

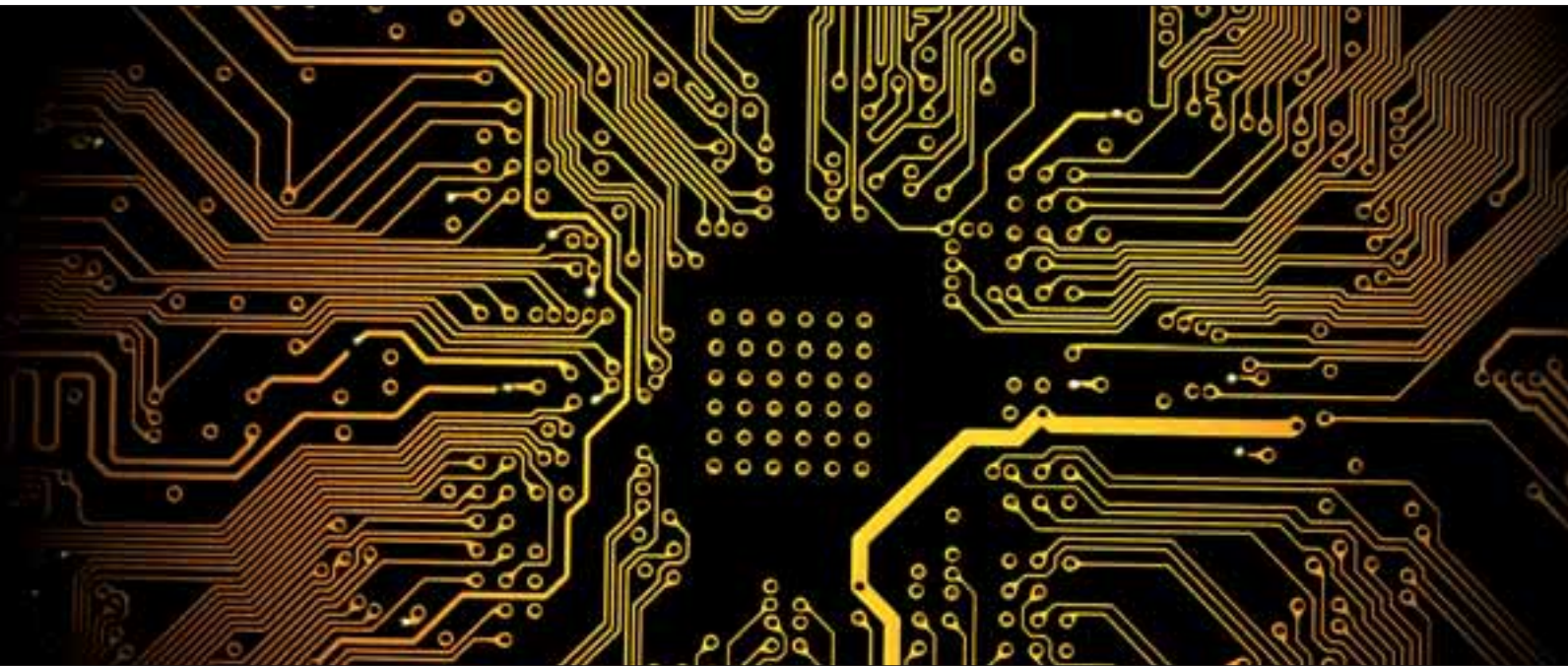
Inside Market Data

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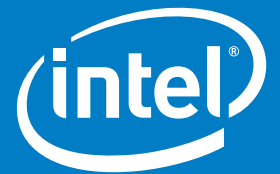
INFRASTRUCTURE

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The Ins and Outs of Infrastructure

Over the past decade, the concept of market data infrastructure has gone from a single core platform in a back room, sending data primarily to terminal displays, where sub-second latency was considered high performance, to a much broader and more complex collection of hardware, software and networks, both within firms' walls and in co-location centers and cloud farms, gobbling budgets, staff and time.

And as infrastructure becomes more complex, it has also become more critical to trading operations. Nathan Boylan, head of IT at asset manager Lord Abbett, calls infrastructure a "business-critical service" that needs continuous modernization and improvement.

Much of the modernization and improvement of recent years has been focused on low-latency technologies. But in reality, this is only one small part of the modern data infrastructure, which begins at the microprocessor level and beyond with multi-core processors, and encompasses everything from how those processors interact to how the circuitboards on which they sit connect to one another, how data is queued, cached and processed, all the way up to the fiber or microwave networks that connect data and trading platforms in a firm's office to its datacenter and to execution venues.

However, die-hard proponents of on-site infrastructure face an uphill battle as the trend of offloading infrastructure to cloud compute models and infrastructure-as-a-service providers grows. While this may not matter for vendors like Intel—who will continue to manufacture high-performance processors for computers, regardless of whether those boxes are owned by trading firms or by someone who leases virtual compute power to trading firms—it does mean that infrastructure providers and customers alike must re-think the way they provision services: Not all systems can instantly move to the cloud without some re-platforming work and its associated time and cost.

Hence, migration to cloud-based infrastructures may be the final nail in the coffin for legacy platforms. Another of those nails is the need to support an increasingly mobile workforce with mobile applications, who expect information on everything from market data to reports about the performance of that data at their fingertips as readily as their personal apps.

Ultimately, these changes may usher in the long-awaited era of true best-of-breed platforms leveraging open standards to stitch together components from multiple vendors and internal sources to deliver best performance. ■



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ING Taps MDX for Real-Time Bond Data Distribution

Dutch bank ING has deployed the MDXT Connect data connectivity platform from UK-based data technology provider MDX Technology to enable the bank to distribute real-time fixed income prices and analytics from its trading desk in Amsterdam to sales teams around the world.

As part of the first phase of the rollout, ING is distributing prices from its fixed income platform—trading technology provider Ion Trading’s Ion MarketView—hosted in a datacenter in Amsterdam to sales staff in seven ING offices around Europe: Milan, Madrid, Paris, Amsterdam, Frankfurt, Brussels and London. In the second phase, ING will expand the distribution to its global sales offices.

Historically, the bank informed sales teams of its holdings using email “runs” via Bloomberg Messaging, to which sales teams needed to subscribe. However, the bank decided to modify its distribution model to share real-time prices with sales staff worldwide, without having to rely on those users having Bloomberg terminals, says Marcus Welling, head of fixed income trading at ING Bank.

“We were looking for a way to provide insight on our holdings on a live basis.... MDXT Connect is a real-time solution, so if I publish a price, it can be picked up and redistributed automatically on a real-time basis,” whereas Bloomberg Messaging did not provide an automatically updated, cen-

tral source of data, Welling says.

The rollout of MDXT Connect will also enable ING to provide prices and additional data such as bid and offers, tiered prices and spreads to sales staff without having to provide access to its trading platform, says Paul Watmough, chief executive of MDX Technology.

Currently, ING is using the MDXT Connect Excel plug-in to download data into spreadsheets and then upload it to the platform’s memory cache, from where it can be distributed to sales staff, but in future the bank plans to partner with MDXT to develop an API that will automatically populate the cache with holdings data from the trading platform. ■

Options Adds Mahwah Co-Lo, Velocimetrics Monitoring

Infrastructure-as-a-service provider Options has expanded its Velocity hosting platform into NYSE Euronext’s datacenter in Mahwah, NJ, completing its coverage of co-location services for all US equity and options markets.

Options has also integrated Velocimetrics’ monitoring and performance analysis technology with its Velocity low-latency market data and connectivity product, to provide clients with “a detailed understanding of their trading performance” as a result of real-time latency monitoring, problem detection, alerting and issue analysis throughout the trading day, allowing users to analyze specific components to identify the root of any event. ■

Colt, MarketPrizm Meld Teams

UK-based network and hosting services provider Colt has created a new unified Colt Capital Markets team that covers sales, product operations and delivery across Europe, drawing from its own staff and from employees from MarketPrizm, the UK-based market data and trading infrastructure services provider it acquired in 2011.

Colt will offer a single, end-to-end service-level agreement covering projects that combine MarketPrizm’s front-office infrastructure solutions with Colt’s datacenter and voice network services, which the vendor hopes will simplify delivery of IT services to clients. The team comprises about 100 existing Colt and MarketPrizm staff, including sales staff that focus on customer relationships, design of services and solutions, and marketing, and a capital markets team that looks at all aspects of the operational delivery of its network. ■

Addicticks Adds Scenario Builder to Infrastructure Emulator

Dutch data technology provider Addicticks has developed new functionality for its TRemulator tool, which simulates data from Thomson Reuters’ Enterprise Platform for Real Time (TREP-RT), Elektron feeds, or feeds based on its Open Methodology Model (OMM) data model, to enable developers to build software applications compatible with Thomson Reuters’ data infrastructure.

Launched in January, the tool comprises TRemulator Publishing Server, a multi-threaded interactive OMM Provider application that simulates the TREP-RT

market data system, and TRemulator Manager, which provides a real-time view of the system. Any application connected to TRemulator Publishing Server behaves as if connected to a real TREP-RT infrastructure or an OMM-based feed.

This month, Addicticks will add a new scenario builder to TRemulator to allow developers at banks, brokers, hedge funds, asset managers and independent software vendors to set their own data parameters for stress-testing applications—for example, spread, prices movements and volatility—and manipulate datafeeds in a way

that is not available via traditional vendor test feeds—for example, allowing them to publish specific data at specific times, such as to simulate high stress levels.

Addicticks will also add more data models over the coming months. Currently the tool supports Thomson Reuters Market_Price, Symbol_list and OMM data models, which are the most commonly adopted models used by the industry, but will add the Market_By_Order and Yield_Curve data models in response to customer demand, to enable the TRemulator to support different types of data. ■



Nasdaq Guts FinQloud, Amazon Gets Clients

Nasdaq OMX is scrapping parts of its FinQloud cloud computing service, handing off some components to Amazon Web Services (AWS)—which provides the underlying cloud infrastructure—and ending support for other aspects of the service.

Launched in 2012, FinQloud provides elastic cloud compute and storage resources, as well as capital markets-specific platforms such as Regulatory Record Retention (R3) and Self-Service Reporting (SSR). R3 provides storage tailored to meet the archival and retrieval requirements of the Securities and Exchange Commission's Rule 17A-4, while SSR

provides centralized storage for broker-dealers' trade data and the ability to run on-demand queries and analytics on that data, using standardized report templates.

In May, Nasdaq told FinQloud clients that from July 31, it will no longer resell AWS services, such as its EC2 cloud computing and S3 storage services. To continue using those services, clients must sign up with AWS, the exchange said.

In addition, Nasdaq told clients that it will discontinue the R3 storage service from Feb. 1, 2015, though it will maintain client records and provide support for up to 60 days following customers'

transition to alternative services.

Several FinQloud clients said they have already migrated smoothly to AWS. "The initial read from Amazon is that they are committed to providing these services," says one FinQloud client.

"At the end of the day, Nasdaq and FinQloud made the use of cloud mainstream in financial services... and cleared the way for others to come in and offer cloud services to the financial industry. They changed the conversation from 'can financial services implement cloud' to 'how does financial services implement cloud'," says another FinQloud client. ■

Panel: Cloud Security Issues Still Outweigh Savings

Firms can deliver significant cost savings by moving their data infrastructures into the cloud, but concerns over security—as well as mistrust of services providers for whom capital markets are not their primary focus—are holding back migration, according to a panel at the North American Financial Information Summit.

One of the biggest advantages of cloud computing and storage is that it provides a consumption-based model for market data services, so firms need only pay for the service and security level they need, said Meenagi Venkat, vice president of cloud managed services, solution and sales enablement at IBM.

Another advantage is cost savings, where panelists agreed that cloud and software-as-a-service models can significantly reduce overhead, though Anthony Concolino, director of operations and technology at Citigroup, says direct comparison isn't always possible, and it can be hard to determine the total cost of owner-

ship of existing market data services and infrastructure.

"If you can determine your actual costs, you will inevitably lower those costs in the cloud. If you're only paying for what you're using—no more, no less—you are going to see economies of scale on day one," he said.

However, some argued that switching to the cloud could incur hidden costs which could impact return on investment.

"When you move into the cloud, there is a certain amount of re-platforming.... You have to decouple data and change codes. So you might not see the return on investment you expect," warned Rosalind Mann, director at RBC Capital Markets.

Meanwhile, Nathan Boylan, head of IT at Lord Abbett, said a major challenge with moving to the cloud is finding providers that truly understand the industry—particularly as many cloud providers are not traditional capital markets players. ■

Celent: Data Vendors to Offer More Infrastructure, Analytics

After a decade of heavy investment in low-latency infrastructure technologies, firms are looking to cut their spend—though still hungry for low-latency data—and focus their budgets on enhancing those infrastructures to better deliver data and provide real-time analytics, according to Neil Katkov, senior vice president of Asia at consultancy Celent, in a presentation at the Tokyo Financial Information Summit.

As a result of this change, market data providers now need to offer more than just datafeeds at the same time that consolidated feeds become more the norm.

"It's not just about providing datafeeds

anymore.... Many of these firms offer some infrastructure around that for connectivity, co-location services, optimized feeds and other types of infrastructure capabilities. The offering is becoming much more complex. This is good for firms because it presents the possibility of not having to do those things yourself," Katkov said.

According to Celent estimates, global market data delivers revenue of \$20 billion for providers annually, with the amount of data available rising from one zettabyte to eight zettabytes over the last 10 years.

"One reason why we do not see growth in market data revenue shooting up to

the degree that the expansion of data is growing is because of the consolidated approach," he said. "Now, consolidated datafeeds are more about... efficient and lower-cost access to the huge amount of data and the wide variety of data available, including traditional market data, news and everything else in one feed. So it's now a strategic product."

Katkov said that with greater demand for cross-asset data, he expects that as market data volumes continue to explode, so will the need for consolidated datafeeds, and so will the investment around real-time data analytics. ■



Infrastructure: From Best of Breed to BYOD Needs

The demands of increasingly competitive content, such as low-latency data and Big Data, have placed an increasing burden on data infrastructures and their underlying technology components required to capture, process, and deliver market data. The modern data infrastructure must support not just traditional data applications, but also central, enterprise data distribution requirements as well as specialized high-performance architectures, while also serving a shift in data consumption habits towards increasingly mobile data interfaces.

IMD: How do you define the scope of the modern market data infrastructure and its multiplicity of components, from in-house data platforms and databases to low-latency technologies, to third-party networks and datacenters: Which are the most critical elements, and how are firms now prioritizing these differently than in the past?

Eric Hanselman, chief analyst, 451 Research: Today, any definition of market data infrastructure has to be broad. There are too many components whose interactions are critical to the effectiveness of the complete platform. Great feeds and analytics are wonderful, but if the results can't deliver timely actions, you've wasted a technology investment. Trading environments are becoming more diverse and more mobile, and the interplay of systems must extend to partner relationships, like those with service providers. There is a whole digital infrastructure that has to be considered to yield effective results.

The most critical elements that firms have started to prioritize are data management and improvements in infrastructure flexibility. Most firms have a good handle on connectivity, and the edge that network speed used to hold is fading. Expanding the range of data that can be integrated into analytics can open new avenues, but there has to be an understanding of how to manage and moderate what can be an overwhelming volume. Moving

away from specialized computing infrastructure can help to manage costs and increase flexibility. We're a long way from moving sophisticated applications to cloud environments, but there are near-term advantages that can be had with more dynamic compute resource allocation. There's greater value in adaptability, both in purpose and scale, and firms should be focusing on classes of infrastructure, rather than building environments one application at a time. That effort has to extend through service providers. There are much more mature, financial services-aware offerings available today that can effectively compliment in-house capacity.

Nathan Boylan, head of IT, Lord Abbett: This is a business-critical service for Lord Abbett that encompasses a multitude of infrastructure elements. Since they are all essential for the completeness of the service, it becomes almost impossible to define any one component as being more critical than the other. To remain competitive, one must continually work on modernizing and improving each aspect of service delivery, while our business teams demand new capabilities and value in what we offer. In particular, the exponentially growing need for data aggregation can be found at the core of almost every new initiative. We need to continually position ourselves to meet future—as well as current—requirements to effectively deliver the services needed.



Ken Richmond
Argent Data Solutions

Ken Richmond, president, Argent Data Solutions: Most large firms are doing everything possible to make the scope of market data infrastructure as large as possible, and to bring more centralization and sharing into play in order to lower costs and enhance efficiency. In the past, many firms had only the major platform (usually RMDS) centralized in the market data department, and various application groups ran the rest of the infrastructure, which is usually more

application-specific. This has also been true of low latency, where the conventional wisdom has been that the centralized groups cannot move fast enough, and shared infrastructure can't be tuned to be part of the centralized infrastructure. As the amount of profit from these areas has declined, the rationale for keeping them separate has also diminished. There is increasing demand to harmonize the infrastructure in a centralized manner to serve as many constituencies as possible and minimize costs.

David Weiss, senior analyst, Aite Group: The most critical element is the connectivity "matrix," the term itself a departure from the simpler days of big pipes hauling market data to the datacenter or even desktops side-by-side with trading applications. It's now a matrix of hosted infrastructure, in many cases co-located near markets, with a combination of cross-connect and carrier connectivity at the hosted datacenter and across multiple datacenters, connectivity from the hosted datacenters to the firms, with some remote-controlled applications and cloud services thrown in, and to varying degrees by firm, some legacy plumbing. This is further complicated by the notion of foreign markets now co-mingled with domestic.

Dejan Kusalovic, marketing director, Financial Services Industry, Intel: Data infrastructure is the backbone of modern business, and trading infrastructure is no different. The boundaries are being pushed in every direction: more data, more types of data, and more uses for data. Just think of the amount of data that is being produced on social networks. Its use in trading is not mainstream yet, but it is coming. Processors, storage and networking are all essential for the new infrastructure. Intel is working to unleash platform-level solutions by optimizing each of the building blocks, from processors to networking to storage. For example, it is advantageous to have data closer to CPUs. Most or all datacenter workloads will benefit from closer proximity to the CPU. This is where Intel solid-state drives (SSDs) make a dramatic difference. We have recently launched PCIe (Peripheral Component Interconnect Express)-based server SSD solutions that are opening interesting avenues in terms of the ability to process great amounts of data really fast. Everybody has been talking about Big Data for quite a while, but it is the ability to process very large datasets in near-real time that creates exciting opportunities in trading and financial services in general.

IMD: What does the concept of "best-of-breed" data infrastructure mean to you? Is this a process of finding the best-fit overall solution, or constructing a patchwork of best-in-class components? What are the benefits and challenges of each?

Richmond: From my perspective, best of breed has always meant buying fit-for-purpose products that best meet the business and technical requirements of the business unit. The goal is to have these products work together in a robust market data infrastructure architecture, which means that they do not work in a patchwork manner. Finding a single vendor that can satisfy all market data needs over the long haul has never been realistic. Committing to a single vendor locks you in, and makes it extremely difficult to support all the business units. They also control the speed at which you can innovate and change. Within their scope, they are great when they work, and solve many problems. The downside of best of breed is that you are now the integration department. However, with a robust market data infrastructure architecture, this is not an insurmountable task.

Boylan: In the past, "best of breed" often entailed literally picking the best solutions available regardless of cost. But we have learned over time that piecing together the most highly rated components and services does not necessarily equate to a robust and reliable solution. These cost-constrained times have forced us to change the way we operate, and in my opinion have improved things tremendously as a result. Not only do we work harder to design and build effective infrastructure that meets our current and future requirements, but we are balancing that with true business value to be successful. This in turn positions us to be a dynamic and effective technology service provider to our business.



Nathan Boylan
Lord Abbett

Weiss: Currently any sense of common infrastructure frameworks is in transition, with a wide range of "standards" adopted across firms, from legacy to bleeding edge and from the US to Europe to Asia-Pacific. Cloud service and applications are tempting to all, but financial services adoption is broadly in its early days. Yet in that domain, Amazon Web Services, Microsoft Azure and Google are considered "best of breed." Beyond them there is no "best of breed," while common infrastructure frameworks remain in flux, only the best solutions for the choices and approaches each individual firm makes. Even in third-party datacenters, "best of breed" varies depending on whether a firm's approach most values a-la-carte services versus full management, and beyond that community and geography. For now a patchwork of best-in-class components seems to be the way to go.

Kusalovic: The best overall solution is the ultimate goal, of course. The purpose of the data infrastructure is to solve business problems, whether it is opening new revenue opportunities or

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reducing process costs. However, the best overall solution is often built upon solid building blocks, and Intel is focused on providing a versatile, agile foundation across the entire data infrastructure with Intel Xeon processors, Intel Xeon Phi co-processors, Intel SSDs, networking and software solutions. We have been benchmarking Intel-based systems on typical computational finance workloads (Monte Carlo, Black-Scholes, and Libor MM, to name a few) for years, and the performance has steadily improved with each new generation of Intel Xeon processors. However, when optimization was applied—in the area of code parallelization, for example—aided by the use of tools such as OpenMP and Intel Thread Building Blocks (TBB), the performance gains were dramatic. It took industry leading building blocks plus optimized software to produce the best results.



Eric Hanselman
451 Research

Hanselman: What's best for any firm is going to be driven by their ability and desire to invest in the process of building their own infrastructure. We spend considerable time with clients, helping them sort out the build/buy/blend decision points on infrastructure and there are no hard and fast rules. Best of-breed functional elements have to match a firm's operational capabilities.

For the same reason that I don't commute in a Formula 1 car, firms should build infrastructure to match their needs and plans. Integrated platform approaches can reduce both deployment time and ongoing operational effort. Part of assessing the fit-for-purpose aspects of a platform is to determine how well it fits existing processes and procedures, and determining the work required by a transition. Transition work shouldn't be ignored or discounted. It's worth considering whether the platform under consideration can be turned up in phases, with limited modules at the outset. Some can accommodate a gradual transition and some can't.

Integrating components can allow a firm to tailor functionality directly to their needs. It can offer flexibility and can reduce transition efforts to smaller chunks. It will also require that the firm makes a larger investment in the integration process, either internally or with partners. It requires a more fully formed strategic vision to be successful. Component selection must be guided firmly by that vision. Without guidance, infrastructures can extend in ways that don't work together and serve to only increase operational efforts. Remember that both Frankenstein's monster and the Formula 1 car are built with a collection of best-of-breed parts.

IMD: How important are standards, open-source technologies and source/vendor-neutral/agnostic systems to creating true best-of-breed infrastructures? How can firms operating in today's trading environments balance these needs for more open, standardized technologies with the need for high-performance processors, networks and proprietary services?

Boylan: We would love a common core of standards across everything we do, but there are so many providers that trying to enforce a common approach is very difficult. We have different development teams, each using different standards, and we have a whole legacy infrastructure—and it is not realistic to go back and retrofit all of these systems. More often than not, vendors don't conform to standards anyway—they always have their own “interpretation” of standards, which is another issue. So for a lot of the aggregation that we've done in the past, we have chosen to custom build. But going forward, we are using off-the-shelf tools and services because we don't have the time, resources or manpower to build common interfaces across all the different products. It's cheaper to pay a third party to do that. The number of interfaces has ballooned, and continues to grow. Plus, off-the-shelf solutions exist today where they didn't in the past, or required extra work to make them run in your environment.

We're a mid-sized organization, so we are limited in terms of resources compared to large banks. We have the same requirements as those large firms, but without the economies of scale. So for the last year or so, we have focused on buying off the shelf rather than building tools ourselves—which involves not only building the tools, but also maintaining them going forward.

It all comes down to having choices, and today we have more opportunity, flexibility and choice than ever before. Add Cloud to the mix and the options and capabilities available now provide every financial firm, regardless of size, with access to technology and services that were traditionally the domain of large organizations. The challenge comes down to whether you build, buy or use a hybrid of the two, in parallel with being able to correctly match solutions to business requirements. So it all comes down to having choices!

Weiss: Even in the more leading/bleeding-edge technologies, there are definitely both open standards and open-source software in wide use, so make no mistake about their importance. FIX has become so common over 20 years that it's now a foregone conclusion, yet just the same, Hadoop is now the standard for macro data collection after just a few years. Firms and independent software vendors alike are now very comfortable with shifting from proprietary APIs and approaches to standardized as they recognize the benefits of leveraging the work of others who do a better job in these areas by virtue of their focus on just those areas. Perhaps the strongest argument against high-performance processors, networks and proprietary services is the virtualization of most of them via software and availability now on an as-a-service basis. That said, for financial services in particular, third-party datacenter choice is one area where private “standards” are emerging... in that there seem to be a few such datacenters where everybody in financial services seems to be coalescing.

Hanselman: Standards hold the promise of easier integration and longer-term flexibility. Realizing the benefits of that promise can be challenging in real deployments. Firms need to balance the ability to differentiate with the amount of investment needed to



operate and maintain the infrastructure that they've built. Where there's a sufficient density of vendors supporting a standard, the benefits can be worthwhile. If they'll let a firm blend capabilities to suit their needs, that can be a useful path, but they should expect to invest at least a modicum of resources on integration.

Extreme performance options and specialized hardware can deliver differentiation, but it's important to ensure that these aren't dead ends. Work with vendors who can offer a clear path as technologies progress and a firm's needs expand. Hardware will continue to increase in performance, but software architectures can become the limiting factor in both performance and capability. It's important to continue to assess application functionality and performance over the application's lifecycle.

Richmond: Ideally, all products selected to be used in the market data infrastructure are standards-compliant and vendor-neutral: that is always the goal. Unfortunately, reality doesn't always meet the goal, and it is our job to make all products fit within the infrastructure by developing robust market data infrastructure architectures. Back to fitness for purpose, if a business unit needs some proprietary product running on specific processors, the architecture needs to be able to accommodate this. Products that are open and meet standards will always be preferred, but we need to create a world that accommodates the business imperatives.

Kusalovic: We are always looking to drive and support open standards, which are extremely important to drive scale. We are actively involved in driving both software and hardware standards. For example, Intel recently drove industry standards in hardware (2.5" PCIe) and software (NVMe drivers) for solid-state drives that are increasingly becoming a "must have" in modern trading infrastructure. Having high-performance processors, networks and storage is not mutually exclusive with open standards-based technologies. Intel has been proving the opposite for decades. Two significant recent trends are the move to software-defined infrastructure and the move to scale-out, distributed applications. We are actively driving standardization efforts in both areas.

IMD: [What are the key challenges facing firms and service providers attempting to integrate new business lines and technologies with legacy incumbent platforms? With budget constraints still affecting the industry, what appetite exists among consumers and vendors to spend on these projects, and how are companies getting around cost obstacles?](#)

Richmond: This depends upon the level of integration required. They can run from specific hardware-software operating system-type issues to software versions and symbology issues. This can manifest itself even when trying to integrate application to use data from mainstream vendors. With budget constraints, it is very difficult to get approval for these types of projects. There needs to be a strong business case. We see some companies try to self-fund these types of projects through projected cost savings. Even these are difficult as there is always risk around achieving cost savings.




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Kusalovic: Proprietary solutions and associated high costs are key challenges. Intel is driving very disruptive solutions on both these vectors. We have a laser focus on enabling high-performance computing (HPC) solutions based on Intel x86 architecture. Whether a particular solution requires our Intel Xeon Phi massively parallel accelerator co-processors or not, this means that developers are using familiar tools upon which datacenters are built. The same code runs across our Intel Xeon processor family and provides tremendous benefits in terms of rapid prototyping and agile development. This ability to be agile and cost effective with Intel-based infrastructure addresses cost concerns, but also provides market players the advantage of getting their new strategies up and running faster, and thus helping the top line, too.

Hanselman: There are more than enough pressures on organizations dealing with legacy systems. A key to moving forward is to start with operational cost management. These are systems that aren't going away, but persist in operational settings that aren't optimized for current utilization levels. That can mean updating environments or working with a hosting or managed service provider, where there are increasing levels of operational experience among service providers, and it can be possible to reap savings by handing off some operational aspects of legacy systems. To be successful, there must be a solid agreement covering not only the financial, but also the operational relationship with the service provider. At the same time, there are more options for integrating and extending access to legacy systems. The data and decision capabilities that they house are still valuable. As firms extend application architectures, layering functionality outside of the legacy environment can retain that functionality while improving processing. This is also a means to begin the transition process, if carefully managed. In efforts like this, many firms start with mobile front ends to applications. With good planning, that front end can expand to improve scale and reach for legacy systems.

Boylan: With the majority of legacy platforms being hosted on-premises, and with Cloud platform solutions rapidly becoming a primary choice for many firms, the task of bridging the divide between these introduces new challenges. Even without current budget constraints, the cost and complexity of modernizing legacy platforms means that many of these will likely remain

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unchanged for the foreseeable future. One exception will be where modernizing is the result of projects driven by new business, into which legacy improvements can be folded. For the rest, there remains an ever-complex and growing infrastructure framework, often requiring sophisticated solutions and broad technical expertise to act as intermediaries. In simple terms, the plumbing becomes multifarious to meet our business needs. Ideally, one would wipe the slate clean and start again, but that is neither practical nor realistic in the world we live in.

Weiss: The biggest challenge is the combination of incumbent IT staff and the current employment outlook. Beyond that, all firms trading OTC derivatives are now facing a plethora of green-field projects around creating much electronic infrastructure for the first time, which—while certainly quite challenging—is also a tremendous opportunity to do so using open standards and adopting the latest IT, software, hosting, and cloud trends.

IMD: How is mobility and the need to support more devices changing the nature and complexity of data infrastructures and data consumption? What are the technical and administrative/security challenges of integrating mobile data access, and accommodating BYOD (bring your own device) and an increasingly mobile workforce and customer base?

Kusalovic: The spread of mobile devices has affected both the quantity and type of data that modern infrastructures need to handle. Mobile trading is rapidly gaining ground as the preferred way to trade retail, and BYOD has presented a set of challenges—security being most prominent—for IT departments. I believe we still are in the early innings of the mobile revolution. Ubiquitous computing access will keep transforming and influencing trading. Intel is extremely active in the mobile computing revolution. Fourth-generation Intel Core and Intel Atom processor-based devices provide great user interfaces and the ability to do real work. Nobody wants their device to freeze when doing a trade. Very importantly, we are looking at end-to-end security. Hardware features designed to provide superb security are built in, both on our server platforms as well as in Intel-powered devices. We also provide software building blocks, including—but not limited to—Intel Security-branded software solutions.

Boylan: Mobility requirements continue to grow, and today firms continue to use a multitude of solutions to meet all their needs, such as security, access, applications and data consumption. The traditional approach has been for firms to control—and in some cases, own—devices. But with consumerization driving exponential growth in the variety of devices and end users becoming highly educated in mobile technology, that has become very difficult to manage and control—not forgetting the ongoing challenge of meeting our industry’s regulatory and audit requirements in addition to the needs of our end users. Going forward, the strategy of being device-agnostic and focusing on ownership and control of the data becomes imperative. Delivering that as part of a seamless end-user experience is critical to success.

Weiss: Mobility’s biggest challenge is... that the “cool stuff” that executives and business users have come to take for granted on their smartphones and tablets has raised the bar by orders of magnitude for their expectations of what traditional applications and infrastructure should be. When every desk head has their photos on iCloud and books on AWS, they assume that’s the way to go for trading, almost as if they’re now cloud experts. Consider that touch is *de facto* not just for these devices but for the latest PC operating systems, yet how many trading applications allow zooming on data or execution via touch. It gives a whole new meaning to high versus low touch. Mobility and BYOD are currently a nightmare for firms, and determining policies is still a big focus before even finding IT solutions to implement them.



David Weiss
Aite Group

Richmond: The need for mobile is definitely making life more challenging. Security and data administration/entitlement management are areas of concern, as are the various vendor pricing schedules and ensuring that the mobile devices don’t cause any upward swing in data costs. Many vendors have developed/are developing nice mobile applications that we can leverage, especially when tied to an existing desktop and pricing scheme. This is often the easiest path to satisfy the business needs without incurring large amounts of incremental costs by doing things ourselves.

Hanselman: Mobile has become mandatory, but the proliferation of device capabilities and formats is a big challenge. Only a handful of firms are successfully working towards a “mobile first” development strategy. There must be greater emphasis on data movement and placement. Whether that comes from partnerships or a distribution of the computing and data infrastructure, data must get closer to mobile users to address this challenge. To deal with security and regulatory requirements, firms have to start handling data more intelligently and considering not only applications, but also computing venues that will make mobile work better. On the application side, sorting out a consistent, if not singular, application path is mandatory. Too much effort is wasted on tactical moves in mobile development. A strategic plan can help to align needs and address an effective data handling plan.

For computing infrastructure, any investment in capacity must be done with an eye to mobile connectivity. That can be had with partnerships in co-location and hosting, or improvements in peering connectivity. The latter is a matter more of topology, than capacity. Being faster is good, but being closer is much better. Being closer in mobile can also mean considering distributing computing and data closer to mobile partners. It’s getting easier to get self-contained chunks of computing infrastructure further from the traditional datacenter, but the ability to take advantage of decomposed or distributed options depends on the architecture of the applications driving them. ■

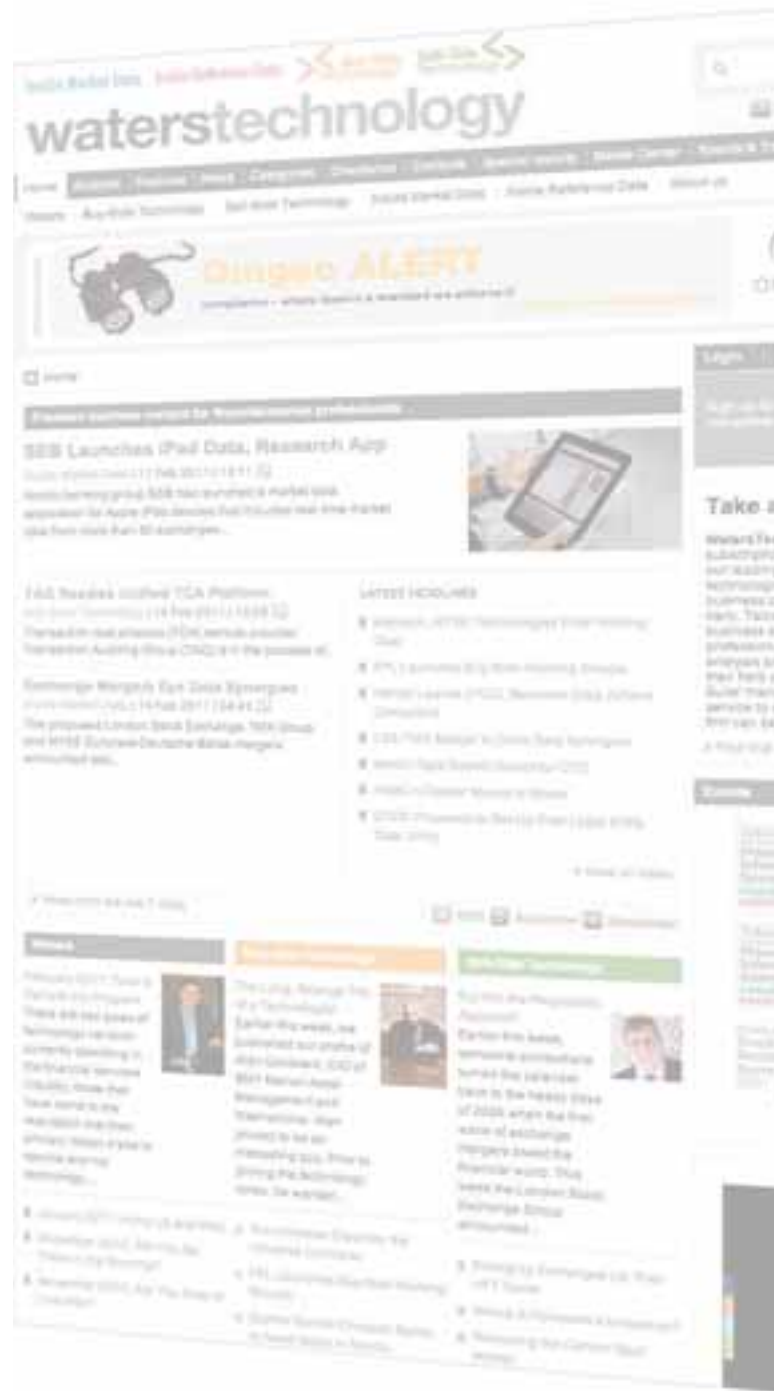
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