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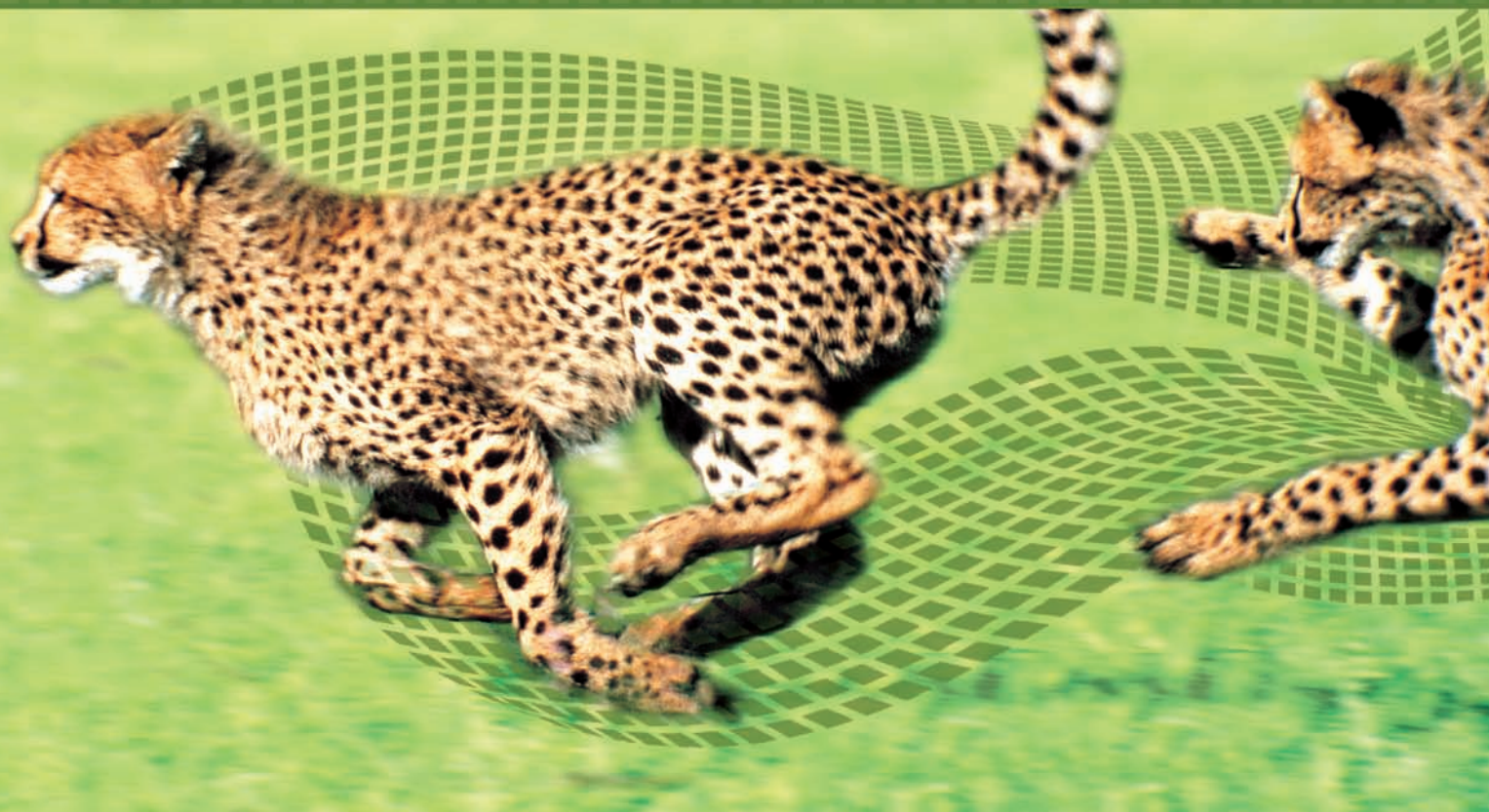


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Capacity Crisis

Until recently, capacity increases were largely linked to reducing data bottlenecks and enabling low latency: 10 megabits of data can't fit down a one-megabit-per-second line within one second. Some data gets through, the rest backs up behind it, introducing latency. The solution: increase the size of the communication line, eliminate the latency.

But throwing bandwidth at the latency problem has contributed to another problem—data volumes spiraling out of control. Technically, the data increases are the result of a range of underlying factors—from regulatory changes creating more trading, to faster markets and low-latency trading creating more competitive and frequent quoting—but, like a 24-hour patisserie to a weak-willed dieter, the abundance of affordable bandwidth has been an enabler to today's situation: suddenly, the all-you-can-eat data diet has firms splitting the seams of their infrastructure outfits.

With firms trading more actively on multiple new markets, the amount of data they need—and generate from their competitive quoting activity—is rising. But it's not just greedy expansion plans that are causing problems. Last August, simply coping with the data spikes coming from the established markets without problems proved more than some firms could handle.

What's to stop firms simply shelling out more for bigger lines and more hardware? The same things that prevent most of us from simply slapping down cash when we want something—budgets, and the knowledge that it's better to reduce the drivers of cost, rather than allow spending to spiral out of control.

So what's the solution? The obvious answer is to reduce the amount of data circulating in the market. But firms fiercely resist any suggestion of exchanges mitigating or conflating the data they distribute, since every tick can represent a trading opportunity. For the same reason, they balk at the idea of quoting less, since every quote represents a potential trade—which represents potential profit.

To an extent, it has to be said, trading firms have dug their way into this deep hole. The question now is whether they leap out, just crawl to the surface, or get buried by the data they have generated.



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NEWS ROUNDUP

Schneider Trading Cuts Latency as Volumes Rise

London-based execution broker Schneider Trading Associates plans to halve latency on its data network in September, when the firm will upgrade its internal network infrastructure to cope with rising data volumes.

The upgrade will replace Schneider's current dual one-gigabit per second con-

nections to its offsite datacenter with a dual 20-Gbps backbone consisting of two bonded 10 Gbps channels, cutting the average internal roundtrip network latency to around 50 microseconds, says Collin Coleman, IT director at Schneider.

The technology upgrade is being driven by the "ever-increasing" demand for bandwidth in response to increasing data volumes, and is designed to provide headroom for five years of volume growth. "That's a long time in IT, but it's based on the rate of growth that we've been experiencing lately, which—while fast—has been steady," Coleman says. "The increases in data volumes are staggering, and the exchanges keep pumping more and more out."

As a result, the amount of data traffic over Schneider's network has doubled every six months—also due to the firm

expanding the number of markets on which it trades, and distributing more data internally, he says.

The upgrade project started last summer, when the firm's technology team began the analysis process, followed by network design, before choosing technology partners early this year. Schneider chose networking equipment and management vendor Cisco Systems' network switches from its Nexus family of datacenter switches, and bandwidth from New York-based fiber connectivity solutions vendor AboveNet.

The enhanced connections to the central London datacenter will provide more scalability, and allow the firm to roll out new services quicker as a result of having spare capacity, Coleman says. From a trading point of view, it will enable users of spread calculation engines and trading algorithms to perform faster, Coleman adds. ■

Interactive Cuts Opra Processing with FIX API

Interactive Data has reduced the CPU capacity requirements for processing data from the Options Price Reporting Authority by 30 percent, as a result of developing a new data API that utilizes the FAST (FIX Adapted for Streaming data) protocol.

The move followed Opra's decision to distribute data entirely using FAST, requiring clients to migrate to FAST as of April 22, when Opra switched off its legacy ASCII data network. The FAST network, which was rolled out last year, reduces bandwidth utilization for Opra data by 70 percent.

Interactive Data initially used the Opra-supplied FAST API, which converted the compressed binary FAST data back to the original, uncompressed non-binary Opra format, which the vendor would then convert into its own internal binary format for consumption by its ticker plant. However, "the multiple layers of conversion in this process are inefficient and consume large amounts of CPU," says Mark Hepsworth, president of institutional business at Interactive Data.

As a solution, Interactive Data designed its own FAST API that directly converts the binary FAST data directly into the vendor's internal binary format, reducing its CPU overhead by around 30 percent, Hepsworth says, which he says proved crucial to maintaining low latency and handling "ever-increasing throughput." ■

MICEX Readies FAST Datafeed

The Moscow Interbank Currency Exchange (MICEX) is developing a new datafeed that utilizes the FIX (Financial Information eXchange) and bandwidth-reducing FAST (FIX Adapted for Streaming data) protocols, which it aims to roll out in the third quarter of this year.

"We expect it to be ready for production at the end of July, but everything depends on various stages, like successful development and testing," says Grigory Baytsur, head of external systems at MICEX. The data will be transmitted using version 4.4 of the FIX protocol and will leverage FAST compression to minimize the amount of bandwidth required by clients to receive the feed.

MICEX will begin testing the new feed architecture, which is designed to support significant further growth in data volumes, in conjunction with broader tests of the exchange's trading platform in the coming weeks. The FIX-FAST feed has the capacity to handle data rates of up to 30,000 messages per second (mps), while the exchange's current trading volumes only generate peaks of around 300 mps.

Once testing is complete, the exchange will have a better insight into the latency of the new feed, though Baytsur says it should not be significantly slower than the existing feed because "the conversion itself [doesn't] take much time."

The FIX-FAST feed is not intended to replace MICEX's existing datafeed, but is intended to help attract more interest from overseas trading firms looking to source a direct feed via industry-standard protocols. "Currently, foreign customers can get our data using Reuters, Bloomberg and other vendors, but FIX is a kind of standard now," Baytsur says.

The feed will offer the same data and analytics currently available via the native MICEX feed, which includes 10 levels of depth for both bid and ask prices. "The team is working on matching... our fields with the standard fields in the FIX protocol. There are some differences, but they are solvable," Baytsur says. Subscribers to the FIX-FAST feed will also be able to customize the content they receive, should they not want to receive the full 10 levels of depth. ■



Opra Rises Frustrate Firms, Mitigation Lacks Consensus

Options trading firms are calling for more effective quote mitigation strategies, following the latest bandwidth figures for the Options Price Reporting Authority's feed of US options trade and quote data.

Firms now need capacity to handle 1,387,000 messages per second (mps), an increase of 480,000 mps from the 907,000 mps that Opra predicted last year.

The new projections also specify that required capacity will increase by 30 percent to 1,807,000 mps between July and next January, with total messages per day increasing from 7.3 billion to 9.7 billion.

This burden is increasingly frustrating consumers of the Opra feed. Albert Doolittle, head of technology research at Weiss Special Operations, says the current rates "would have choked us if we maintained the full Opra feed," forcing the firm to migrate to Opra's lower-bandwidth Level 1 BBO feed instead.

Peter Bottini, head of trading at derivatives broker OptionsXpress, says the firm's largest expense is the hardware required "to manage quotes effectively." Bottini says the quote mitigation plans implemented by the US options exchanges last year to stem volume rises from the trading of options in penny increments have only had moderate success so far, and says he

wants the exchanges to beef up these strategies to lessen the cost to the industry of handling mounting message traffic.

The "alarming" traffic growth is also impacting data providers, with the frequent revisions making it hard for vendors to plan their own capacity requirements, says Daniel May, director of Chicago-based ticker plant provider SpryWare. Also, May says there are currently "no best practices from exchanges for mitigation or conflation."

In response, some industry participants are pressing US options exchanges to agree on a coordinated, cross-exchange strategy for slowing the continuing rise of data.

US options exchanges have each implemented different quote mitigation strategies to reduce the growing amount of options data sent to market—buoyed by the expansion of the options penny pilot and the introduction of the Nasdaq Options Market—but have thus far been unable to reach a consensus on whether a coordinated strategy is required.

Despite the implementation of mitigation strategies, quote traffic for option classes in the penny pilot continued to grow between September 2007 and January 2008, with some exchanges reporting doubling or tripling of growth.

To address this, the American Stock Exchange has advocated forming a committee comprised of exchanges, regulators and industry participants to establish rules for which options series should trade, which would involve amending the listing procedures that options exchanges file with regulators, says Michael Bickford, senior vice president of options at Amex. Bickford says that discussions among the exchanges on this effort are ongoing.

Scott Morris, chief executive of the Boston Options Exchange, suggests implementing a coordinated request-for-quote mechanism across all the exchanges, or establishing rules by which quotes for an options class are available from at least two exchanges, rather than being listed by every exchange.

Coordinated strategies, however, are "difficult to put in place and difficult to manage," says Ed Boyle, senior vice president at NYSE Arca Options. If regulators imposed standards on which options could be listed and by who, exchanges might be unable to respond to requests from customers to provide certain listings, Boyle says. Expanding capacity requirements are simply part of the evolution of the options industry, and determine "who is able to mature in the business," Boyle says. ■

Europe Braces for Options Data Growth

Rising options data volumes in Europe are prompting exchanges in the region to deploy new technologies and upgrade client bandwidth connectivity to accommodate current and anticipated rises.

Simon Chapman, executive director at derivatives technology services for Euronext.liffe, the European derivatives market of NYSE Euronext, says European options exchanges face many of the same problems as those in the US, with complex market data models, an increasing number of instruments and smaller tick sizes all contributing to spiraling data volumes.

"From a latency point of view, the second wave of European exchange feeds will be on a par with the US, with latency figures

dropping every year," says Falke Bruinsma, head of development at ticker plant vendor InfoDyne. "European volumes... are increasing, but are significantly lower than those of Nasdaq, the Consolidated Tape feeds or Opra," he says.

Derivatives exchange Eurex last year struck a deal with fiber provider euNetworks to provide traders with full-depth, unnetted data direct from Eurex's matching engine via its EBS market depth feed.

"Infrastructure costs incurred by members can be significant these days, and users should be able to limit these costs by subscribing only to the data they require," says Wolfgang Eholzer, head of trading system design at Eurex. "We have a very

diverse membership.... Some are interested in reducing every last millisecond of latency, but we also have members who regard [latency] as less relevant."

Sam Malone-Jansens, sales manager at Swedish data and trading technology vendor Orc Software, says the "dramatic" rises in options data put more onus on vendors to efficiently process throughput without forcing customers to upgrade hardware and connectivity. "We expect this pattern to continue as arbitrage opportunities become tighter—hence the need for smaller and smaller tick sizes," he says, which have been introduced by both Liffe and Eurex, and which create more price levels, and hence more potential quote data. ■

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SPONSOR'S STATEMENT

New Models for Managing Data

As data consumers grapple with data volumes and capacity, vendors are responding with services to reduce the end-user burden. By Mark Hepsworth, president of institutional business at Interactive Data.

The continuing exponential increase in market data volumes is changing the way firms think about supporting their market data needs. The cost of processing market data is increasing by 30 percent each year, according to some estimates, and firms are increasingly looking for new models to help control those costs. Many firms are offloading some or all of the market data processing and distribution functions to vendors, taking advantage of the economies of scale and core competency offered by many of these providers.

There is a spectrum of solutions available. At one end of the spectrum, the firm outsources everything, including management of client-site hardware and software, and even the infrastructure for market data applications that support the firm's clients. At the other end, the customer firm manages everything, including the ticker plant.

For instance, clients can opt for a fully managed or co-location service based in a hosting facility where they just need to cross-connect to the market data server to receive the direct exchange or consolidated data. This can help dramatically reduce communication costs for certain clients, compared to a deployed solution.

With this fully managed or co-location model, the market data infrastructure—including all capacity planning—is managed by the vendor. Interactive Data's DirectPlus, a fully managed, ultra-low latency direct exchange feed service, and PlusFeed Co-location, a co-location service for users of the PlusFeed low latency consolidated global datafeed, are examples of these models.

Pushing the Boundaries

Another option is hosted datafeed services, such as Interactive Data's PlusFeed Select and PlusFeed VPN, where clients connect to PlusFeed over a fully managed

leased line or secure Internet VPN and receive only the data they subscribe to and require. These services also can dramatically reduce communication costs, and can allow clients to benefit from not having to deploy or maintain datafeed servers (CSPs) onsite.

In addition, mitigated exchange feeds such as our Essential Options Service can help minimize the impact of growing data volumes. The Essential Options Service is designed to help reduce bandwidth by approximately 80 percent, compared to the full Options Price Reporting Authority feed. Interactive Data also offers full-tick Opra data.

"Many firms are offloading some or all of the market data processing and distribution functions to vendors, taking advantage of the economies of scale and core competency offered by many of these providers."

At the same time as vendors must provide a spectrum of products, they need to continue pushing the boundaries of technology to deliver optimal performance to their clients. Interactive Data invests heavily in its infrastructure technology, and has seen very good results for its efforts. The PlusFeed low-latency consolidated datafeed, for instance, is capable of handling huge volumes—currently, it generally delivers over 800,000 messages per second.

In addition, the footprint at the PlusFeed customer location is very small. Currently, two very small client-site processors with two inexpensive servers can process 1.35 million messages per second, and we are now testing the next generation of the software that will deliver even better performance.



Mark Hepsworth
Interactive Data

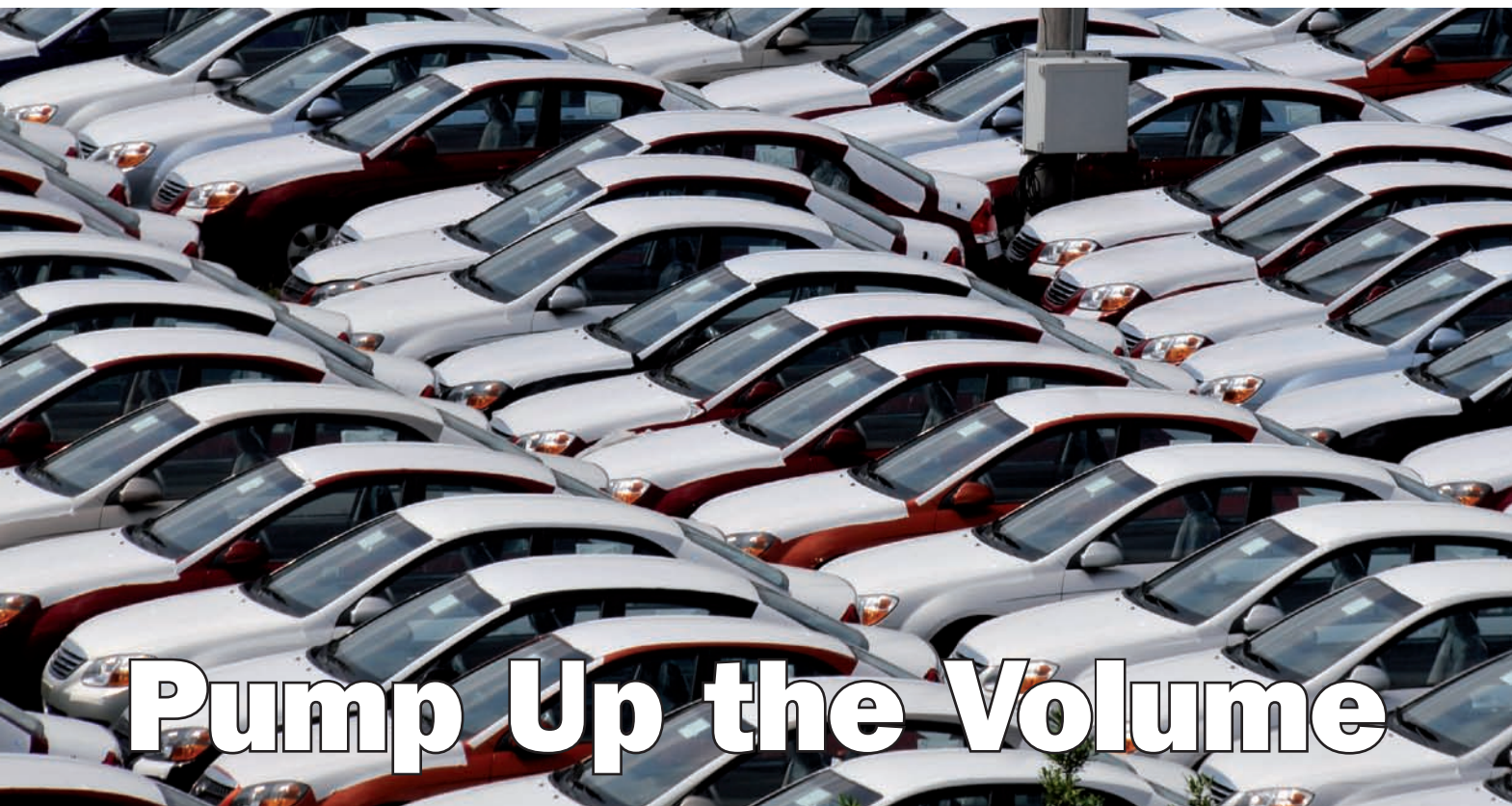
We've also redesigned the Options Price Reporting Authority's FAST API decompression software, to make it approximately 30 percent faster.

Examining Data Usage

To deal with ever-increasing market data volumes, firms should also re-examine their market data needs and ensure that the products they buy are tailored to the needs of the various user groups within the firm. For instance, wealth managers can help manage workstation costs by identifying the appropriate level of data and tools that are needed by their internal users and their clients.

Algorithmic trading applications, on the other hand, generally need full-tick data, and they also need that data to be delivered extremely quickly. Interactive Data is committed to providing low and ultra-low latency data, along with an array of APIs to make it easy to integrate with firms' applications.

As market data volumes continue to rise by almost 100 percent each year, and firms must continue spending more each year on communications and infrastructure to process and distribute the data, they are looking for new solutions. Interactive Data's Real-Time Services business is committed to giving firms a range of services and the flexibility to select the model that helps them address the challenge of continuously increasing volumes and best suits their particular needs. ■



Pump Up the Volume

A combination of market forces is creating a deluge of data, stressing the capacity of trading firms' data networks and internal systems. With volumes rising fast, how can firms address capacity issues before they reach breaking point?

IMD: What are the key drivers of increasing volumes, and what impact are they having on trading firms, exchanges, and service providers such as data vendors and network providers?

Steve Listhaus, head of market data services, corporate and investment banking, Wachovia: The drivers for increasing volume of market data update rates are those that have been at work in the markets for the last few years—regulation, algorithmic/black-box trading, exchange competition, and execution venue proliferation. Trading firms have the challenge of putting context to growth rates by attempting to apply exchange forecasts and industry prediction to their particular watchlist of securities and to analyze carefully the impact of new applications or changes to their business that would translate to new or expanded real-time data needs. The resulting investments are progressed on a must-have basis, despite any challenges in the overall business climate—at times, other expenses must be trimmed to create budget room for capacity upgrades. Exchanges are hit on both ends of their platforms—their order systems and matching engines need to grow to meet demand, and the by-product market data stream needs to be delivered to consumers with the lowest possible latency and increasingly via data feeds that are optimized for particular purposes. Data vendors face challenges in continuing to invest in their networks to keep pace with capacity and to re-architect when

current architectures are not capable of efficient scaling. Data providers are also expected to keep prices from rising, and therefore must continually find both technical and process efficiencies in the delivery of their services. Not all data vendors are keeping pace, which is creating opportunities for new players.

Mike Powell, global head, Enterprise Information, Thomson Reuters: The drivers are well documented, particularly the proliferation of algorithmic trading and liquidity fragmentation caused by an increase in alternative liquidity venues. Increasingly global adoption of algorithmic trading tools by both the buy and sell-side is driving a data volume explosion, and is reducing the average deal size.

Market fragmentation also has a dual impact. When liquidity for an instrument is carried on multiple venues, this generates more data. As new, alternative sources of liquidity generally carry the most liquid instruments, this has a disproportionate effect on growth. Secondly, liquidity across multiple venues creates arbitrage opportunities, leading to greater overall trading volume.

In parallel, commoditization of high-performance technology has enabled a far broader segment of the industry to engage in electronic trading activity, while at the same time reducing the cost of entry to new liquidity providers.



Many exchanges have responded to increased competition by investing in higher-performance platforms with matching engines capable of far greater volumes, enhancing their offering but creating problems for the industry through increased data generation.

From a trading entity perspective, the growth of market data and focus on latency have created an arms race whereby firms either invest heavily in infrastructure or look at alternative business models such as outsourcing their execution.

Assuming that the output from venues continues to grow, and customers demand access to all the data, vendors have little choice but to invest in their capability to manage and distribute vast quantities in a value-added format. This will also mean helping customers efficiently manage the content by providing differing qualities of service based on usage requirements.

One would expect the network providers to gain the most. However, they are not without their own challenges in having to upgrade their infrastructures and improve their ability to deliver connectivity in an increasingly timely manner.

Sang Lee, managing partner, Aite Group: There are many key drivers for the overall increase in volume. The most obvious one would be the continued adoption of electronic and algorithmic trading. Others include market fragmentation, declining spreads, declining average trade size, more active participation from hedge funds and asset management firms. The increase in overall volume has put a tremendous amount of pressure on financial institutions, and has increased the competitive advantage of larger firms with annual IT budgets large enough to maintain their overall capacity.

 <p>Neil Boyd Director of Sales CodeStreet Tel: +1 646 442 2817 www.codestreet.com</p>	
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Jeff Hays, vice president of professional services, West Highland Support Services: The key drivers fueling the growth in market data volumes are:

- Advances in trading technology, particularly around ECNs;
- Availability of full-depth market data feeds;
- Increases in electronic, algorithmic and high-frequency trading;
- Evolution of sophisticated trading strategies.

The ECNs were like the new kid on the block driving their fast car. The concept of pushing their entire order book added

fuel to the electronic trading fire, providing visibility into all the liquidity in the market. Pretty soon, folks started understanding and modeling quoting behavior, leading to predictive strategies based on solid evidence.

In an effort to catch up, larger entities seeking to close the technology gap have purchased innovative companies such as Wombat, Arca, Inet, InfoDyne and Lava, while Reuters has sought to protect its market share with its own direct feed offering.

“Commoditization of high-performance technology has enabled a far broader segment of the industry to engage in electronic trading activity, while at the same time reducing the cost of entry to new liquidity providers.”

Mike Powell, global head, Enterprise Information, Thomson Reuters

Alexander Shlyappo, director, trading systems development, MICEX: The Russian financial markets are rapidly developing due to overall economy growth and the fact that they are very young and are still in the process of establishing their “proportional” share in the worldwide financial community. Key factors explaining the doubling of trades and orders counts at MICEX every year are:

- Rapid growth of interest in equities markets among private investors, because of factors including: the economy, with increasing wealth of certain population groups triggering interest to invest disposable income in financial instruments; more education, information and active advertisement of online trading by major Russian brokerage companies; better infrastructure, with improved and lower-cost Internet connectivity, especially in remote areas, making online trading accessible to more private investors; and the effect of volume, where greater numbers of clients allow brokerage firms to lower commissions thus making online trading affordable for a wider range of private investors.
- Technology advances at the brokerage systems level allow faster trading and drive traders to generate more orders to stay competitive. This includes utilization of various automated techniques by international and domestic trading firms.
- Trusted funds and mutual funds becoming more popular and are trading more actively due to competition between them.
- Introduction of new financial instruments and growing list of actively traded instruments, causing a virtuous circle—the more and better trading opportunities there are, more trades will be generated.

MICEX’s integrated trading and clearing system is much faster than is needed by the current order flow rate. In current Russian realities, increased volumes mainly affect requirements for the external to the exchange trading/communication infrastructure.

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The trading firms are often faced with the need to:

- improve their trading system performance to stay in sync with the market;
- increase network communication speed and reduce the network latency to get market data and send orders in time;
- fully utilize existing connectivity solutions to MICEX.

The MICEX development team is constantly improving communication interfaces that help reduce data volume and network traffic. We also consult customers to help them build optimized communication components of their brokerage systems.

MICEX has an integrated system that combines its real-time trading and clearing system with a back-office database and connection to depository and settlement systems. Increasing daily orders and trades require more system RAM to store all of them during the trading session. The back-office database, depository and settlement systems performance and capacity should be enough to process all data within a settlement timeframe.

Neil Boyd, director of sales, CodeStreet: The key drivers are high-frequency electronic trading, growth in the number of trading venues, and the move toward smaller pricing increments. Given that these trends are deeply rooted and unlikely to reverse course, the real question is how to stay ahead of the resulting explosion in data rates. Central to any successful response will be a plan for regular and systematic capacity-planning exercises, which will require purpose-built tools that make it possible to subject market data infrastructures to repeatable stress scenarios while monitoring associated latency. Going forward, competitive organizations will need to understand the limitations of their infrastructures more deeply than before.

“Some estimates show the cost of processing market data is rising by 30 percent a year or more, making it a leading area of cost growth, with a very direct impact on bottom-line results, as these costs increase regardless of overall market performance or individual company performance.”

Mark Hepsworth, president of institutional business, Interactive Data

Manisha Kimmel, executive director, the Financial Information Forum: Changing market structure, regulation, technology innovation, and recent market volatility have all contributed to the increased market data volumes. The convergence of these elements has resulted in more market centers, increased algorithmic trading, smaller order sizes, smaller profit margins per trade, smart order routers, dark pools of liquidity, increased options trading, overlap between buy/sell side firms as well as birth of ultra-low latency trading strategies.

Trading firms are now relying on sophisticated, low-latency trading platforms to achieve millisecond and microsecond advantages. With depth-of-book datafeeds, the exchanges are offering trading firms sophisticated ways to discover liquidity. Service and network providers are capitalizing on this low-latency demand by introducing sophisticated new product lines that offer extremely high-throughput messaging capabilities, as well as augmenting their datacenter services with proximity/co-located hosting services to address the most demanding low-latency requirements.

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Mark Hepsworth, president of institutional business, Interactive Data: You’ve covered most of the key factors—another one is the exchanges’ creation of new products. The increasing volumes are putting a greater burden on firms’ resources, and this problem is accelerating. As a result of volume growth, trading firms, exchanges and vendors must spend more on communications and infrastructure to process and distribute the data, and there are greater costs associated with ongoing maintenance of the larger market data infrastructures. Indeed, some estimates show the cost of processing market data is rising by 30 percent a year or more, making it a leading area of cost growth, with a very direct impact on bottom-line results, as these costs increase regardless of overall market performance or individual company performance.

IMD: What can market participants do to mitigate the impact of volume growth without impacting latency or reducing the potential quotes—and hence trading opportunities—available to them?

Hays: First and foremost, market participants need to push the exchanges to find a way to filter out the noise and eliminate useless market data. The practice of sending orders and immediately canceling them needs to be curtailed. Quotes and orders light years away from the NBBO should not be sent to customers. These practices are equivalent to littering on the market data highway—if there was a fine for creating this type of spam traffic, it would stop.

Secondly, companies would benefit from taking a closer look at who among their data consumers needs what types of data and for what purpose. The biggest challenge from

ROUNDTABLE

a capacity standpoint is streaming low-latency, full-depth market data. The update rates make this type of data a bad choice for display applications. Similarly, applications trading off the BBO probably don't need full-depth data. I have seen companies hire low-latency vendors to build conflation servers to slow down the flow of full-depth data. Paying a premium for low-latency data and paying again to slow it down is silly.

But the most critical ingredient needed to survive the unending increases in market data rates is the ability to measure and engineer scalable system deployments. A lot of solutions are emerging that may help boost system capacity. An environment to test and quantify the impact of these technologies is crucial for separating the wheat from the chaff. Tools are needed to simulate market data arriving at a site and these tools need to accelerate data rates and create bursts that mimic real world conditions. Today's peak/spike will be tomorrow's average rate.

Kimmel: Market participants should examine their end-to-end trading latency to identify alternative approaches to addressing capacity. These approaches should contain a market participant's network infrastructure costs while offering lower end-to-end latency characteristics. A co-located trading system, for example, will reduce the wide area network infrastructure costs

required to deliver the bandwidth-intensive market data feeds and simultaneously minimize the message propagation delay between data source and trading engine. Similarly, adopting a FAST compression algorithm allows firms to minimize a feed's bandwidth requirements, while lowering the latency in processing the feed itself. InfiniBand, distributed caches, and hardware accelerators are some additional approaches to providing sufficient processing capacity within accepted time intervals.

Boyd: Above all else, firms must carry out a regular program of sensible planning and testing exercises to ensure that their infrastructures are robust, well-designed, and capable of trading at low latencies during peak trading. Beyond today's peaks, any serious, systematic testing regime must include the ability to model the capacity and latency of one's market data infrastructure against anticipated future volume levels and update rates. Ideally, this testing should replicate as closely as possible the behavioural characteristics of real-world market situations. To identify points of weakness, firms should leverage recorded data using a system that allows the update rate of this historical data to be accelerated at will. Such a planning protocol would bring market data in line with modern software testing methodology, enabling firms to implement rigorous regression tests regularly and at minimal cost.

Listhaus: Market participants have to understand at a very detailed level what their consumers—be they individuals or applications—need. These use cases then need to be looked at and grouped by common solution sets. For large, diversified financial services firms, it's easy to see that not every use case requires low-latency, full-tick market data (when considering the broad audience of analysts, bankers, retail brokers, salespeople, and traders). For those without that requirement, streaming full-tick data is neither required nor beneficial, given the added costs for acquiring, disseminating, and processing updates that come too quickly to be of value. Applications' data needs also need to be carefully understood. In some cases, intervalized data is acceptable or preferable (such as for real-time risk calculations that calculate risk at specific intervals), while in other cases only some of the fields in an update need to be processed by the application. With the costs of distribution growing rapidly against rising volumes, it is increasingly important that data is filtered such that the inbound stream to consumers represents the smallest possible amount of data to meet the need. This enables careful and targeted investments where full-tick, low-latency data is needed.

Hepsworth: Managed market data solutions can mitigate the impact of volume growth and help firms reduce the total cost of market data ownership. For instance, Interactive Data's Real-Time Services business offers a fully managed, ultra-low latency direct exchange feed service as well as a managed low-latency consolidated feed service. In addition, services such

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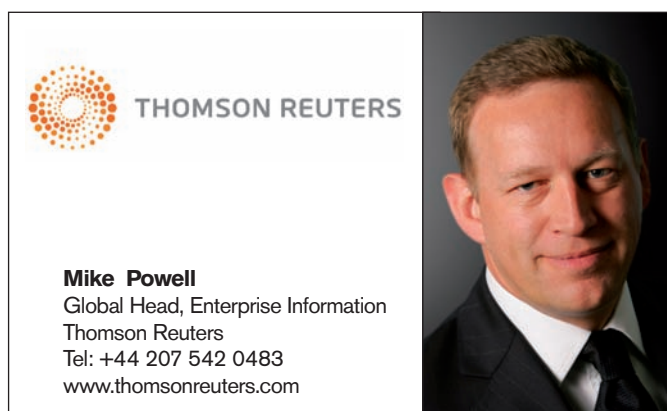
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as hosted datafeeds and mitigated exchange feeds are also designed to minimize the impact of growing data volumes. Example of such services offered by Interactive Data would be DirectPlus, PlusFeed Co-location, PlusFeed Select and the Essential Options Service.



Powell: Trading entities will need to look at technology, structural and business solutions to remain competitive and protect margins. Many will pursue a strategy of investment to keep pace with rising data rates and reduce latency. However, firms will be thinking harder about how they structure their trading operations, synthesizing data into smaller, targeted content sets rather than flooding their entire network.

Many customers have created parallel infrastructures or segmented their market data platforms to achieve this. Thomson Reuters helps customers in this respect, through the ability of RMDs, the DACS entitlement system and other value-added services, to shape the quality of service delivered to different parts of an organization. In addition, our consolidated feeds can be delivered in full-tick or bandwidth-optimized, conflated formats, while our low-latency, direct feed connections provide full-tick, full-depth market access. By selecting services that meet the end consumer's requirements, firms can better manage market data flow across their organization.

A firm's data distribution platform capability is becoming increasingly important, given not just the rise in exchange-traded data volumes but also the requirement to access other sources of liquidity, such as dark pools and other forms of peer-to-peer transactions. The ability to blend this data with more traditional exchange-traded liquidity and manage the distribution of selective content to specific areas of a firm has become a key requirement.

Many trading firms will become more specialized in the services they provide and will potentially outsource their execution. Certainly we are seeing a growing trend in buying rather than building technology solutions—the rapidly changing exchange landscape means developing in-house solutions is becoming increasingly challenging, and many firms prefer to buy vendor offerings, focusing their own development on more competitor-differentiating projects.

Grigoriy Baitсур, head of external systems, customer software support service, trading systems development, MICEX:

The scalable architecture of the trading and clearing system at MICEX has enough potential to deal with current volume trends for several years. However, MICEX is constantly optimizing its technology, including:

- Moving to Linux-based gateways that proved to be significantly faster;
- Optimizing code to speed up order execution and generation of market data packets;
- Preparing for a transition to a 64-bit operating system, eliminating the four-gigabyte barrier in available RAM;
- Tight monitoring of trading system load, and proactive searching and resolving of bottlenecks at the system level;
- Monitoring of system load generated by client applications, and helping clients to maintain efficient communication with the MICEX engine with low system impact;
- Analyzing the trends in volumes and, potentially, trigger the preparations for switching to a more capable solution in advance.

To mitigate the volume impact on the client side at brokerage firms in Russia, network quality improvement is still a major factor, especially in distant areas. For many small and mid-size market participants, we see a clear opportunity to improve latency by optimizing connectivity software and hardware components.

“Not every use case requires low-latency, full-tick market data (when considering the broad audience of analysts, bankers and traders). For those without that requirement, streaming full-tick data is neither required nor beneficial, given the added costs for acquiring, disseminating, and processing updates that come too quickly to be of value.”

Steve Listhaus, head of market data services, corporate and investment banking, Wachovia

Lee: This truly is a firm by firm case. Most firms obviously do not trade all the assets available, so by focusing on specific contracts they typically trade, they can certainly mitigate the overall volume processing without sacrificing latency.

IMD: If volumes continue to grow at current rates, how soon will they outpace firms' ability to manage them with existing technologies, and what innovations will they and vendors need to introduce to address the next round of rises?

Kimmel: Predicting this is difficult. Remember, before SIAC adopted FAST compression, Opra was quickly approaching the bandwidth capacity of an OC-12 line. With relatively straightforward changes, FAST gave Opra consumers the

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ability to circumvent looming capacity problems, and this kind of innovation from necessity should continue to offer firms alternative approaches to combat the data volume problem. This said, the approach of throwing increasingly more hardware to address the rising data volumes is not sustainable from two standpoints—first, the cost of the hardware, and second, the cost of the energy required to power this hardware. Innovations to handle the next round of rises should focus less on requiring more hardware, and more on maximizing a firm's existing technology investment to minimize bandwidth requirements while improving end-to-end latency.

Hays: It is unlikely that data volumes will continue to grow at current rates—instead, the growth rate will most likely accelerate. Scheduled events like Federal Reserve board announcements and Russell rebalancings have vendors and consumers battenning down the system hatches and preparing for the inevitable deluge of data.

Because data flows “downstream” from vendors, through the market data infrastructure and to the client application, alleviating a bottleneck in one place increases throughput for that component and can push the bottleneck down to

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Grigoriy Baitsur, head of external systems, customer software support service, trading systems development, MICEX

another system component. By the time all components have been upgraded to handle the existing load, rates increase and another bottleneck occurs—kind of like Sisyphus pushing the rock uphill.

Steaming data is currently delivered in an “all-or-nothing” fashion. Perhaps if a request for data included some indication of why the request is being made, the amount of data could be tailored for that specific need. For instance, if a client wants to trade 10,000 shares of a stock, perhaps the number of price levels streamed to the customer could be limited to the best prices for a size of 10,000 shares.

While an argument can be made that implementing this type of processing logic would introduce latency (which it would), less data would be sent through the network, and the client application processing load would be reduced, introducing efficiencies at the final leg of the data's journey that could negate the added latency and reduce capacity requirements.



Hepsworth: We don't think volumes will outpace firms' ability to manage them. Firms may need to adjust their market data processing model and invest a greater proportion of budget to deal with market data, but the combination of product innovations and their willingness to make some changes will help enable them manage the growing volumes. Firms need to re-examine their market data needs and ensure that products are tailored to the needs of the various user groups within the firm. For instance, there is no value in providing expensive ultra-low latency data to end-user workstations because the human eye cannot process data that fast. It is much more cost effective to use a consolidated datafeed for such applications, while reserving the more expensive direct exchange services for electronic trading applications that depend on sub-millisecond latency. Once firms have established the needs of each user group, they should consider the cost and strategic implications of meeting those needs through internal solutions, vendor solutions or a combination of the two.

For their part, vendors need to continue pushing the boundaries of technology to eke as much performance as possible out of the latest technology. Vendors such as Interactive Data are continually working with technology and network providers, testing the latest hardware and software solutions to be able to offer clients high-performance services—from multicast distribution to 10-gigabit network cards, etc. Vendors also need to serve a range of client requirements—some customers want all of the data, and some want a more managed data set. In the future, vendors may offer more products to enable clients to mitigate the data flow, by providing custom-created algorithms that enable clients to determine how much data they receive.

Listhaus: There is already some evidence to suggest that the extraordinary growth and overall cost of acquiring and processing updates related to listed options (Opra data) has created a thinning of the herd among market participants. Technical advances will continue to somewhat blunt the impact of growth, including bandwidth compression technologies, hardware-accelerated appliances, high-speed datacenter interconnect technologies, faster, more powerful servers and the tweaking of software to fully leverage multi-core/multi-CPU



capabilities. When electronic trading began to take hold, it typically used infrastructures that existed largely for display purposes (aggregated datafeeds, for example). When these technologies began to show their limitations, new products entered the marketplace (direct feeds, for example). I see a world now where market data is increasingly segregated between those services that are useful to individuals and those that serve as fuel for applications. The jury is still out on whether—and if so, where—these infrastructures meet. I see vendors being active and innovative at both ends of the spectrum. While it doesn't get as much press as a switching appliance capable of processing 10 million messages per second at sub-millisecond latency, some of the traffic management techniques being applied to keep the data stream served up to a retail broker's desktop are quite impressive and effective.

“In the foreseeable future, the best-positioned firms may well be those able to optimize their existing infrastructures to provide sufficient bandwidth at minimum expense.”

Neil Boyd, director of sales, CodeStreet

Powell: Market data growth and technical innovation are indelibly linked. Expectations are that firms will be able to keep pace—it is more a question of investment and resultant margin.

The hardware industry is evolving so rapidly that the major concern is the availability of sufficient space and power rather than the underlying technology. Hardware based solutions such as FPGA technology continue to be scrutinized, but potentially the commoditization of high-performance, off-the-shelf hardware solutions is a more realistic direction for the industry.

Compression technology is also playing an increasingly important role in effectively managing communications and infrastructure costs. Advances in this space will be important for firms to monitor when thinking about how best to deploy these technologies.

Demand for managed services and hosted capabilities will continue to grow, both to minimize latency (proximity hosting) and to utilize full-tick market data close to the source rather than having to distribute it across the globe.

Boyd: There is no doubt that market data platforms will ultimately be re-architected and re-built in response to market needs and technological innovations. The issue in the near-term is cost—how to stay ahead of crushing volume increases without breaking the bank. Indeed, in the foreseeable future, the best-positioned firms may well be those able to optimize their existing infrastructures to provide sufficient bandwidth at minimum expense. Such companies will, of course, not be immune from the transformational pressures exerted by

continued volume growth, but they will certainly face fewer issues than their peers using less-disciplined capacity planning approaches.

Lee: This is a tough one to predict, and firms will at worst throw money, software, hardware and human resources to deal with the issue. A lot of vendors are also playing a key role in meeting some of these challenges, such as high-performance database platforms, ticker plants, middleware messaging, CEP, and messaging hardware solutions.

Baitsur: For MICEX's integrated trading and clearing system, the current volume growth trend does not look dangerous for the next three to five years. The most important innovation is switching to a 64-bit operating system on all servers to remove the RAM size limitation. This would involve upgrading software at all MICEX gateways and in remote locations across Russia, accompanied sometimes by hardware upgrades to accommodate increased amounts of RAM.

The electronic infrastructure in Russia is improving at a rate well exceeding expected volume growth, thus there is good chance that it will serve the needs of electronic exchanges into the future.

Brokerage firms are acting in a competitive landscape, which forces them to keep their systems capacity in line with market needs.

The FIX connectivity being developed now at MICEX, while not a direct step toward solving the data volumes problem, may help FIX-enabled clients to utilize well-established trading platforms on the Russian stock market.

IMD: Is the long-term solution to capacity problems just continuing to find ways to handle rising volumes, or to find ways to reduce volume overall, and if so, where does responsibility for reducing volumes lie—with exchanges, regulators, or trading firms?

Lee: I would say that potentially it is little bit of both. Certainly, exchanges can potentially reduce messaging traffic by doing things like charging firms for cancellations. However, in today's trading environment driven by low-latency and market fragmentation, it will be tough to do that. Overall trading volume is just a reflection of what is happening in the marketplace.



Sang Lee
Aite Group

Hays: The industry appears to be speaking with a single voice in this regard, and a paradigm shift is required. The current approach of taking all available data and pushing it through the enterprise is not sustainable. Trading firms need to stop sending quotes and orders that they intend to immediately cancel, exchanges need to create some incentives for firms to

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send only meaningful data, and vendors need to get away from blindly pushing out whatever data comes their way. While regulation would help, things will probably have to get much worse before such drastic measures are taken. Perhaps FISD or SIFMA could take the lead on this issue and gain some type of industry consensus.

Listhaus: For consumers of market data, the vast majority of our efforts should be aimed at dealing with anticipated growth. Technological advantage has become an important competitive battleground among execution venues and sell-side shops, and the firms with the fastest and most scalable platforms are capturing increasing levels of market share.

There is little incentive for data sources to take pity on consumers. In the US, gas consumption is showing signs of a slowdown now that the average price of gas exceeds \$4.00 per gallon. We haven't yet reached that point in the market data industry—for now, consuming firms are reasonably content to continue spending more to keep up with rates, and have not shown a willingness to trim consumption. Ultimately, regulation may provide the only relief if the cost of doing business becomes too great for small or medium-sized firms, and competitiveness in the industry is hampered. According to one survey, the top four firms captured a 67 percent market share of daily algorithmic trading volume in 2007. These four are well-known firms and are also known to have made substantial financial commitments to their underlying infrastructures. If the market share number for these four were 98 percent, would regulators take note and attempt to level the playing field by reducing costly technical barriers to entry?

“Exchanges are in the best position to effect change. Trading firms need to have incentives for sending meaningful information. A quote or an order should be firm, and cancellations should not be an explicit part of a quoting strategy.”

Jeff Hays, vice president of professional services, West Highland Support Services

Sergey Vasiliev, deputy head, market data sales, MICEX: Due to the developing nature of the Russian stock market, placing strong restrictions on generated volumes per client may negatively affect market growth, because many current tiny “learning” investors will be the next source of increased market turnover. Forcing them to limit the number of orders may divert them from trading on the stock market. Improving the system capacity at the exchange and trading firms will be a better choice for the next few years.

However, the massive deployment of algorithmic trading might require the introduction of a kind of soft resistance to volume growth. This can be done at the exchange and at trading

firms by adding fixed commission per transaction, thus asking over-active clients to pay for the increased load they generate.

Hepsworth: Volume growth is primarily driven by traders maximizing their use of the latest technology. As long as we continue to provide the trading community with technology innovations, market data volumes will continue to increase. We believe there are some market data users that will continue to take all the data, while others will want it in a more mitigated way. We don't expect exchanges or regulators to mandate that this needs to decrease because it will slow down trading activity, and we believe they would have taken action before now.

Powell: It is difficult to see market data rates being reduced by specific market initiatives. Currently, the regulatory environment is driving volumes higher by encouraging competition in the form of the trade-through rule in the US and dissolving market concentration rules in Europe. It is also unlikely that venues will collaborate on this issue, given their profit focus.

One trend that may accelerate is increased “hubbing” of trading activity around key liquidity centers. Anyone trading a market will want to locate in close proximity, with only non-trading functions located outside of a center/country. This would mean traders locating at the centre of liquidity (physically or via proximity hosting), and requiring less data to be distributed more broadly across their organization.

Kimmel: A key catalyst driving capacity is the level of market volatility, which is largely out of everyone's control. The most viable solution is for market participants to plan on handling rising volumes with approaches that try to reduce the data's bandwidth footprint or with technologies that can accommodate escalating volumes in a cost-effective manner.

Vendors are likely to step up to the challenge, innovating towards better, more efficient solutions that target the need for more processing power and increased network capacity. For example, messaging system vendors can evolve the filtering capabilities of their product lines towards offering finer-grained subscriptions that limit a feed's bandwidth requirements while offering customized data streams in a timely manner. Co-location service providers can continue to extend the economy of scale benefits of their datacenters to trading firms of all sizes.

Boyd: For years now, other industries have dealt with high data-rate issues—involving digital video, for instance—through the widespread standardization of sophisticated compression techniques. In finance, a uniform adoption of analogous techniques has long been overdue. The FAST protocol is a step in the right direction. Nevertheless, for the foreseeable future, the final burden of keeping data volumes at manageable levels will continue to lie with market data administrators and engineers. And while these professionals may reduce some content through techniques such as data filtering, data conflation, permissioning, and



aggressive inventory management, in all likelihood, their systems will simply have to be robust enough to support the increased load without sacrificing data quality or speed.

IMD: What steps can trading firms and exchanges take to reduce the amount of data being generated into the market?

Hepsworth: As long as firms feel that it makes economic sense to generate high quote volumes, they will continue to do so. A new market data revenue sharing model could be implemented by the regulators or exchanges that would provide the necessary incentives to minimize “low-value” quotes and reduce the quote-to-trade ratio.

Kimmel: It is not likely that trading firms are going to start reacting differently to market conditions just to reduce the amount of data they see in the marketplace. Unfortunately, the drivers of capacity also represent opportunities for firms trying to achieve their trading strategies. The options exchanges have already adopted quote mitigation strategies as part of the SEC-approved penny pilot for options. But while quote mitigation strategies like holdback timers have been effective, we still saw Opra annual growth at just over 75 percent. Given that the CQS feed more than tripled in capacity growth, maybe there is room for quote mitigation for equities, too.



Manisha Kimmel
Financial Information Forum

Hays: Exchanges are in the best position to effect change. Trading firms need to have incentives for sending meaningful information. A quote or an order should be firm, and cancellations should not be an explicit part of a quoting strategy.

Effecting changes of this nature will require an investment in technology and most likely a change to policies governing responsibilities for disseminating market data. It is time to re-tool the way information is distributed to maintain efficiencies that have been compromised by technology advances and the growth of electronic trading.

Powell: Smaller trade sizes will be difficult to sanction against, unless the trading venues stipulate minimums to halt this trend. Without market legislation, this is unlikely. With exchanges under pressure to reduce the cost per trade, this further removes barriers to more frequent trades of smaller sizes. Technology will continue to enable more firms to participate actively in the market, with broker-provided DMA services an example of a market innovation that has enabled many buy-side firms to pursue more active trading strategies than previously.

So it is hard to see the amount of trading activity and resultant market data being reduced. With latency playing such an important role, and the rising cost of delivering market data

across an organization’s global footprint, the more likely scenario is that trading functions will locate close to liquidity hubs and a managed sub-set of the data will be delivered to other functions.

Shlyappo: Apart from establishing fixed commission per order placed, there may be an increase of lot size. Better market segmentation may also help in limiting the data volumes being distributed.

However, in the current Russian market, all these steps require thorough analysis of market impact, including the risk of suppressing turnover growth. The Russian stock market is still in the process of rapid development, so careless steps may seriously affect it.

Boyd: Moving forward, subscription management is likely to be more critical than ever, not just at the item-level, but also down to the field-level. Yet the reality is that long-term trends toward electronic execution and computer-driven modelling mean market data volumes will continue their steady growth, outpacing any reductions achieved through such innovations. In this environment, the key for any firm is having the ability to ensure its market data infrastructure is fit for purpose and able to cope with inevitable increases in volume. Therefore any integrated, managed approach for dealing with the explosion in market data rates will demand purpose-built tools for realistic capacity planning, modelling, and testing.

“I just don’t see Wall Street rewarding a sell-side firm for removing quotes from the marketplace to help with the deluge of data. It’s the trading firms that create the problem, and there is simply little incentive to them to unilaterally take steps to mitigate.”

Steve Listhaus, head of market data services, corporate and investment banking, Wachovia

Listhaus: I see parallels to the increasing dialogue about regulation of another long-standing challenge—carbon emissions. Despite broad recognition of the need to reduce our carbon footprint, there was historically little financial incentive to going green (with gas at \$2.50 a gallon, hybrid cars typically did not save enough money for the average driver to warrant their additional cost). Some firms launched their green programs by leveraging the goodwill created through marketing their humanitarian efforts. I just don’t see Wall Street rewarding a sell-side firm for removing quotes from the marketplace to help with the deluge of data. It’s the trading firms that create the problem, and there is simply little incentive to them to unilaterally take steps to mitigate, and no organizing forces in the industry that would cause trading firms to, as a group, lay down their armaments. ■

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The Capacity Conundrum

Addressing today's capacity issues requires a paradigm shift to match data with its intended usage. By Jeff Hays, vice president of professional services, West Highland Support Services.

At *Inside Market Data's* North American Financial Information Summit, nearly every speaker described the need for a paradigm shift to change the way real-time market data is distributed to consumers. The explosive growth in data rates saddles exchanges, vendors and consumers with a hefty load of orders, quotes and trades that must be ferried through their systems and networks to trading programs which in turn, generate more orders, quotes and trades.

In the past, these problems produced technology advances that increased system capacity, but in a cruel twist of fate, technology advances enabling faster data distribution provide the means for increasing the rate at which orders and quotes can be generated and sent to exchanges and ECNs, making the problem worse.

This type of conundrum requires a paradigm shift as simply throwing money and technology at this problem will not make it go away.

Centralized Market Data Service

In the 90s, with the advent of distributed data systems such as Triarch and TIB, firms centralized their market data distribution responsibilities, helping to mitigate exchange reporting risk and providing centralized control of software deployments, operational monitoring and helpdesk/support functions.

Over the past decade, while market data rates were skyrocketing, full-depth, low-latency data solutions became available. While the market data team was busy keeping their legacy systems running, business units installed direct feed solutions and developed software to capitalize on low-latency, full-depth data.

This decentralization of control, while necessary to address short-term needs, needs to be undone in order to cope with spiraling data rates. The first stage

of the required paradigm shift is to ensure that responsibility for delivering market data rests with the market data group. The business units need to concern themselves with how to make money using the data, and spend less time getting it into the enterprise. In short, they should drive on the road, as opposed to building and maintaining it.

Rationalizing Market Data Needs

Data consumers must scrutinize who in their firm uses market data, and for what purpose.

For example, data rates began to skyrocket with the success of order book feeds such as Arca, Inet and BATS. These feeds display the venue's "full book" of orders at all price levels. Consolidating this information with national feeds by symbol provides a comprehensive view of liquidity for particular stocks, and tracking the updates reveals how the entire market is moving. Leveraging this amount of data requires a computer program that executes trades based on how liquidity emerges, and full-depth low-latency data is needed. A user looking at market data on a screen does not require this type of rapidly updating data.

This result of this analysis is an inventory of market data needs, and a clear understanding of the data attributes needed to best satisfy them.

Rationalizing Market Data Services

The second aspect of the paradigm shift is a vendor-agnostic evaluation of the market data services used by firms. Every effort should be made to limit the number of services providing the same type of data. As data rates continue to rise, consolidating services provides an opportunity to limit scaling requirements to a smaller number of systems.



Jeff Hays
West Highland

Stop Pushing All That Data Around

This goal is to provide users with the data that best serves their business purpose. Electronic trading applications requiring low-latency, full-depth data remain the gas-guzzling SUVs of market data. Because they require every message, firms should localize the capacity hit and avoid having it rippling through the enterprise.

The third aspect of the paradigm shift requires that market data delivery be differentiated based on its intended use.

Applications requiring low-latency, full-depth data use it to trigger trading strategies. In this case, it would be more efficient to "push" the strategies up to a "Direct Market Access/ Market Data" system that breaks down the strategies to conditional execution instructions. The market access component would react to changes in the order book, and conditionally execute trades according to the specified strategy. In this manner, data is not pushed to applications—trading objectives are sent to the engine, limiting the amount of data moved around the enterprise. Engineering and system resources needed for high-performance data processing are focused on fewer components. Firms will decrease the amount of applications receiving market data, reducing exchange display fees.

In summary, firms must be smarter about how they deploy and use real-time market data. Customers need to devise and execute a delivery strategy that matches their data with its business purpose. Understanding how data will be used is the first step to arrive at a workable paradigm for the delivery of real-time market data. ■

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