined, which says that for every trade to be settled on the exchange, in every case wherein the balance is not adequate, interim finance facilities have to be provided. If the entire exercise of settling such trades is done manually, it would, no doubt, be extensive and error-prone. On the
contrary, if the settlement is defined by rules and workflow automation, it would ease operations and minimise the risk of errors.

- **Standardising messages**

  FIX and SWIFT 15022 messages are emerging as the most acceptable messaging standards. Both are XML-based, but not without drawbacks. FIX messages handle pre-trade requirements; SWIFT messages manage post-trade requirements. There is no common standard that links pre-trade and post-trade messages!

  Also, SWIFT 15022 messages constitute the first step in separating physical messages from data elements. It achieves this by creating a data field dictionary. The industry needs to take the next step by adopting a standard that would give securities firms the flexibility to define both messages and data elements. This evolves a message standard users could employ to define UML models. As a result, relevant messages can be derived using data elements from the data field dictionary. Furthermore, additional information is required to be added to the SWIFT 15022 messages, making them pre-trade compliant and domain-compliant. The SWIFT 20022 (currently being developed) aims to achieve this.

  The 20022 message standards would have the capability to reverse-engineer FIX-based messages and develop appropriate business models.

  The adoption of SWIFT 20022 messages also brings into being a framework for securities firms that allows users to define requirements (which could be syntax-independent). It requires business users to partake in the information exchange process.

**T+0 Settlement – The Next Milestone**

With T+1 settlement becoming a reality, the next step would be T+0 settlement, or real-time settlement, or trade-for-trade settlement. The bourses, clearing corporations, central depositories, payment systems, all require to gear up for trade-for-trade settlement. Migrating to such a framework implies overhauling the current infrastructure in the securities industry and assessing their portfolio of applications.

It further calls for:

- systems that can handle trade-for-trade settlement, continuous net settlement and multiple batches in a day;
- the facility to integrate with securities lending and borrowing mechanisms to ensure compliance with T+0 settlement;
- ability to pre-validate for securities balances or cash balances for investors of securities firms before converting these to trades (to minimise the failure of trade);
- the capability to pre-validate for securities and cash balances in the trade at the clearing corporation and depository levels;
- the adoption, by securities firms and clearing corporations, of a continuous, net settlement framework to pro-actively manage intra-day risk with a view to minimise settlement failures; and,
- the adoption of confirmation and allocation of matching utilities, especially for large value deals to reduce exceptions and curtail the risk of settlement.

**Evolution of Service-oriented Application Architecture**

Securities firms would require service-oriented and object-oriented application architecture to really meet the T+0 settlement deadline. Service-oriented architecture comprises a collection of services on a network that can communicate with one another. It defines a framework for various services and enables businesses to leverage different types of technology for different service-levels.

The services of the firms need to be grouped as logical objects. Accordingly,
The first step in achieving a service-oriented architecture would be to identify opportunities for automation. The next step is about identifying areas where users could define rules and the logic for processing. In the last step, services with similar functionalities are aggregated into the service-oriented architecture in containing objects (components) that are invoked to provide a service for a specific role (function).

processing and information flow are defined. Achieving a service-oriented architecture would make these securities firms agile enough to respond to dynamic regulatory changes. Change is a constant factor in the evolution cycles of securities firms and firms would learn to accept it as such. They will need to define appropriate systems and processes, which are rule-based and flexible.

A service-oriented application architecture can be achieved in stages. The first step would be to identify opportunities to automate. The next step is about identifying areas where users could define rules and the logic for processing. In the last step, services with similar functionalities are aggregated into a service-oriented architecture containing objects (components) that are invoked to provide a service for a specific role (function).

…and a consolidating market infrastructure

STP is impacting markets significantly. The way infrastructure is made available to market participants and securities firms is changing. Some of the global initiatives driving this include:

• **Target 2**

The European Union plans to implement a new, common RTGS system. With a common RTGS system in place, banks and securities firms in the Union would require to interface using standardised formats. This is expected to make banks more adaptive.

• **DTCC – Deriserve**

DTCC introduced an OTC derivatives confirmation and affirmation matching service which is gaining industry acceptance. The service matches and confirms trade details (to both parties) electronically. This quickens the confirmation and settlement process, and reduces manual processes.

• **DTCC corporate actions hub**

Departing from earlier message transmission practices involving multiple agencies, DTCC introduced a corporate actions hub that sends messages to every participant in the securities market arena (including custodians, broker and dealers, investment managers, mutual funds, prime brokerages, etc.) Also, DTCC plans to make the corporate actions hub a single point for all data relating to securities and corporate actions – an attempt to standardise a part of the reference data for the whole market. Attempts are on by DTCC to further enable the corporate actions hub to exchange messages between senders and receivers, and even accept election instructions from participants.

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The Derivatives Market: Heading for Prime Time

The derivatives market appears ready for prime time. With sagging returns from equities and fixed-income markets, an increasing number of firms are turning to derivatives instruments to enhance their investment performance. In addition, the exponential growth of the hedge fund community and its active role in derivatives instruments has certainly helped the overall expansion.
Broadly speaking, the derivatives market can be separated into two different markets:

- **Exchange-traded.** Exchange-traded derivatives are more standardised in nature as they are traded on a regulated exchange. Exchange-traded agreements are less costly due to the same characteristics. Certain drawbacks to exchange-traded derivatives are that they are not necessarily customisable, and not long-term.

- **OTC.** OTC derivatives contracts are customised and, therefore, expensive. However, the potential for new products is much greater, given a little creativity and enough information to create a plausible model. The downside of OTC derivatives is the lack of market transparency and regulation compared to those traded on an exchange.

Currently, the OTC derivatives market dwarfs the exchange-listed market in terms of total market size. At year-end 2004, notional amounts outstanding for exchange-traded derivatives and over-the-counter derivatives amounted to approximately USD 295 trillion. Over-the-counter derivatives notional amounts were more than five times greater than exchange-traded derivatives. Exchange-traded derivatives amounted to nearly USD 47 trillion, while over the counter derivatives ended 2004 at over USD 248 trillion (Figure: 1).

On the exchange-traded side, at the end of March 2005, exchange-traded derivatives outstanding amounts totalled USD 59 trillion and interest rate derivatives comprised the greatest amounts outstanding. In the futures vs. options comparison, futures products outpaced the options with 72 percent of the market (Figure: 2&3).

In the OTC market, at year-end 2004, OTC derivatives notional amounts
showed steady growth totalling USD 248 trillion, up from USD 220 trillion at end-June 2004 (up 12.8 percent from 04H1) (Figure: 4).

At end-2004, interest rate contracts comprised 75 percent of the total OTC notional amounts, while foreign exchange contracts were a distant second at 12 percent (Figure: 5).

Rapid Adoption of Credit Derivatives

Prior to the early 1990s, credit derivatives were rarely traded. Indeed, it was not until 1997 that credit derivatives began to be tracked. Credit derivatives are bilateral contracts that enable users to manage their exposure to credit risk. As with any other derivative contract, credit derivatives can be used either to take on or avoid more risk. Firms can hedge their exposure to the credit risk of a corporation by buying protection in the form of a credit default swap (CDS), an option that commercial and investment banks have been most keen on exercising. Likewise, investors willing to take on that risk can sell protection – insurance companies looking to enhance their returns on their investment portfolios have frequently taken this side of a deal.

As the documentation of CDSs has become more standardised, a brisk trading market in CDSs has come about with hedge funds, proprietary trading desks at banks, and other leveraged investors becoming most active. Usage of CDSs has also been spurred by the maturation of credit derivative indices, improvement of trading platforms, and the issuance of collateralised debt obligations (CDOs). According to the International Swaps and Derivatives Association (ISDA), notional values at the end of 2004 were USD 1.4 trillion (Figure: 6).

Adoption In Interest Rate Swaps

Most electronic trading in the credit derivatives market has taken place in the index products with close to one quarter of all index trading occurring electronically at the end of 2005. On the other hand, single-name CDS trading has experienced a slow adoption (Figure: 7).
notional amount outstanding figure for interest rate swaps stood at an estimated USD 147 trillion, up from a mere USD 40 trillion just five years earlier (Figure: 8).

Interest rate contracts dominate the OTC derivatives market, typically accounting for over 70 percent of all outstanding OTC derivatives instruments. Within the interest rate contracts, interest rate swaps represented an overwhelming 78 percent of the market at the end of 2004 (Figure: 9).

Some of the most common types of interest rate swaps include plain vanilla, overnight index swaps, and international money market swaps. And despite the enormous size of the market, the interest rate swaps are seldom traded. Not surprisingly, most trading has occurred on the plain vanilla interest rates swaps.

In terms of electronic trading, overall adoption remains low with about 4 percent of all interest rate swaps being traded electronically at the end of 2005. However, that figure is projected to reach over 10 percent by the end of 2008 (Figure: 10).

**Post-trade Processing and Standardisation**

One of the biggest obstacles to active trading in derivatives instruments is clearly the lack of automated post-trade processing capability. Most trading still takes place manually, typically via the telephone, and managed by middle- and back-office staff, increasing the chances for processing errors. Complex products, lack of standards, and dismal straight-through processing (STP) capabilities have also slowed adoption.

In the hope of increasing overall liquidity in the marketplace, most of the work in electronic trading will focus on pre-trade discovery and post-trade processing areas as firms continue to work on standardising the operational aspects of derivatives electronic trading. The continued industry adoption of FpML (Financial Products Markup Language) protocol for electronic data exchange will only help this cause.

Additionally, regulators are pondering the operational aspects of credit derivatives. The International Swaps and Derivatives Association (ISDA) has developed the bulk of the standard documents in the industry, and it is in a good position to respond to the lack of uniformity in the documentation.
of credit derivatives. The lack of standardisation concerning the assignment of credit derivatives trades threatens to stifle growth by creating a backlog of unconfirmed trades resulting from delayed trade confirmations. The ISDA is in the process of standardising and streamlining the process, but cooperation from market players will be vital.

Significant industry initiatives in post-trade processing and standardisation include the following:

- **DTCC Deriv/SERV.** Matching and confirmation service provided by the DTCC designed to improve post-trade processing of derivatives through automation and standardisation.

- **SwapsWire.** Owned by leading dealers, SwapsWire provides trade confirmation and back-office processing services for OTC derivatives.

- **Markit Group.** Operates RED (Reference Entity Database), a database originally created by Goldman Sachs, Deutsche Bank, and JP Morgan; it holds CDS composite and contributor level data on over 2,400 individual entities tiers with data at the tier, currency and documentation clause level.

**It Trends and Spending Projections**

The derivatives IT market has moved well beyond its focus on plain vanilla products. Instead, in recent years, the
By end-2009, IT spending on derivatives management is expected to reach well over USD 7 billion, a substantial increase from the current level of approximately USD 6 billion.

The focus of the derivatives management platform has also moved into multi-asset support capability. In addition, the demand for system consolidation and integration across different business units will continue to move aggressively into replaced by enterprise-wide solutions capable of handling multiple asset classes. For those firms looking for an enterprise-wide solution, the question becomes, how much of the existing IT infrastructure are they willing to replace? Instead of wholesale replacements, most firms will try to minimise the total number of vendor relationships and will prudently seek flexible solutions that will enable them to leverage the existing infrastructure (Figure: 11).

Most of the IT spending to date has focused on the front-office. However, as the market continues to mature, the emphasis is gradually shifting to meet the most urgent needs in back-office processing of derivatives transactions. By end of 2009, IT spending on derivatives management is expected to reach well over USD 7 billion, a substantial increase from the current level of approximately USD 6 billion in 2005.

Finding The Right Balance

The traditionally manual-intensive derivatives processing operation is gradually giving way to automation. As interest in various exchange-listed and OTC derivatives instruments continue to expand, derivatives management solution providers will continue to see a growing interest in their services. The growing adoption of industry standards, such as FpML, is creating a strong foundation for the automation of the derivatives marketplace.

For those financial institutions looking for a derivatives management platform,
the following points should be considered:

• **Buy vs. Build.** With the preponderance of cost-effective and highly reliable third-party solutions flooding the marketplace, the buy vs. build argument is increasingly becoming a “no-brainer” for most financial institutions. The emphasis should be placed on streamlining the overall infrastructure, favouring fewer vendor relationships that have the potential to provide multiple-asset class and STP capability.

• **Front-office, middle-office, back-office.** Depending on their needs, financial institutions have plenty of options in identifying the right vendor solution for their operations.

• **Emphasis on workflow management and flexibility.** In a market characterised by constant product innovations and increasing regulatory pressures, the key to developing a long-term derivatives management infrastructure is to focus on highly open and flexible rule-based platforms with a particular emphasis on workflow management so that financial institutions can evolve and adapt to new changes.

• **A clear business case.** Based on the rapid growth of the market, it is becoming abundantly clear that derivatives management system implementations need to focus on more enterprise-wide deployment. However, in an age of tight IT budgets and the existence of tough-to-eliminate legacy systems, pushing through a multi-year, enterprise-wide solution deal is highly unlikely.

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**Derivatives Management Operations**

![Diagram of Derivatives Management Operations](Figure_12)

Source: Aite Group

A gradual approach with clearly set interim goals is the optimal implementation approach in this marketplace. A “big bang” approach should be avoided at all costs. (Figure: 12)

The eventual winners in the derivatives market will be those firms that understand the key trends in the marketplace and formulate the appropriate business, IT, and regulatory strategies to build the necessary firm-wide infrastructure capable of growing and adapting to a rapidly changing market environment. After years of obscurity, the derivatives management system market appears poised for prime time at last.

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Emerging Models in Securities Lending

Contemporary securities markets are getting more competitive today. With transaction costs increasing, beneficial owners are looking for newer ways to maximise returns on their lending portfolio. This paper provides an overview of the transaction structure and emerging models in the lending industry.
Securities lending today is no longer an ad hoc, back-office operation wherein borrowers trade on securities they currently don’t own. Nor is it merely a low-risk option for lenders to earn a few more basis points or cut custody fees on their holdings. Securities lending as an industry has, in fact, matured to evolve into a foremost source of internal financing today.

Securities lending involves the temporary transfer of securities from a lender to a borrower, along with an obligation to return these securities either on demand from the lender or at the end of an agreed term. For the period of the loan, the lender is secured by acceptable assets delivered by the borrower to the lender as collateral. The collateral can either be in the form of cash, government securities, corporate bonds or deposits, equities, or assets such as Letter of Credits. When cash is the collateral, the lender usually offers a rebate for its usage. The revenue generated in cash-collateralised transactions is the difference between the re-investment rate and the rebated rate (provided to the borrower from the lender).

Lending generates incremental income that can be used either to increase the overall performance of the portfolio or to offset expenses that might be associated with maintaining a portfolio, for instance, custody costs. Considering the competitive nature of the investment management business, even a small performance gain can make a substantial difference in fund performance— a fact which may influence investors’ investment decisions and/or allocations. Some of the factors that predicate borrowing include covering a short position (settlement coverage, naked shorting, market making or arbitrage trading) as part of the financing transaction, to transferring ownership temporarily for tax arbitrage or dividend reinvestment plan arbitrage.

Securities lending today is no longer an ad hoc, back-office operation wherein borrowers trade on securities they currently don’t own. Nor is it merely a low-risk option for institutional investor lenders to earn a few more basis points or cut custody fees on their holdings. Securities lending as an industry has, in fact, matured to evolve into a foremost source of internal financing that any capital market needs to achieve as a world-class practice.

The volumes in the securities lending market have been increasing due to a spurt in the participation of hedge funds from the demand side. (Figure 2).

The revenue generated from securities lending is divided between security owners and agents, and the amount is determined by service levels and risk mitigation factors such as indemnity, amongst many others. Securities lending is often part of a larger relationship; therefore, the split negotiation can become part of a bundled approach to the pricing of a wide range of services.

Specialist intermediaries may assume a principal role or act as an agency in the securities lending market. These intermediaries separate underlying owners who are, typically, large pension funds, insurance companies, or other funds from eventual borrowers of securities.

A beneficial owner has two ways to access the securities lending market; either directly without the use of any
The Lending Market Continues to Grow

Volume has been expanding between 8-10% annually

Mutual funds have seen the largest expansion

Total Lendable Assets 2Q05: $15.3 Trillion
Source: FRS Flow of Funds

Figure 1: Growing volumes in the lending industry

Source: The ASTEC Consulting Group, Inc.
Agency lending bridges the gap between the beneficial owner who holds shares, and broker-dealers (via prime brokerage units), and hedge funds whose voracious appetite for securities have nearly doubled in the last two years. The agency or custodial lending model has grown significantly in recent years and large institutions such as pension funds, mutual funds, unit trusts, amongst others, have opted for this model. Many beneficial owners running their own programmes have changed their route to market as they have not been able to keep up with new developments in technology.

Custodians are successful at converting pure custody programmes into lending programmes (Figure 3 (a&b)). Even contributions from custodial programmes have been continuously rising – contribution from non-custodial programmes was 21 percent higher than custodian programs in the first two quarters of 2005, compared to 37 percent in 2002. Moreover, seven out of the top-ten public funds in the contribution rate are custodial programmes.

How has the agency lending model gained a corpulent share of the lending industry? There are numerous reasons for this. Agencies usually have access to larger markets. And, with the addition

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**Figure 2:** The growth in demand can be attributed to the growth in the number and size of hedge funds. Source: The ASTEC Consulting Group, Inc.
of new portfolios and stocks, their buying power is appreciably larger than that of direct lending owners. Concurrently, multiple portfolios, efficient trading techniques and risk mitigation measures ensure that agencies are able to diversify their legal structure, whereas direct lenders usually follow a strict risk regime that may result in decreased profits and value.

Setting up a securities lending desk in-house can increase overheads, a factor that agents are usually able to plan and account for. Similarly, security owners may not be able to invest in new technology, resources or data feeds that are intrinsic to the running of the business. And, with shortened settlement cycles today, highly automated environments have become the norm. Agents also offer beneficial owners flexibility in terms of managing various types of collateral. Through large collateral re-investment desks that invest and utilise cash or other types of collateral, they are able to derive the best returns.

The agency lending model may not be an optimum route to adopt for all kinds of securities. Most agents follow pre-defined structures and algorithms for lending, which may not always fit into the specific requirements of owners. These algorithms process the lending activity by ensuring that everybody in the pool has an opportunity to earn income. Revenue earned would depend on the demands of the market for the shares in the pool and, particularly, on the number of securities a beneficial owner contributes to this pool; larger the contributions to the pool, higher are the returns. An owner would always fear that an individual security may get lost among the enormous volumes managed by an agency and, therefore, be prompted to move towards a direct model.

With markets getting more competitive and transaction costs increasing, beneficial owners are constantly looking for novel ways to maximise returns on their portfolio. With an agency, an owner’s access to fund management would be somewhat diminished, leading to a lesser than pro-active approach from the owner. Agents, therefore, have their tasks cut out in that they have to strive for best returns for their customers.

The industry is also witnessing an increasing trend where the lending activity is being outsourced to new, evolving models.

The Auction Model

Lending through exclusive arrangements is not new. It is a well-established route
to market utilised by a broad range of institutional lenders. For certain types of portfolios, particularly, for global equity and fixed-income portfolios, exclusive borrowing arrangements offer significant advantage when compared to custodial programmes.

A large number of funds are opting for the auction model for securities lending. Funds that lend directly are able to leverage auctions to obtain a better rate at a cheaper cost. Approximately 1.3 million trades, totalling USD 875 billion, have been transacted during the last twelve months, with the platform accounting for 85 percent (in terms of USD) of domestic transactions in the USA and 15 percent (in terms of USD) of international transactions. The growth of auctions has been more dramatic than third-party lending, with high-profile auctions grabbing headlines. Apart from offering a new route to market, auctions increase utilisation and are proving to be a mechanism for obtaining the best deals. Auction companies work closely with each client to build a comprehensive and well-considered programme that optimises returns within their individual guidelines and risk parameters. As a result, these lending programmes generate:

- Optimal returns: With no queues, the auction process provides maximum flexibility for lenders to completely customise their programmes based on specific objectives, guidelines and risk tolerance
- Transparent results for lenders: The auction process allows lenders to make unbiased award decisions, based on measurable results
- True comparison of borrowers by lenders: The auction process ensures that all borrowers are bidding on the same assumptions and terms, allowing for a valid, true comparison of borrower bids

The Third-party Lending Model

Beneficial owners like pension funds, superannuation schemes and county councils who feel that they are too small to achieve large incomes from a custodian lending arrangement tend to use smaller, third-party agent lenders to improve their strategic positions. In such a scenario, funds and security portfolios are deposited with the selected custodian bank, but the beneficial owner arranges with a third-party lender to manage these portfolios through the custodian. So, the custodian loses the use of those shares in its lending programme, but retains custody of the portfolio. The third-party agent lender has access to a
large, varied and, sometimes, specialised client base of borrowers, and places securities out on loan for the beneficial owner. This third-party works with the objective of increased performance and amplified lending. The key advantages to this model lie in the close interactions between third-party providers and clients that inevitably guarantee higher success rates.

Unbundling Custodial and Lending Businesses

Unbundling custodial and lending activities, wherein custodial lenders and third-party services are treated as two separate entities that every beneficial owner needs to have access to, is another new development in the securities industry. With this trend, custodians are finding new ways to compete and emphasise operational efficiency and other areas where they can excel. A few custodians are even beginning to offer third-party services to owners.

The only exceptions to these transformed services would be owners that have just begun to lend or who are not aware of this new development. Custodians hoping to win exclusive lending rights will increasingly have to be satisfied with organisational inertia or temporary mandates from new lenders.

It’s difficult to predict whether agency lending programmes will enjoy the continued success they have had in recent years. It would all depend on how agencies are able to perform. And, it is evident that agents are more than happy to provide whatever comfort they can to their clients in the form of specialised, prompt payment of cash dividends on defined payment dates (whether or not the money comes into the bank from the paying agent), marshalling sufficient resources to avoid fail-to-deliver transactions (the custodian will simply borrow the necessary issues from other clients who hold the same issue), client-customised reports, among others.

For now, a healthy competition exists among beneficial owners, custodians, their internal programmes, and third-party agent lenders. And, the most proactive model, within the given risk parameters, is bound to flourish.

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An area that has witnessed a great amount of academic and practical research in the past is financial modelling. However, these models that characterise probabilities of most future outcomes are mere simplifications of reality and cannot capture every aspect of risk. Many recent financial market debacles such as the stock market decline in the USA in October 1987, the Asian financial crisis of 1997, financial market fluctuations surrounding the Russian default of 1998 (LTCM), amongst others, have highlighted the limitations of traditional statistical models to predict extreme events. This limitation poses a major challenge to portfolio managers in terms of managing their assets, particularly, those with a high exposure towards derivative securities. Another challenge that risk managers face is effective communication to senior management while managing large risk exposures,
Stress tests can provide information about a firm’s risk exposure that other risk measures such as VaR do not capture, particularly, when the model focuses on normal market risks rather than extreme events.

predominantly, while trading in complex market instruments.

Stress tests are a response to this problem. They are mostly used in managing market risk associated with traded market portfolios. These portfolios also include interest rates, equity, foreign exchange and commodity instruments that are amenable to stress testing because market prices are updated on a regular basis. Stress tests can provide complete information about a firm’s risk exposure that other risk measures such as VaR do not capture, particularly, when the model focuses on normal market risks rather than extreme events. The other approach to modelling extreme events is Extreme Value Theory, a statistical tool that captures extreme distribution of scenarios.

Stress Testing

Stress-testing techniques fall into two general categories: sensitivity tests and scenario tests. Sensitivity tests assess the impact of large movements in financial variables on portfolio values without specifying the reason for such movements. A typical example might be a 100 basis point increase across an yield curve or a 10 percent decline in stock market indices. These tests can be run relatively quickly, and are commonly used as a first approximation of the portfolio impact of a financial market move.

Scenario tests are constructed either within the context of a specific portfolio or in the light of historical events common across portfolios. Risk managers identify a portfolio’s key financial drivers and formulate scenarios in which these drivers are stressed beyond standard VaR levels. Wherever possible, stress tests should therefore reflect periods of extreme market behaviour. The Basel Committee proposes stress testing over periods similar to the 1987 market crash, 1993 ERM crisis and the bond market collapse in 1994. (See Table 1 for the popular stress tests used by global firms.)

Stress scenarios are based on plausible but unlikely events, and their analysis addresses how these events might affect the risk factors relevant to a portfolio. Stress tests simulate portfolio performance during abnormal market periods. Accordingly, they provide information about risks falling outside those typically captured by the VaR framework. These risks include those associated with extreme price movements and forward-looking scenarios that are not reflected in the recent history of the price series.

Modelling Market Portfolio Using Stress Testing

A critical drawback of the stress testing method is that results are not probabilistically estimated, therefore, making interpretation difficult. An
answer to most of these problems is to integrate stress testing with formal risk modelling by assigning probabilities to stress test scenarios. (Berkowitz 1999)

Once scenarios are in probabilistic form, they would give an idea of whether to take a particular scenario seriously or not, thereby, creating a unified and coherent risk measurement system rather than two incompatible ones.

Inevitably, the choice of scenarios will remain subjective, but even there, the need to assign probabilities to scenarios will impose some discipline on risk managers and pressurise them to distinguish between scenarios that matter and those that do not.

The secret, therefore, is to assign probabilities to defined stress events. An approach to modelling market risk by assigning probabilities to events can be established in four stages (Jose Aragones et al 2000):

**Stage One:** Identify scenarios and produce realised profits and losses (P/L) under each scenario.

**Stage Two:** Employ a judgmental process and assign probabilities to each scenario having established its P/L outcomes.

**Stage Three:** Use a formal risk modelling process of the traditional kind and model risks using appropriate risk measurement techniques. The outcome of this process is a set of P/L figures and their associated probabilities.

**Stage Four:** Having obtained the above information, bring together two sets of P/L figures and two sets of associated probabilities and carry out integrated risk estimation.

### Extreme Value Theory

Extreme Value Theory (EVT) has emerged as an important statistical discipline in the area of finance. EVT is a tool which attempts to provide us with the best possible estimate of the extreme outcome. It deals with the frequency and magnitude of low probability events. As extreme events are rare and the availability of data is very limited, the resulting probability estimates and VaRs are not accurate enough. EVT attempts to overcome this problem, and suggests a suitable approach to modelling extreme events by providing guidance about the kind of distribution that should be selected so that extreme risks are handled conservatively.

Financial returns are usually fat-tailed, and assuming normality can lead to serious underestimates of VaR.

Given the challenge of having low frequency events and limited data in estimating extreme events, a more satisfactory assumption is that returns follow a fat-tailed distribution. A suitable theorem used for estimation of extreme events, using all the data subject to certain conditions, states that the distribution of extreme returns converges asymptotically to: (McNeil, 1996)

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**Table: 1**

<table>
<thead>
<tr>
<th>Events Cited</th>
<th>Number of tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Monday, October 1987</td>
<td>23</td>
</tr>
<tr>
<td>Gulf war in 1990-91</td>
<td>5</td>
</tr>
<tr>
<td>European currency crisis in 1992</td>
<td>8</td>
</tr>
<tr>
<td>Global bond price crash in 1994</td>
<td>18</td>
</tr>
<tr>
<td>Increase in US official interest rates in 1994</td>
<td>2</td>
</tr>
<tr>
<td>Mexican peso crisis in 1994</td>
<td>5</td>
</tr>
<tr>
<td>Yield curve shape change in 1994</td>
<td>2</td>
</tr>
<tr>
<td>Latin-American market in 1995</td>
<td>1</td>
</tr>
<tr>
<td>1997 Asian crisis (currency devaluation and credit deterioration)</td>
<td>22</td>
</tr>
<tr>
<td>Sharp one-day sell-off USD against JPY in 1998</td>
<td>3</td>
</tr>
<tr>
<td>1998 10/7 – LTCM crisis</td>
<td>8</td>
</tr>
<tr>
<td>1998 August – Russian debt default and currency devaluation</td>
<td>15</td>
</tr>
<tr>
<td>Stock price decline observed globally in 2000</td>
<td>1</td>
</tr>
<tr>
<td>Terrorist attacks in the United States in September 2001</td>
<td>30</td>
</tr>
<tr>
<td>Accounting problems in United States in 2002</td>
<td>3</td>
</tr>
<tr>
<td>US interest rate rise observed in 2003</td>
<td>4</td>
</tr>
<tr>
<td>Hostilities in Iraq in 2003-04</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Stress testing at major financial institutions: Survey results and practice (BIS, 2005)
The parameters $\mu$ and $\sigma$ correspond to the mean and standard deviation, and the third parameter, $\xi$, known as the tail index, gives an indication of the heaviness of the tails: the bigger $\xi$, the heavier the tail. The case of most interest in finance is where $\xi > 0$, where the asymptotic distribution takes the form of a Fréchet distribution. The distribution includes all heavy-tailed distributions and is particularly suitable for financial data. This approach seems more appropriate in tackling problems that focus on distinctive extreme values.

This theorem shows that limiting distributions of extreme returns always have the same form irrespective of the distribution of the parent variable from which the returns are drawn. It is related to the better known Central Limit Theorem, but applies to the extremes of observations rather than their means. This model allows an estimation of the asymptotic distribution of extreme values without making strong assumptions about an unknown parent distribution. The significance of this model is that it not only suggests a method for estimating VaRs, but also measures the accuracy of the estimates by constructing confidence intervals around them. The advantage of the EVT approach to the traditional approach in estimating VaR is that in the traditional approach, VaR is estimated by fitting the distribution to certain central observations or sample ranges rather than including tail events. However, in spite of the benefits, experts still deliberate on the theoretical pitfalls inherent in the EVT models. (Paul Embrechts, 2000)

Survey of Stress Tests
A significant benefit of stress testing that has led to its wider acceptance in managing risk is its ability to link potential impacts to specific events. Stress tests continue to focus primarily on traded market portfolios, which are marked to market on a regular basis.

A survey of firms for enterprise-wide stress tests was conducted for 64 banks and securities firms representing 16 countries. The survey reports that stress tests based on movements in interest rates are the dominant type of stress tests among firms globally. Historical stress events with particular relevance to bank and security firm portfolios are Black Monday (1987), the Asian financial crisis (1997), financial market gyrations associated with the failure of LTCM (Long-term Capital Management), the Russian default in 1998, and the most popular stress test reference of the September 11 attack in the USA.

Survey of Stress Tests
Number of Tests

![Graph showing stress tests by asset type and region]

Note: The numbers in parentheses refer to the number of banks running these tests. Includes funding liquidity stress tests.

Figure 2

Source: Stress testing at major financial institutions: survey results and practice (BIS, 2005)
Historical Stress Tests

With as much acceptance to the application of stress tests in managing risks among firms, there remain issues that need to be addressed. Areas which require focus for a wider applicability in the financial market are:

- developing better stress tests incorporating loan portfolios
- integrating risk management for different types of risks such as market, credit and operational
- developing firm-wide credit stress tests for both trading and loan books
- treating market liquidity

Conclusion

The modern approaches to modelling market portfolio under extreme events such as stress testing and EVT are becoming more integrated into risk management frameworks at firms, particularly, in the management of market risks. The outcome of stress test reports will form a critical input for risk managers and, also, for senior management to evaluate risk appetites and formulate their decision-making process. In order to better appreciate the use of these tools, they have to be viewed as a complement to major risk management tools such as value-at-risk, as this practice would enable firms with a large derivative exposure manage their risk more efficiently and minimise the impact of financial disasters. The successful use of these techniques requires an understanding of their strengths and limitations, and a lot depends on judgment and experience.

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References
Ever since the publication of the risk metrics technical document by JPMorgan in 1994, Value at Risk or VaR, as a metric for measuring market risk, has been debated about extensively. The reason for this being that while almost everyone intuitively understands VaR, measuring it is far from easy.

A Building-block Approach to Measuring VaR
The three basic methodologies proposed in risk metrics – the Parametric or Variance-Covariance method, Historical Simulation and Monte Carlo Simulation methods run into several pages of text and formulae, with the inherent supposition that the user understands the mathematical assumptions underlying each of these simulations.

There exists a need, therefore, to simplify the explanation of these three methodologies and the commonality involved in their calculation. This paper proposes a building-block approach as a base to measuring Value at Risk (VaR).

A primary observation is that although there are three different methodologies that measure VaR, there exist a homogeneous set of building blocks that can be assembled together in manifold ways to compute VaR. This paper outlines these basic building blocks and the underlying methodologies involved in the computation of VaR.

**Position exposures**

Any VaR computation begins with ascertaining the position in an instrument. Correspondingly, as with all risk measures, determining what exposure amounts are at risk is of equal consequence. The first building block seeks to determine the amount of risk exposure from the positions in the portfolio.

**Pricing engine and asset sensitivity to changes in prices or rates**

A pricing engine is a key component of a VaR computation model and links the value of assets to the rates and pricing of the underlying instrument. An interpolation would determine the applicable rate or price for instances where the underlying rates are not available. For example, while standard prices or rates may be available for three and six months, it is possible that the position in the books would be due to mature in five months. Sometimes, it is possible to determine the impact of changing prices or rates to the value of the exposure as a linear function.

In multiple ways, the most common method of determining this distribution is by defining two parameters – the mean and the volatility. These two parameters sufficiently characterise a normal distribution and, therefore, assuming a normal distribution for prices and rates would imply that volatility estimation becomes a crucial component of the risk to the value of the exposure. While the sensitivity divulges the effect of a basis point change to the exposure, volatility actually conveys the variance of change in value that has historically been observed or is assumed and, therefore, determines what fluctuations to actually expect around the mean of the prices or rates.

**Distribution of rates and prices**

Changes in prices or rates over a certain time period are determined by a probabilistic distribution. Defined in multiple ways, the most common method of determining this distribution is by defining two parameters – the mean and the volatility. These two parameters sufficiently characterise a normal distribution for prices and rates would imply that volatility estimation becomes a crucial component of the risk to the value of the exposure. While the sensitivity divulges the effect of a basis point change to the exposure, volatility actually conveys the variance of change in value that has historically been observed or is assumed and, therefore, determines what fluctuations to actually expect around the mean of the prices or rates.

**Co-dependence of rates and prices**

Since most exposures consist of a combination of positions in various financial instruments, each position is subject to its individual distribution, referred to as the marginal distribution. If marginal distributions are assumed to be normal, each one of them can be characterised by a mean value and volatility value of the price or rate of that instrument. However, a certain co-dependence is observed between various instruments and positions which make up the portfolio. The co-
dependence is characteristic of how the underlying rates or prices move together. For instance, while two stocks, when considered independently, might have certain probabilities of increasing by 10 percent in a single day, the determination of the probability that both the stocks will increase by 10 percent in the same day falls under the area of their joint movements or joint distributions. Co-dependence is a way to link the joint movements of the two stocks to their movements had they been independent. The value of an asset which is dependent on any of these two stocks will be linked to the value taken by the stocks or rates through the sensitivity. While the joint distribution is dependent on the co-dependence, sensitivity is not.

For certain joint distributions, the most famous of which being the multivariate normal distribution, co-dependence is characterised by the Pearson Correlation Matrix. There are many other measures of correlation like Spearman’s, Kendall’s Tau, amongst others. Similarly, there are general methods of handling co-dependence using Copulas wherein Pearson’s Correlation Coefficient becomes a special case among the multivariate normal cases. This correlation needs to be factored in along with the individual variances/volatilities while determining the VaR for the whole portfolio.

For certain joint distributions, the most famous of which being the multivariate normal distribution, co-dependence is characterised by the Pearson Correlation Matrix. There are many other measures of correlation like Spearman’s, Kendall’s Tau, amongst others. Similarly, there are general methods of handling co-dependence using Copulas wherein Pearson’s Correlation Coefficient becomes a special case among the multivariate normal cases. This correlation needs to be factored in along with the individual variances/volatilities while determining the VaR for the whole portfolio.

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It is important to note that while positions in two offsetting instruments may have negative correlation, positions in one instrument will cancel out the gain or loss of movements in prices on the exposure on the other instrument. This is typically observed in perfectly-hedged exposures. A good example is a long position in an equity stock with an equal short position in a forward on the stock.

Correspondingly, positions in like instruments will mean that a change in price of an underlying instrument could affect the price of the other, and the risk of the portfolio will need to factor this co-movement (in the same or opposite direction as stated above) in the prices as a key component of determining VaR of the portfolio.

**P&L calculation**

Based on the individual positions or exposure amounts, the prices of the instruments, the joint distribution, the sensitivity of individual assets to the underlying prices or rates or the pricing engine, amongst others, are determined for various changes to prices by generating joint random scenarios for the portfolio’s underlying prices or rates. The resultant portfolio value can either be more or less than the current portfolio value in each of these scenarios. This gain or loss is determined for various price changes which result in a distribution of the portfolio values – an approach known as the Monte Carlo Simulation. In the event that the joint distribution mentioned above is not a known distribution but is available as a
series of historic scenarios, we can pick up a random scenario from the list and continue with the remaining steps as described above. This process is known as the Historic Simulation.

If in addition to multivariate normal joint distribution, we also assume that the sensitivities of assets to underlying prices or rates are linear, we can completely skip the P&L calculation and directly proceed to the confidence-level determination.

Confidence-level determination
In cases where we are not able to assume that sensitivities are linear and the joint distribution of underlying prices or rates is multivariate normal, we proceed with the portfolio distribution as determined above. One of the key determinants of a VaR number is the degree of confidence that can be placed in that number. Hence, every VaR number is associated with a probability number that states that the confidence that can be placed in it by determining that the number will not be exceeded in 95 percent or 99 percent of the scenarios being considered. The quantiles of a normal distribution can be tabulated. Based on the constitution of the portfolio, an appropriate confidence level is chosen.

Gamma adjustments for skewness
The VaR is finally read off a distribution of the portfolio values at various price points. The distribution from which the VaR is read is ideally expected to be a normal distribution, which would be the case if constituent instruments are linearly linked to the underlying prices/rates. It is often observed that based on the instruments in the portfolio, the linkages are not linear and, therefore, the distribution of instruments may not necessarily follow a strict normal distribution. There are certain convexity adjustments that need to be made as the distribution is skewed. It is therefore important to factor this skew in the distribution in addition to the linear sensitivity factor. The degree of skew will determine how many standard deviations from the mean are to be used for determining the VaR. For instance, for a perfectly normal distribution, 99 percent of the area under the curve is within 2.33 standard deviations of the mean. This number would have to change to a higher or lower number to factor the skew of the distribution.

Time series of prices
The actual observed time series of prices or a simulated time series is required to determine VaR. This time series is used to determine the distribution parameters for prices or rates for the Parametric and Monte Carlo Simulation Methods, while the Historical Simulation Method follows a simulated time series.

Scenario generation
Finally, for the Monte Carlo Simulation method, a sophisticated scenario generator is required as it needs to not only generate random numbers as per different distributions applicable for different instruments, but it also needs to factor in the correlations and volatility to generate meaningful scenarios. Hence, the scenario generator would have to simulate real-life combinations of prices and volatilities for it to be effective.

Methodologies: Assembling Building Blocks
The building blocks identified in the previous section can be assembled together to estimate the VaR of a portfolio, as per table 1.

**Parametric Method or Variance-Covariance Method**

The Parametric Method of computing VaR involves assembling the following building blocks in the sequence defined below:

1) Position exposure: This is used to determine the exposure for each position in the portfolio.
2) Sensitivity to changes: The change in the position exposure for every basis point change is the delta of the position, and referred to as the sensitivity of the position.
3) Volatilities in rates and prices: Volatilities are typically observed historical volatilities for standard time frames for different instruments.
4) Correlations of rates and prices: Correlations between prices and rates are again historically observed correlations.
5) P&L Calculation: The VaR or P&L computation is performed on the basis of the portfolio positions, deltas, volatilities and the correlations.
6) Confidence-level determination: The VaR number as determined above is multiplied by the number of standard deviations from the mean for different confidence levels. For instance, for a 95 percent confidence, the multiplier is 1.65 and for a 99 percent confidence, the multiplier is 2.33.
7) Skew adjustment: The above multipliers will be applicable if the distribution of portfolio values is assumed to be a normal distribution. If, however, a skewed distribution is assumed, these multipliers would change. Accordingly, an appropriate multiplier will need to be determined based on the distribution assumed.

**Historical Simulation Method**

The Historical Simulation Method can be used either by a full revaluation of the portfolio based on historical prices or merely on sensitivities of the P&L to changing historical prices. Depending on the approach, distinct building blocks may be used as explained below:

1) Position exposure: This is used to determine the exposure for each position in the portfolio.
2) Sensitivity to changes: The change in the position exposure for every historical price point is the delta of the position.
3) P&L Calculation: The P&L

<table>
<thead>
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<th>Historical</th>
<th>Monte Carlo</th>
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<td>P&amp;L Calculation:</td>
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<td>Gamma Adjustments for Skewness:</td>
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<td>Time Series of Prices:</td>
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<tr>
<td>Scenario Generation:</td>
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Table 1
computation is performed on the basis of the portfolio positions multiplied by the delta of the position. The delta is the difference between the current prices or rates and the historical prices or rates. The volatilities and the correlations are implied in the historical prices or rates, and do not need to be factored separately.

4) Skew adjustment: The P&L calculated is sometimes adjusted for the skewed nature by providing for a gamma adjustment. This is used whenever gamma sensitivities can be computed by VaR engines.

5) Pricing engine: The pricing engine comes into use whenever the full revaluation approach is taken while using historical prices instead of mere sensitivities. This leads to the determination of P&L of the entire portfolio for each historical day being considered.

6) Confidence-level determination: The historical daily P&Ls are again arranged as a distribution and the VaR is read off this distribution based on the confidence level determined. For a 95 percent VaR, 95 percent of the daily P&Ls are excluded and only the fall in P&Ls are considered, i.e., negative changes are considered only for the bottom five percent of the distribution losses.

7) Time series of prices: This is a requirement for the Historical Simulation Method as historical prices drive this approach.

Monte Carlo Simulation Method

1) Position exposure: This is used to determine the exposure for each position in the portfolio.

2) Scenario generator: The scenario generator is the key building block of the Monte Carlo method. It simulates the price changes that are used to determine VaR.

3) Time series of prices: The time series of prices are simulated using the scenario generator.

4) Volatilities of rates and prices: The scenario generator needs to consider appropriate volatilities for different instruments while simulating price movements.

5) Correlations of rates and prices: The scenario generator needs to take into consideration the appropriate correlations between instruments in the portfolio while simulating price movements for each instrument.

6) Pricing engine: Based on the simulated prices, the pricing engine is used in a full revaluation approach.

7) Sensitivity to changes: If, on the other hand, the full revaluation approach is not taken, the position exposure for every simulated price point is the delta of the position.

8) P&L calculation: The P&L computation is performed on the basis of the portfolio positions multiplied by the delta of the position. The delta is the difference between the current prices or rates and the historical prices or rates. The volatilities and the correlations are implied in the historical prices or rates, and need not be factored separately.

9) Skew adjustment: For the sensitivity approach, the P&L calculated is sometimes adjusted for skew behaviour by providing for a gamma adjustment. This is used whenever gamma sensitivities can be computed by VaR engines.

10) Confidence-level determination: The simulated daily P&Ls are again arranged as a distribution, and the VaR is read off this distribution based on the confidence level determined. For a 95 percent VaR, 95 percent of the daily P&Ls are excluded and only the fall in P&Ls are considered, i.e., negative changes are considered only for the bottom five percent of the distribution losses.

The aforementioned methods demonstrate that it is possible to compute VaR using a common set of building blocks, irrespective of the method used for computation.

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Choose Reveleus. And you’ll never be on slippery ground.
Corporate actions automation is a critical issue affecting the operations of all capital market participants, particularly, custodians, investment firms, brokers, dealers and prime brokerages (Figure 1). Historically, corporate actions processing has been labour-intensive, requiring a high degree of manual intervention. Worse still, there are no standard market practices in place with announcements coming in from across the globe in different languages and formats. It is an area open to significant operational risk, especially, for financial institutions involved in processing. Risks arise due to conflicting and incomplete information, late notifications resulting in delayed payments, loss of interest, and missed opportunities capable of causing significant financial loss. With increased cross-border trading activity and the addition of a number of sophisticated instruments, currency conversions and taxation issues also need to be addressed. There is, therefore, a compelling need to automate this business area.
With T+1 settlement becoming an imperative, it is essential for securities market participants such as custodians, asset managers and prime brokerages, amongst others, to re-look at existing processes responsible for corporate actions, identify those that are predictive in nature, and consider automating them.

This white paper discusses some initiatives the industry has taken towards corporate actions automation.

Examining Current Trends

We notice the following dominant trends in the corporate actions automation landscape:

- **Workflow automation**

  Securities firms are identifying areas requiring little or no human intervention with the intent of successfully automating their corporate actions. But, instead of considering these areas as mere points for automation, securities firms need to keep them more generic and define the processes based on certain rules. Many securities firms are gradually adopting workflow automation tools to avoid manual errors. These tools can help open up more processes for automation.

- **Exception processing**

  Corporate actions processing in a security firm is more or less a manual process. Exceptions would therefore occur, falling into two categories – (a) those requiring no intervention, and, (b) those requiring intervention.

  Corporate actions requiring no intervention could be automated and resolved through the data enrichment process. Securities firms are identifying such processes within their firms and attempting to overcome the problems associated with exception processing. Identifying and automating such instances result in successful exception processing management.

- **Communications via SWIFT 15022**

  Until recently, most of the communication and information exchanges with respect to corporate actions were manual. Further, information was received and sent to various entities using fax, e-mails or proprietary messages. The attendant inconsistency drained the resources of securities firms considerably. With the advent of T+1, these processes were automated in a short while.

  As a first step towards achieving this automation, the industry adopted a certain set of standardised messages to address the issues of interoperability, ease of workflow and cost reduction for the organisation. ISO 15022, developed by SWIFT, was one such initiative to standardise message exchange amongst participants. Many securities firms have now adopted these message types thus reducing workflow pressures.

**Asset Managers**

Asset managers are keen to know the details of securities that serve as trading-cum-corporate action benefits and when they would be traded as ex-benefits (for e.g., ex-bonus or cum-bonus). Such details help them decide whether or not they should invest in the said securities. Asset managers are equally keen about the way these corporate actions affect their portfolio valuations. Mindful of this, they would like to access updated information. They are also increasingly
interested in interfacing with data vendors and information sources, who can offer real-time, online information on the immediate impact of corporate actions on investments.

**Brokers and Dealers**

Brokers and dealers would like to offer the best quotes to their clients and in turn would like to be provided with the latest quotes. They also like to receive the information online on their trader screens to view the market impact and avoid pricing errors. They would like to interface with all possible data sources to reflect the influence of corporate actions on their front-and back-office applications.

**Custodians**

The benefits of corporate actions automation are most felt by custodial businesses. Successful corporate actions processing is the key to good custodial service. Custodians own a range of systems — record keeping systems, stock lending-borrowing systems, data vendor management systems, client interface applications, and messaging interfaces — that manage their customers’ holdings. To realise corporate actions automation, all these systems would have to coherently link via workflows and rules engines.

**Stock Exchanges and Clearing Corporations**

Regulatory entities such as stock exchanges and clearing corporations also need to disseminate information to their trading and clearing members. This includes information supporting corporate actions and its impact on indices, securities, derivatives, exchange traded funds, amongst others, listed on the exchange. It is important for trading members and brokers to capture such information in their back-office systems in order to process corporate actions. However, stock exchanges and clearing corporations need to adopt industry-acceptable standards like SWIFT 15022 to disseminate information in place of proprietary formats.

![Diagram](Image)

*Figure 1: Impact of corporate actions processing on securities market entities*
entities concerned are sure to find such standards more acceptable.

- **Centralising the dissemination of corporate actions information**

  Usually securities firms receive corporate actions information from various sources that run on different technologies and avenues. The message formats (in which the information is received) are usually proprietary and dependent on the data vendor. The industry is undertaking initiatives to standardise such information-vending as well. A case in point is the Depositories Trust and Clearing Corporation (DTCC), a corporate actions hub. DTCC standardises and disseminates data with respect to corporate actions to all the market participants. Similarly, the London Stock Exchange disseminates corporate information with respect to securities through SWIFT 15022 messages. This is an example where a consolidated market infrastructure yields immediate benefits.

<table>
<thead>
<tr>
<th>Stages</th>
<th>Steps</th>
<th>Activities</th>
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| Data receipt and aggregation | Step 1. Information is received from multiple sources such as data vendors, stock exchanges, clearing corporations, etc.  
Step 2. Data received from various data sources is reconciled; a common reference record for all the applications concerned in the securities firm is created | 1. Information is received  
2. Information is recorded  
3. Data or information is reconciled  
4. Data is scrubbed or cleaned  
5. A common reference record is created |
| Data or information updates | Step 1. Information is captured in multiple applications  
Step 2. Data in various applications for settled and unsettled trades is reconciled | 1. Information is updated in multiple applications  
2. Differences, if any, are reconciled |
| Investor decision-making and processing | Step 1. Investors are informed in every case requiring their decision for further processing of corporate actions within a set time frame  
Step 2. Investors’ decisions are transmitted to the company or registrars  
Step 3. The corporate action is processed on confirmation from the company or registrars; back-office records are updated  
Step 4. All records are processed where corporate action is due (Irrespective of investor intervention) | 1. Investors are informed  
2. Investors’ decisions are received  
3. Investors’ decisions are communicated to company registrar  
4. Confirmation is received from company/registrar  
5. Corporate actions are processed in multiple back-office applications |
| Reconciliation and dissemination to investors | Step 1. The effect of corporate actions is reconciled in every back-office application  
Step 2. The information is disseminated to the investors concerned | 1. Reconciliation report is prepared  
2. Information is disseminated to investors |

*Figure 2: A successful corporate actions life cycle*
and substantial benefits to market participants.

- **Reference data management**
  Among other things, one needs to draw upon an extensive reference data framework to achieve corporate actions automation. Let’s look at why it is imperative for industry participants to overcome issues related to corporate actions. Typically, industry participants look at corporate actions automation for the following reasons:
  
  - Manual processing of corporate actions can lead to errors. With increased volumes and shrinking settlement cycles, it is imperative that securities firms process trades promptly and reduce error rates.
  - Securities firms have disparate systems, each with its own master data on which transactions are processed. Reconciliation is an important step for systems involved in corporate actions processing. It verifies if security balances are reflected accurately in every legacy application. Automating reconciliation processes is a major challenge that securities firms are trying to come to terms with.
  - With financial markets expanding globally, there has also been a simultaneous increase in cross-border trading. Alongside, T+1 deadlines have come to apply to trade settlements. With shortened settlement durations, there is a need to identify areas and processes for automation. Corporate actions represent one such area where the probability of manual errors is quite high and processes are intensive. The issues crowding corporate actions automation, therefore, demand a relook.
  - Financial institutions are investing in emerging and non-traditional markets today and have a wide, expansive range of investment instruments to choose from. Corporate actions linked to these instruments vary and they need to
be met within short, pre-defined timelines. In such a scenario, it is imperative for corporate actions automation to overcome the complexities and the time lag in processing the trade.

- With investors in a position to invest in more markets, one needs to address the question of market-specific rules and regulations for processing corporate actions. As a result of diverse local regulations, the same corporate actions might follow a different process in each place. It takes trained resources to process such actions successfully and in an error-free manner.

A fine understanding of the corporate actions processing life cycle is critical to achieving corporate actions automation (Figure 2).

**The Road to Corporate Actions Automation**

The approach to corporate actions automation can be finalised only after we have categorised corporate actions. Broadly, there are three categories of corporate actions:

- **Mandatory corporate actions**
  These are obligatory or mandatory processes requiring no manual intervention, and which can be easily automated. E.g., cash dividend, stock distribution, etc.

- **Optional corporate actions**
  These include corporate actions that require investor decisions. In these corporate actions, the users have to decide whether they need to go ahead with the benefits of the corporate action. E.g., rights, proxy voting, etc. Such corporate actions require investor interface, and process automation is not as easy as in the case of mandatory corporate actions.

- **Mandatory and optional corporate actions**
These corporate actions represent a mix of both mandatory and optional corporate actions. These are usually multiple corporate actions on the same security, which are part mandatory and part optional. E.g., consider the bonus declared on a security and the rights issue that could be attached to the same security.

**Methodology for Implementing Corporate Actions Processing**

The approach to automating corporate actions in a securities firm is represented in Figure 3. The methodology works by ascertaining whether it is required to automate corporate actions processing. In every case requiring such automation, the methodology determines the approach to automation, defines the road map, and performs a periodic review.

**Challenges to Implementation**

Corporate actions automation is typically plagued by implementation issues. A discussion of the core implementation issues, therefore, seems appropriate:

- **Automating processes**
  
  This requires interfacing with investors. To process corporate actions further, securities firms require inputs from investors. To this end, processes need to be defined to capture investor decisions and process corporate actions (without any manual intervention). Identifying processes that can capture investor decisions is a concern for any securities firm.

- **Data management**
  
  Corporate actions processing concerns itself for the most part with data management. Data arrives from multiple sources (including vendors) in various formats. The problem lies in interpreting data in its respective format and reconciling it for correctness. The reference data copy can be defined only post such reconciliation. Aggregating data from various data vendors, and cleaning and scrubbing it to arrive at the reference copy is a pertinent implementation issue facing securities firms.

- **Reconciling data**
  
  All systems need to be in sync. However, many securities firms have disparate systems which replicate the same data sets, leading to data redundancy and data reconciliation issues. It takes comprehensive data reconciliation mechanisms to make corporate actions automation possible. This makes a strong case for reference data management.

- **Retaining local flavour**
  
  In tune with expanding investor- and instrument demographics-bases, securities firms need to retain the local flavour of their markets and adhere to specific rules governing each market. Additionally, corporate actions are to be processed round-the-clock depending on the investor’s geography and the instrument being traded. In cross border trading, corporate actions carry multi-currency implications. All these issues need to be factored in while automating corporate actions processing.

- **Trading in a plethora of instruments**
  
  Securities firms process trades in various instruments. A corporate action could have repercussions on several instruments where the underlying logic is the same. A stock bonus or stock distribution could change the holdings of the investors as well as change the strike price of the option instrument. These particulars need to be borne in mind while implementing corporate actions automation. Needless to say, the solution for corporate actions automation has to be arrived at in stages.

**The Proposed Solution**

The ideal framework is a rules-based corporate actions processing engine which defines all conditions that a securities firm could face in terms of corporate actions.

To start with, the rules engine could be based on trade and instrument life cycles. A combination of both would have a rule attached to the same with respect to corporate actions. This means that appropriate corporate actions processing can be initiated when a certain security achieves a combination of a particular transaction life cycle and instrument life cycle. For instance, let’s break down the transaction into three
Organisations need to make their architecture more open by adopting industry-acceptable standards to increase interoperability between systems. Once an organisation has achieved automation, it can optimise its resources, providing more value-added services in the long run.

This is simply a sneak preview of how corporate actions could be automated.

Similarly, the rules engine can also be used for scrubbing data in a particular format when particular conditions are achieved. Similar rules could be defined where information is disseminated to various systems for further corporate actions processing. Rules can also be defined for automatic message-generation in standardised formats.

Many securities firms now go the extra mile to perform data enrichment exercises. Such exercises ensure that when the security reaches a particular transaction life cycle and instrument life cycle-status, the data gets enriched automatically. The enriched data then becomes the reference data copy for all applications.

**In a Nutshell**

Corporate actions automation is one of the more complex exercises an institution needs to perform in its march towards Straight-Through Processing (STP), and it should be approached and implemented in phases. Automation in processing eliminates manual intervention, ensures a wider decision window, enables participants to manage risks, reduce costs (existing manpower can be utilised for other activities or to handle higher volumes as we have seen in the industry), and helps achieve greater levels of STP, thereby, improving efficiency and providing better customer service in a highly competitive environment.
the Oracle Grid

turns 64 small servers into a giant mainframe

It’s fast...
it’s cheap...
and it never breaks

oracle.com/grid

Note: ‘Never breaks’ indicates that when a server goes down, your system keeps on running.
Over the past several years, the market has developed numerous algorithmic trading strategies as a result of innovations by sell-side firms, hedge funds and independent technology providers. Today, every major broker-dealer offers a full suite of algorithmic trading solutions, as do a number of agency brokers. Buy-side OMS providers tout their ability to interface with leading broker-dealer algorithms and direct market access (DMA) systems. Advanced trade management/routing platforms and DMA providers have embedded algorithms in their front-ends, and provide access to a range of third-party algorithmic trading destinations. Hedge funds, the earliest developers of integrated quantitative research and trade execution systems, continue to roll out ever more...
sophisticated algorithms. In short, algorithmic trading has become an integral part of today’s equity markets.

As much interest as algorithmic trading has generated in the financial services community, there remains a certain amount of confusion as to what, exactly, constitutes an algorithmic trading solution. Indeed, the term “algorithmic trading” has been used interchangeably with “programme trading,” “quantitative trading,” and “black-box trading” as a catch-all phrase to describe computer-driven tools that have led to increased automation in (1) identifying investment and trading opportunities, and (2) executing orders for a variety of asset classes. But is algorithmic trading really the same as quant trading? Or programme trading? More importantly, how advanced is the market in terms of adoption and technological innovation?

Algorithmic Trading Defined

Broadly defined, an algorithm is any quantitative model that automatically executes a specific order according to the parameters of the given algorithm, and includes any user-defined constraints that can be imposed at the time of execution. Specifically, algorithms analyse an order and determine the timing, size, and destination of its constituent trades. In many cases, algorithms are designed to generate results tied to a specific benchmark, such as the volume weighted average price of a particular security over the course of a day. Examples of some of the more well-known algorithms available today include:

- **VWAP (Volume Weighted Average Price).** Seeks to return an average price of a security over the course of a trading day (or other time period); weighted according to trade volume.
- **Implementation shortfall (also known as arrival price).** Seeks to beat the mid-spread price that prevailed at the time the order was received; can be used to minimise implementation shortfall by beating the arrival price.

What Algorithmic Trading is Not

Some industry observers have expanded their definition of algorithmic trading solutions to include sophisticated analytical programmes that alert traders when specific investment opportunities arise. These models vary widely across the spectrum of technical analysis and sophistication, and range from the relatively straightforward (ratios or formulae that, according to historical analysis, generate an expected return) to the truly complex (employing non-linear programming techniques to determine underlying statistical patterns in security movements).

Strictly speaking, these so-called “predictive” models are algorithms as well. The most sophisticated rely on real-time tick-data analysis and are supported by special high-speed databases. So-called “quant funds” were some of the earliest developers of algorithms, and most would argue that their proprietary analytical and trading models together constitute an integrated algorithmic trading solution. The term “black-box trading” was coined to describe these highly sophisticated auto-trading systems.

However, the predictive models at the heart of such systems are more accurately classified as “quantitative research and trading” tools – that is, programmes that have been developed to analyse current market conditions based on historical and/or real-time data and identify specific trading opportunities. In contrast, algorithmic trading as discussed herein involves the execution of a pre-determined order in which the timing, size and destination of that order are determined according to
the parameters of a specific algorithm. Simply put, advanced, real-time predictive models identify the “what” in a particular strategy; algorithmic trading solutions identify “when, where, and at what size” that order should be executed.

How Did We Get Here?
The global equity markets remain extremely fragmented, perhaps no more so than in the United States (the recent NYSE/Arca and Nasdaq/Instinet mergers notwithstanding). Indeed, market fragmentation was the driving force behind the creation of the first generation of “smart order routing” algorithms that were geared toward negotiating – and taking advantage of – these disparate pools of liquidity.

However, market fragmentation was certainly not the only factor that contributed to the growth of algorithmic trading. As noted earlier, hedge funds were some of the earliest developers of sophisticated computer-driven modelling and automated trading systems. Quant funds created an array of proprietary algorithms that automated ever more complex trading strategies.

Structural changes and technological advancements also helped spur interest in advanced execution. Decimalisation led to a sharp increase in the number of equity orders and a corresponding decrease in average trade size. The cost of “stepping in front of an order” – picking off a trade by bidding/asking a penny more/less – also decreased. Size essentially disappeared and bid/offer spreads tightened considerably.

As a result, firms became much more interested in algorithmic trading solutions that could help traders navigate this new market environment. From a technology standpoint, the development of FIX, increased use of electronic trading, faster delivery of market data, and dramatic increases in the speed and reliability of trade execution further propelled the market towards wider adoption of algorithmic trading solutions.

Algorithmic Trading Today
Today, the market has evolved into an increasingly complex – and no less fragmented – web of market

If anything, the role of the trader in today’s world is enhanced, not diminished, by algorithms. The ability to automate so called “low-touch” trades means that traders can now make better use of their time, focusing on more complex orders and strategies.
Traditional OMS providers

OMS providers have been working diligently to integrate their platforms with brokers’ algorithmic trading solutions. Some firms offer embedded access to numerous broker strategies and some others offer similar services to their clients as an integrated extension of each firms’ proprietary OMS.

Data latency and execution speed

As the buy-side takes greater control over the trading process, hyper-fast (and accurate) delivery of market data and trade execution becomes increasingly important. In response, some of the larger hedge funds are abandoning consolidated data feeds in favour of raw, direct feeds piped in directly from exchanges. While the differences in delivery speeds between data aggregators and direct market feeds appear miniscule – between 100 and 200 milliseconds on average – this is an eternity for firms employing advanced, quantitative analysis and algorithmic trading strategies. In addition, the sheer volume of data traffic has increased dramatically over the past few years, and is only expected to rise further. As a result, firms demanding comprehensive data solutions are increasingly turning to direct market feeds.

Growth and Future Trends

Celent predicts that algorithmic trading will increase from approximately 14 percent of all equity trades to approximately 25 percent by the end of 2008.

Hedge funds

As the earliest adopters of advanced execution strategies, hedge funds will continue to develop integrated, quant-driven trading systems. The influx of capital into the hedge fund community and the explosion in the number of funds worldwide has depressed returns considerably. As a result, funds are creating ever more complex trading strategies with which to generate alpha. Algorithmic trading will continue to play an integral role in these strategies, as funds employ both proprietary and third-party models. More traditional funds seeking to bring execution in-house will rely on the suite of trading tools provided by their prime brokers.

Traditional buy-side firms

Although traditional buy-side firms still lag behind other industry segments in terms of algorithmic trading, the next three to four years will see a dramatic increase in buy-side adoption. More robust pre- and post-trade analytical tools will help buy-side traders navigate the various algorithms at their disposal. In addition, the sell-side will take a more active role in educating their clients about which strategies are appropriate for various trading situations. Finally, buy-side attitudes about the use of algorithms are slowly beginning to change. For many buy-side firms, algorithmic trading means one thing – VWAP. As such, many firms remain somewhat leery of algorithms, viewing them as benchmarks to mediocrity. However, as the sell-side continues to develop and aggressively market additional algorithms, adoption rates among buy-side firms will certainly increase.

Sell-side firms

Continued downward pressure on commissions (and revenues as a whole) will force the sell-side to seek greater efficiencies in their trading operations. Algorithms will allow sell-side traders...
Algorithms and the Future of the Modern Trader

In February 1996, Gary Kasparov, the reigning world chess champion, went head-to-head with IBM’s Deep Blue in a duel of man versus machine. Kasparov famously lost the opening game of the six-game match, marking the first time that a computer had defeated a world champion under tournament conditions. With the advent of algorithmic trading, it has been suggested that human traders might one day face a similar fate. However, it would be a huge mistake to draw parallels between man versus computer in a game of chess and the role of a trader in today’s market. At the end of the day, algorithms are simply another set of tools that traders now have at their disposal.

Decisions about how to best use these tools (including understanding which algorithms are appropriate for each trading scenario) remains a trader’s responsibility.

As noted earlier in this report, some hedge funds have developed extremely sophisticated, integrated research and trading systems – “black boxes” that take a purely quantitative approach to trading. There is a certain subset of trading (highly statistical arbitrage strategies, for example) for which such systems may indeed trump their human counterparts. However, the range and complexity of securities, asset classes, and investment strategies that make up the global capital markets far exceeds the analytical capabilities of any algorithm.

If anything, the role of the trader in today’s world is enhanced, not diminished, by algorithms. The ability to automate so called “low-touch” trades means that traders can now make better use of their time, focusing on more complex orders and strategies. Of course, less time spent on low-touch trades means that traders can take on even more volume. While the end result of this increase in efficiency may be a marginal reduction in headcount, the value of human capital in an increasingly sophisticated trading environment will only increase.
A Foundation for Cross-asset Class Trading

These are interesting times for capital markets. A slew of new regulations have opened up fresh opportunities and restricted numerous others. Mature markets have become efficient to an extent where alpha is difficult to find with traditional strategies. As a result, market participants are engaging in complex deals that cross traditional asset class silos. Hedge funds, in search of alpha, have ventured into greener and, perhaps, riskier pastures like distressed debt and emerging markets. Many institutional players, concerned with long-term liabilities, are looking at alternative investments as an essential part of their strategy.
Increasing Instrument Complexity

Traditionally, endowments have been active in alternative investment areas, but these days even conservative players have begun allocating a significant percentage of assets to alternative strategies. Jane Buchan, Chief Executive – Pacific Alternative Asset Management, noted in The New York Times “…institutions are getting really aggressive about looking for alpha: they are investing anywhere they can find it.” Arbitrageurs, unable to find pricing inefficiencies in mature markets, are now transacting across borders and tapping into opportunities characteristic of cross-border trading. The net result of these circumstances is increasing instrument complexity, multi-leg transactions, OTC derivatives and structured products. Synthetic CDOs (Collateralised Debt Obligations), for instance, are now enormously popular as they offer almost infinite ways for banks, insurers, hedge funds, and money managers to play credit spreads. A few other examples include spreads between multiple debt markets, issuers, and multiple classes of debt on a single company’s balance sheet. Other innovations are swaps on first-to-default and nth-to-default baskets, swaps on credit derivative indexes, and other highly complex swaps that attempt to cover more than plain default risks by combining amortisation, call, and pre-payment provisions into a single package.

Connecting Diverse Markets

a) Increasing financial instrument volumes: The BMA reported a total market of USD 44.1 trillion in 2005 that encompassed municipal and corporate debt, asset-backed securities (ABS), CDOs and mortgage related securities. Auto loans, credit card receivables, CDOs, money market instruments and corporate bonds are expected to increase in volumes significantly in the next few years, throwing up the gargantuan challenge of valuation. Be it an interest rate swap with foreign debt as the reference entity, or a total return swap with little known equities trading in a remote corner of the world, or something as exotic as commodities futures hedged with weather futures – this complex interplay of asset classes has given rise to an unprecedented need for connectivity to diverse markets, both, for execution and data.

b) Fragmented liquidity: This need for connectivity is exacerbated with fragmented liquidity resulting from the arrival of ECNs and crossing networks. In the backdrop of regulations such as Regulation NMS, broker-dealers have been purchasing large interests in moribund regional exchanges in the hope of bolstering dwindling margins. The smaller exchanges now assume greater importance with these developments. Hybrids of algorithmic trading and crossing networks have begun to mop up available liquidity causing problems for diversified financial services institutions and companies specialising in subsets of asset classes.

c) Risk management: Increasing awareness in risk management has fuelled the appetite for market and related data. SEC regulations seek to enforce a fund’s compliance with certain defined objectives and prudent money management practices, resulting in an increased focus on better risk management practices. Meanwhile, Basel II is training the spotlight on market, credit and operational risks. Even organisations not required by law to comply are voluntarily undertaking significant investments to comply for competitive reasons. This has culminated in the need for a consolidated view of holdings across all asset classes.

Security Master – a Consolidated View of Instruments

Undoubtedly, the need for a consolidated view of instruments, often referred to as the “security master,” across all asset classes is the solution. This consolidated view further needs to be updated by diverse market data sources and would have to support risk metrics across all asset classes. These capabilities in turn should facilitate:

a) packing multiple asset classes into a single transaction, b) analysing risk exposures at several levels seamlessly (for instance, deal, book, portfolio, accounts); c) viewing a single, real-time P&L at various levels without the need to manually process data; and, d) corporate actions and valuations.

In addition to the aforementioned qualifications, a common order management system for all transactions and a reference-data source for all execution venues; seamless analysis of
risk exposures across contracts, books, portfolios and accounts; real-time, consolidated, multi-level P&L; and, single-pass valuation and application of corporate actions form an integral part of this vision for a security master.

**Technology and a Security Master**

How can technology help realise this vision? Software applications would need to do more than automate simple tasks; they would need to animate financial instruments themselves. A simple example of a mortgage loan should illustrate this idea better. A mortgage is loaned by a bank to a home owner secured by a home and involves four primary entities – bank, homeowner, home, and the loan, each playing a unique role in the mortgage process.

A traditional mortgage software application used a “file” to store unique data about each kind of entity. Files corresponding to multiple data and lists of values were cross-referenced to accommodate vital relationships and processes and, often, stored in a superset of files. This normalisation created a system that was incredibly complex under the hood, in addition to making it rigid and inflexible. The advent of home equity loans further weakened these systems. A home owner’s equity is also used as collateral and borrowed against on a rotating basis, thereby, introducing several new entities into a traditional mortgage system – equity as line, collateral and loan – and stretching its reach to an unreasonable extent in the process.

Besides this, mortgages attain multiple hues in the form of fixed, variable, and convertible. Neither a mortgage system nor the home equity application was designed to manage these multifaceted variations and, at some point, this network of loosely coupled applications attained a convoluted nature. Re-automating the entire business would have indeed proven more cost effective.

Today’s mortgage application is built using “objects” that perform “services”. Newly defined services are able to blend into existing and changing landscapes in a seamless manner. In short, these applications are designed to scale up and adapt to dynamically evolving business needs and services.

The capital markets are changing too fast to rely on a top-down, command-driven requirements system. Changes must be organic – as a business develops, the system design would have to change, too. Applying the mortgage application analogy to capital markets would clearly prove that the level of complexity and dynamic nature inherent with the capital markets are far beyond the reach of any software application.

A “security master” should ideally manage anthropomorphic financial instruments that are capable of being combined and sub-divided. It should comprise dynamic features that are in tune with changing market forces, and stay up-to-date with the markets. For this to happen, technology would have to lean strongly on a rigorous and precise explanation of a business, and its changing parameters and processes. Most requirement specifications documents usually capture a business’ requirements and not the finer aspects of business operations – a subtle, but critically important difference.

**Business and Data Modelling Techniques**

Existing business models are usually too complex to serve as an effective means of business-to-technology communication; and, for the most part, they are engaged in addressing today’s requirements rather than in describing the dynamics of the business itself.
Object-oriented analysis (OOA) and logical data modelling techniques begin with an identification of primitive and fundamental elements of a business. A complete description of attributes, relationships and behaviour related to the business are subsequently used to model business processes and design database software.

Let’s examine this proposed model more closely. What are “the elements of the business?” Any entities that play a role in the business such as stocks, bonds, currencies, markets, buyers, sellers, investors, agents, brokers, issuers, and regulators are defined in exactly the same way as they are described in a business context – by their attributes and relationships with each other.

With OOA and logical data modelling, these attributes and their relationships can be described in an accurate manner. Database designs perform three strategic operations: store data efficiently, present logical views of stored data, and connect data with logical views. With a logical data model, the only views needed (by definition) are the business elements. This would imply that the logical data model and database design are “linked by definition.” In other words, the database itself replicates and models the business. The database can now become, in a controlled way, as complex as the business by combining and recombining its elemental parts, without the need for inarticulate translation by intervening technologists.

The essential idea here is that the
business model (and the logical data model) describe the business (creating, in fact, a precise language for this purpose), and subsequently, guide any direct implication on the security master, as the recombination of database elements are precisely defined by an infinitely flexible business language model would actually act as a high-level scheme uniting all third-party applications, where each application deals with a particular asset class or bundle of asset classes. By being able to map an asset class or classes to a particular application, a business can control how information – such as market data updates – is distributed. As applications are replaced or upgraded, this mapping may need some rework, but the fundamental business descriptions of the underlying assets, or how they are processed, would not change.

Crafting a security master begins with conceptualising and creating a business model as defined in this white paper and, subsequently, connecting it with a logical data model. It is imperative that the business model proves itself by deploying inherent elements to describe the business. Once proven, this model would link to the new database design or application using formulae that can be reconstructed as and when the business evolves.

**With a logical data model, the only views needed (by definition) are the business elements.** This would imply that the logical data model and database design are “linked by definition.” In other words, the database itself replicates and models the business.

database design – in short, implying that the business model would change only when the business objectives change. Business model modifications reflect on the underlying database design, which in most cases can be formula-driven and easily repeatable. Besides a changing business, any upgrade in technology would also affect database design. As technology upgrades are independent of business-driven changes, the business model can disconnect from the database design and reconnect after these alterations are accomplished.

**Security Master Database**

A prerequisite to a strategic, multi-faceted “security master database” is an unambiguous business model definition and database design. Multiple asset-class databases can then be combined to create even the most complex transactions. This would not have (the logical data model). Even when combined, these primitive elements create a totally new entity, one which cannot be deconstructed, as the business fundamentals that went into the combination can be explained as part of the model.

As the security master is designed by a formula that links the logical data model to the database design, technological investments and upgrades would not affect it as the database can always be recreated from the business description.

**A Security Master in the Face of Third-party Solutions**

Few organisations build their own software today – a fact that may seem contrary to the business and data model theory propounded so far and making it seem like, in such an instance, the model can no longer be connected to the implemented data. But, in reality, the

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