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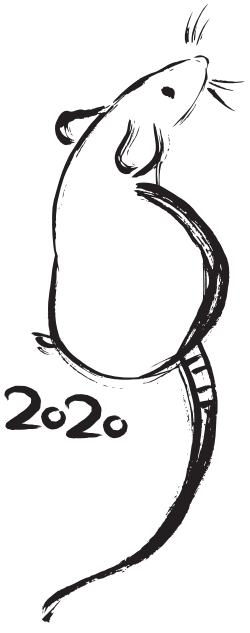
THE USE-CASE ISSUE



Machine Learning. Blockchain. Public Cloud. App Interoperability. 5G and IoT. *WatersTechnology* looks back at some of the more interesting use-cases in the capital markets from 2019 to preview what's ahead for the technologies in 2020 and beyond.

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Looking Back to Look Ahead

With this issue of *WatersTechnology*, we tried to do something a bit different. Five of the features (*pages 16–47*) look back at the biggest trend areas from 2019: machine learning, blockchain, cloud, 5G and the Internet of Things (IoT), and desktop application interoperability.

We wanted to create a one-stop-shop for some of the major projects working their way through the capital markets: the 5G and app interop stories are more like think pieces due to the nascence of the technologies, but will have profound impacts in the near future; the machine-learning, blockchain, and cloud features are flashbacks of previous articles that have appeared on WatersTechnology.com. Combined, we hope that they show where the market progressed last year so that our readers can glean insights into what's in store for this year and beyond.

It's no secret that the pace of change in the tech world is staggering. Because of that, it's easy to become unable to see the forest for the trees. As we've seen so often, technology advancement in finance is an evolution, rather than a burst. When I joined *WatersTechnology* a decade ago, the idea of using a public cloud provider to store important information was anathema; today, most firms are using multiple public cloud providers. A decade ago, artificial intelligence was more about robotic process automation; today, most firms are increasingly experimenting with machine learning, or are using products that leverage machine-learning algos. As for blockchain, it's been a rollercoaster ride of hype and disillusionment and, now, rationality.

In the coming years, we'll see increased use of deep neural networks. We'll see the rollout of true 5G networks. We'll see advancements in quantum computing. All the while, your "basic" technologies will need to be upgraded and improved upon. Hopefully, this issue provides you with a resource to look at some of the cutting-edge initiatives in the capital markets, while you also grapple with everyday trading tools and regulatory reporting requirements.

As for what's ahead for *WatersTechnology*, in the March issue we will take a dive deep into the worlds of environmental, social and governance (ESG) principles, post-trade technology, Refinitiv's Thomson Reuters Enterprise Platform, and why data mining is—sorry for the language—bullshit (much of the time). wt

Anthony Malakian
Editor-in-Chief

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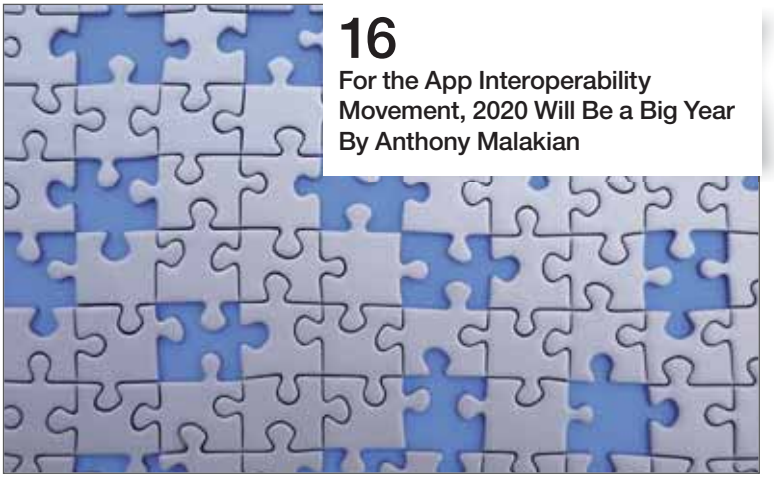

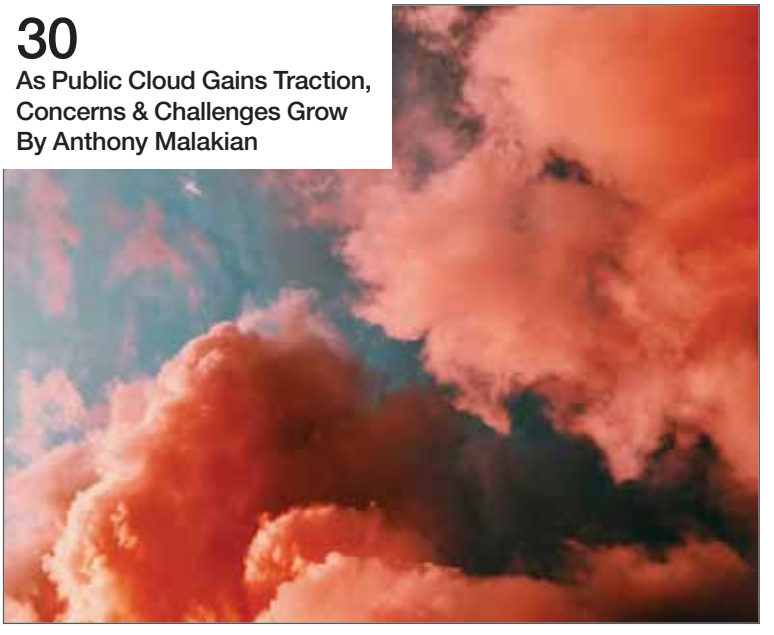

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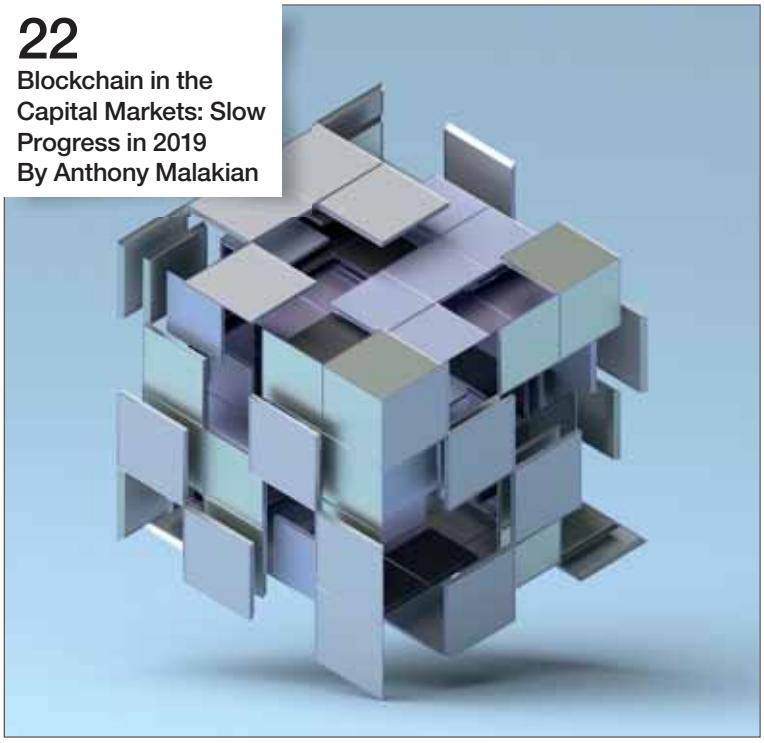


GLMX Looks to Securities Lending and Swaps for Electronification

The platform provider is looking at opportunities in securities lending and swaps, as it pursues expansion in Europe. By Joanna Wright

Securities financing trading platform GLMX is looking to drive electronification in markets beyond repo, says Phil Buck, its managing director for Europe.

Buck says the company sees a potential "huge advantage" in developing offerings around securities lending, which despite sharing some similarities with repo is a fundamentally different product.

"From the start, the view of GLMX was that the area of financing, particularly secured financing, is one that is collectively not yet too far along the electronification curve. In addition to repo, there is securities lending, which is related and similar, but is also a different business where people are lending to each other on a fee basis," Buck says.

"This is an area we are building for right now," he says.

The company, which is a registered broker- dealer and technology provider, has a web-based platform that connects intermediary dealers in repo markets to their buy-side clients. GLMX has been a proponent of automation in this historically manual market, being among the first providers to offer a request-for-quote (RFQ) solution on its platform in 2016.

> "From the start, the view of GLMX was that the area of financing, particularly secured financing, is one that is collectively not yet too far along the electronification curve."
> **Phil Buck, GLMX**

Last year, as part of the drive to expand its securities lending business, the company hired a 30-year veteran of the securities financing industry, former Credit Suisse managing director Rory Zirpolo. It is also engaged in talking to clients about their needs in this area, Buck adds.

Buck himself joined GLMX in mid-2018 to help drive its European expansion. He was fresh from a year off, but prior to that spent a combined 21 years at Anvil Software and Ion Trading (which acquired Anvil in 2006)—11 of those as CEO of ION's repo, securities lending and collateral management business.

When Buck started at GLMX, he and one or two others were the only people working in the London office; it now consists of eight people based out of a WeWork office in trendy Hoxton, equidistant between GLMX's sell-side clients on the Wharf and in the City, and its buy-side clients in the West End. The company's development team is in the US, but the London office is

equipped for sales and client onboarding functions.

Buck says he envisions electronification as a curve: While equities and foreign exchange have been far along the curve for years, repo is still somewhere near the bottom. However, the drive to bring increased efficiency and automation to these markets is growing as the first phase of the Securities Financing Transactions Regulation (SFTR) comes into force in April.

Stuart Campbell, head of trading at BlueBay Asset Management—a client of GLMX—says preparing for the regulation is a priority at his firm. "There has been a marked shift in the repo market toward electronic trading over the past few months, as firms prepare for the implementation of SFTR," he says.

BlueBay's repo flow has gone from completely manual to 99% electronic using GLMX, Campbell says, adding: "Not only do we now have an effective solution for SFTR, but we're also benefiting from significant efficiency gains."

Funding Alternatives

Repo markets have been subject to more volatility in recent years, with a particularly dramatic example occurring last year when, on September 17, the cost of overnight funding in the market shot up to four times its usual rate. As our sibling publication *Risk.net* has reported, structural shifts were responsible for the stress, including a decline in banks' excess reserves and the popularity of the Fixed Income Clearing Corporation's (FICC's) sponsored repo program, which concentrated business at a handful of banks and tilted the market toward overnight funding.

As a result of this volatility, and the fact that post-crisis regulation tends to punish short-term funding, banks like Goldman Sachs and JP Morgan are reportedly experimenting with total return swaps (TRS), which imitate repo without making banks take the capital hit. Assessing the potential of TRS will be a focus for GLMX in 2020, Buck says. The company is engaging with consultants to understand what it might be able to provide to users in this space.

But GLMX is still focused on its core business of supporting repo markets, with sponsored repo emerging from the US as an impetus for innovation. In a sponsored repo transaction, a dealer sponsors its buy-side counterparty on the FICC cleared repo platform, allowing it to net transactions and reduce the impact on the dealer's balance sheet. The program was expanded in 2017 to money market funds, and since then has had a massive impact on the repo industry.

GLMX added a feature that allows users to identify a repo transaction as sponsored or not, in order to route it to the right downstream systems, and Buck says he is starting to see take-up among users. Buck will now be looking to do the same thing for European markets, building connectivity to clearinghouses there.

At the same time, regulators are pushing for greater transparency and efficiency in repo markets, with SFTR set to be the most important regulatory initiative of 2020 in these markets.

A lot can happen to a repo in its lifetime, Buck says: it could be repriced if interest rates change, it must be re-rated, and so on. This is where operational difficulties come in for market participants, as they have to manually update that information, often closing out trades and booking new ones at the new price or interest rate. GLMX has introduced the functionality to allow users to book trades *en masse* and the dealers can accept them all at once.

"Repo has been a bit behind the [electronification] curve. People within that world are used to interacting in a particular way, which has been quite manual and relationship-driven and has not had any great stimulus for change. But that is there now: It's certainly not all about SFTR or reg reporting, but I think the regulatory landscape is ultimately seeking to have more accountability and transparency in trading," Buck says. "We have moved to a world where people need to do more with less in general and are trying to find ways of making things scalable. Electronification is a drive to do that without removing the important relationship element." wt

Brown Brothers Harriman to 'Transform' its Fund Accounting Service by 2021

The bank is in the throes of a hefty transformation project within its Investor Services division, which began with machine learning efforts last year. By Rebecca Natale

By 2021, Brown Brothers Harriman's (BBH) hopes to have radically transformed its fund accounting process end-to-end. At the core of this movement is artificial intelligence, including machine learning and natural language generation.

Last year, BBH began incorporating supervised machine learning in order to strike net asset values (NAVs) for clients. The algorithms replaced hundreds of manual-work hours by analysts, who would sift through thousands of pricing anomalies, or exceptions, finding that as few as 1% were true exceptions. Through its machine learning-powered Anomaly NAV Tracking System (ANTS), the bank has eliminated 90% of false positives.

The next big venture began in Q4 of 2019 and will be implemented by the end of Q2 this year. The system, dubbed Guardrail, expands upon ANTS and entails looking at the overall portfolio of a fund against a benchmark, such as the S&P 500 or another index, and making sure there are no dramatic price movements from a client's fund versus the desired benchmark. Clients will be able to receive custom reports based on these comparisons.

One of the benefits of Guardrail, says Michael Cook, vice president of investor services at BBH, is the time saved by analysts who, if there is such a deviation, must currently sift through all the components of a NAV to determine why it deviated, and write up an analysis.

"2021 is where all these AI projects we're doing in fund accounting come together," Cook says. "ANTS right now is [about] security pricing, but as we build out for the AI to review interest, and to do standardization, and to go through all these journal entries to be able to summarize and provide an analysis at the end of the day, we think that's going to be transformational."

> "If BBH has built something and you've got a hypothesis, we have the opportunity to let [the client] leverage that to make sure it's a good investment for them."
> **Kevin Welch, Brown Brothers Harriman**

The firm is also leaning on natural language generation technology in order to lessen analysts' reliance on Excel spreadsheets. After taking in all of the information within their spreadsheets—the bank has already developed its natural language processing capabilities—it is building a platform that will be able to automatically generate language that says definitively, for example, "Yes, your Class A share diverged [due to an expense posting]," says Kevin Welch, managing director of investor services at BBH.

Finally, the firm is also looking to launch an algo-validation tool that can help clients to more easily verify their own proofs-of-concept.

"Something like 70% of AI algorithms that are being built never go into production," Welch says. "If BBH has built something and you've got a hypothesis, we have the opportunity to let [the client] leverage that to make sure it's a good investment for them before they move forward, or they can make the decision that maybe it's even something they want to use daily in our algorithm as well."

The tool has been in development since July. wt

In the Matrix

Despite the industry-wide push for innovation, regulatory concerns can hinder development. When machines are making decisions for humans, explainability is crucial. That's where a confusion matrix comes in. Though not new nor an exclusive method—it's used in most, if not all, machine learning endeavors— BBH's managing director of investor services, Kevin Welch, says they are crucial in providing a visual into how these algorithms perform. As many new and sophisticated machine learning algos are essentially black boxes, a confusion matrix can provide explainability, management and oversight, and the ability to measure the machine's effectiveness.

"For BBH's risk profile, and for the industry's risk profile, we need to focus on making sure our solutions are glass boxes—where we can sit down with a regulator, an auditor, or one of our internal control groups, and show them how the machine is making the decision," Welch says. "In order for me to do that, I need to understand things like the confusion matrix because that's going to be a proof point when I'm showing that."

On the matrix's X-axis are predicted results. One column shows a "yes" prediction, while the other shows a "no" prediction. The Y-axis shows actual results—an actual "no" and an actual "yes." Ideally, the values in the quadrants should match up.

What Welch and BBH's data scientists have done within their production environment is added a dashboard with a confusion matrix right on it. The team can use the dashboard and decide where to make an adjustment if there's an unacceptable number of false positives. (It should be in the vicinity of 500, Welch says.) To that end, they've created a threshold where, if the analysts start to see 750 to 1,000 false positives, for example, the tech teams might need to go back into the algorithm and make an adjustment.

SEC Preps Consolidated Tape Shakeup

The SEC wants a single consolidated data plan to improve data latency and availability over the current consolidated tapes. By Emilia David and Max Bowie

The Securities and Exchange Commission (SEC) has proposed drastic changes to how the US consolidated tapes of market data from equities exchanges will be operated and governed, in a bid to simplify their decades-old structure and keep pace with the technology used by direct exchange feeds to ensure those using the tapes are not at a competitive disadvantage.

The SEC—concerned over the inability of these data plans to keep pace with the exchanges' premium proprietary datafeeds—wants to do away with three separate market data plans and replace them with a single plan operated by an independent third party with no proprietary data conflicts, and governed by an operating committee comprised of self-regulating organizations (SROs) such as exchanges and consumers, including institutional investors, broker-dealers, and retail investors.

"There should be one new consolidated data plan to promote the application of consistent policies, procedures, terms, fees, and conditions that would be more transparent and easily understood across all data products offered," the SEC said in its proposal, which was published on January 8. "Replacing the three existing equity data plans with a single new consolidated data plan… would simplify the process of making future enhancements to the equity data plans' operations so that core data meets on a continuing basis the needs of market participants."

Given that the current system already features identical operating committees who hold joint meetings, it makes sense to streamline their operation with a single data plan to be operated by a plan processor selected and overseen by the SROs, the regulator said, with a voting structure that grants each exchange group a single vote, regardless of how many marketplaces they operate—though exchange groups would receive a second vote if their overall market share exceeds 15% (and hypothetically, a third vote if they exceed 30%)—to allow a fairer decision-making process.

The SEC believes the current tape setup is inefficient

Currently, there are three equity data plans that consolidate securities information into tapes: the Consolidated Tape Association (CTA) plan, the Consolidated Quotation Plan, and the Unlisted Trading Privileges Basis (UTP). The CTA collects and disseminates trade data for securities listed on the New York Stock Exchange (now owned by Intercontinental Exchange), and those not listed in either NYSE or Nasdaq, while UTP does the same for Nasdaq-listed securities. The CTA is run by NYSE, while UTP is run by Nasdaq.

The SEC believes this legacy model is inefficient and unduly costly—and others agree. "There are historical reasons why the tapes were separate, but since the introduction of Reg. NMS, and the fragmentation of trading across venues, those reasons no longer exist," says one source familiar with the consolidated tapes. "Give me one good reason why there should be two SIPS [Securities Information Processors—the mechanisms that collect and distribute the data] doing the same thing."

In addition, the SEC notes that since the rise of low-latency trading, proprietary datafeeds have become more popular, which opens up conflicts of interest within an exchange. The regulator highlighted latency as one instance where the current equity data plans have not received the same level of investment as proprietary feeds, and hence lag the direct exchange feeds, making the consolidated tapes impractical for trading purposes.

Indeed, this dynamic both serves to increase demand for proprietary exchange data products, and create an inherent conflict of interest by incentivizing exchanges to maintain the disparity between the tapes and their own, premium datafeeds. For example, the SEC notes that since Reg. NMS, exchanges continued to improve their proprietary feeds, reflecting the increased importance of depth-of-book data, without making similar improvements to the consolidated tapes

When contacted for comment on the SEC's proposal, Nasdaq and ICE pointed to a statement from the Equity Markets Association (EMA) of which both are members.

"EMA members create and steward the delivery of a vast majority of US market data, and we welcome dialogue to improve the SIP, providing we do not disrupt the unparalleled fairness, depth and robust nature of these markets that provide extraordinary benefits to all investors and our economy," the statement says. wt

MEMX Builds Out Infrastructure as it Waits on Regulatory Approval

The exchange's CEO and COO discuss its matching engine, Intel partnership, cloud strategy and plans for the future. By Mariella Reason

As is true of any startup, the Members Exchange (MEMX) is currently making buy-vs-build decisions as it looks to build out its infrastructure. At the same time, it is waiting on regulatory approval. While speaking on a recent *Waters Wavelength* podcast, Jonathan Kellner, MEMX's chief executive, and Tom Fay, the company's chief operating officer, discussed some of those decisions, the hires they've made, and what comes next from a regulatory perspective.

Since the exchange was first proposed at the beginning of January 2019, it has been working toward regulatory approval. In September, MEMX filed its exchange license, which was put up on the SEC website on Halloween. On Nov. 6, it was published to the federal register, which opened a 45-day comment period. (Nasdaq and the New York Stock Exchange filed comments.) Now, the exchange is working with the SEC to answer any additional questions.

"We're pretty confident that sometime over the next 30 to 90 days we will be able to get our exchange license approval," Kellner says.

Additionally, because MEMX will conduct its own order routing, it has filed an application with the Financial Industry Regulatory Authority to be a routing broker-dealer.

If those applications go off without a hitch, Kellner says they will look to launch "sometime in the summer."

Currently, MEMX has hired 31 people. Kellner, who was previously CEO of Instinet, was announced as chief executive last February. Fay joined in June from Nasdaq, where he worked as senior vice president of enterprise architecture. The exchange has since filled out its management level, including Dominick Paniscotti as chief technology officer, Louise Curbishley as chief financial officer, Lindsay Gilliam as chief people officer, and Colin Clark as head of business development.

MEMX is aiming for 'hyper-converged' IT infrastruture

Kellner says MEMX expects to launch with 49 employees. Included in the next round of hires will be a chief information security officer, developers, network and infrastructure specialists, and market and trade operations professionals.

The Big Build

That leaves technology. MEMX is building its matching engine internally, outsourcing surveillance to an as-yet-unnamed vendor, and "talking to all the cloud providers," according to Kellner, as it looks to deploy a multi-cloud strategy.

Fay says the whole point of the exchange is the data. "It's really not about algorithms anymore. If one views an order as the primitive order type that drives the entire ecosystem, you can actually architect a system around availability and visibility of that data, and that's what we've done."

MEMX has looked to unlock the value of that data for customers by building a system that doesn't need to be run inside a traditional datacenter for post-trade processing and analytics. "That was a different way to look at the problem rather than: Hey, everybody's got to go to where the matching engine is. It's more like: Bring your compute to the data," Fay says.

The exchange is also looking to a build a switching infrastructure with a smaller IT footprint than what's seen at the bigger, established exchanges. MEMX has partnered with Intel, using its Optane Memory offering, which is the seventh generation of Intel's Core-series processors.

"We're going to be able to run the entire exchange in a single rack of computers—what we call a hyper-converged infrastructure—and still maintain N+1, and in some cases N+2 redundancy through that entire stack," Fay says. "That smaller footprint decreases risk for the industry, but also increases determinism performance because we don't have this layer upon layer of bloat at the infrastructure side. So, literally, there's just a couple of switches between a client and our matching complex."

In order for the exchange to be successful in the long-term, it will need a reliable trading ecosystem, which is why both Kellner and Fay are keen to talk about determinism—getting the same response from the exchange regardless of trade volume. That requires consistency when it comes to latency and jitter.

By shrinking the exchange's IT footprint, they hope to achieve those reductions in latency and jitter while maintaining a stable environment. wt

SEC Democratic Commissioner Slams CAT Delays

Robert Jackson dissented from a new proposed order to modernize exchange data. By Joanna Wright

In mid-January, the Securities and Exchange Commission's Robert Jackson slammed the lack of progress in building the Consolidated Audit Tape (CAT) as he dissented from a new proposal to modernize the National Market System (NMS).

"Our history governing markets through NMS plans is hardly encouraging. One need look no further than the Consolidated Audit Trail to see what happens when the Commission replaces real regulations with mere hope that stock exchanges will act against their own interests," said Jackson, who is one of two Democratic commissioners.

The SEC has announced that it is seeking comment on a proposed order to modernize the NMS. The CAT is one attempt to modernize equities and options markets, but has been subject to repeated delays for six years.

"Rather than give investors a real say over the data that drives our markets, today's release merely invites for-profit exchanges to draft their own rules on these questions. … That approach has failed investors before, and there's no reason to expect it to succeed now," Jackson said.

The SEC's announcement says the proposal would direct the equities exchanges and self-regulatory organization Finra to file a new NMS plan with the Commission designed to increase transparency.

Jackson said that by proposing an order under the NMS, the SEC is asking the exchanges to address the conflicts of interest arising from the fact that they profit from the sale of market data.

"No one should be surprised when the exchanges respond that, rather than give investors votes on the operation of the public feed, they'd rather continue controlling it themselves," he said. "Instead of a clear solution to an obvious problem, today's proposal will produce little more than a long process that will benefit lobbyists and lawyers—but not the ordinary investors living with the tax of rising data costs in our markets."

Robert Jackson: Plans "will benefit lobbyists and lawyers"

Slow CAT

The CAT, a centralized repository of market data, is intended as an industry response to the Flash Crash of 2010. It is supposed to allow regulators to track activity in US equity and options markets. But the ambitious project has been beset by disruptions, notably the removal from the project of Thesys CAT, the technology company initially contracted to build it. As *WatersTechnology* reported at the time, the industry laid the blame for these disruptions equally with the vendors, the self-regulatory organizations tasked with running the project, and with the regulators themselves.

The database is designed to capture all trade data from all market participants. Testing of industry reporting to the CAT began in mid-December, amid concerns from broker-dealers about the CAT reporting agreement. Reporting firms have to sign this agreement in order to gain access to the testing environment, but many are delaying as they believe the agreement protects exchanges from liability and opens up sensitive data.

"Our biggest problem with the agreement is that there are several clauses throughout it that basically shield the SROs from any liability in connection with CAT reporting," Ellen Greene, managing director of Sifma's Financial Services Operations group, told *WatersTechnology* as testing began. "Our firms are contributing not only sensitive customer data, but they're also sending in institutional data, including their trade data. This is a very high breach target, and we just don't feel that it's appropriate for members to sign away liability, given the potential risk that this opens up for them."

Live production of the CAT in April is mainly for industry members dealing with equities that were previously reporters to Finra's Order Audit Trail System. Options, specific to large broker-dealers, go live a month later. Full production is expected to take place by December 2021.

CAT reporters must pass several tests to prove their data has an error rate of 10% or less before they can participate in live production by April 20, 2020. wt

Additional reporting by Mariella Reason.

ICE Looks to Bolster ESG Service as Investors Suffer Lack of Standards

ICE Data Services says investors will be able to access its reference data subscription service later this year to build out their ESG strategies. By Mariella Reason

Standards and regulation around environmental, social and governance (ESG) strategies for investing are still evolving, but interest in the area is growing among investors, says Lynn Martin, president of ICE Data Services.

"The EU put in some regulations at the end of last year, but this is an area that is still very much evolving, and firms' compliance is very much evolving," Martin says.

ICE recently announced that it is launching a reference data service to help investors assess ESG risks and opportunities in corporations. The subscription will provide access to data points on companies, such as reported greenhouse gas emissions and diversity metrics, the company said last week. Bank of America's Global Research division is ICE's development partner in the service, and will use the service itself in its global equity and credit analysis. The reference data service will be available to subscribers in the second half of 2020. Martin says it will produce more than 500 attributes relating to different aspects of ESG.

"The ESG landscape is evolving rapidly, and investors are increasingly looking for comparable, decision-useful data," Martin says.

She says the service is effectively an extension of ICE's fixed income terms and conditions business, where it compiles and publishes the information held in the prospectuses put out by bond issuers. Users can now synthesize this data with the ESG information that companies put in their ESG filings and other reports.

Martin says that, ultimately, she would like the service to be used globally, but the initial focus of development will be within the US, as this is where ICE's partner, Bank of America, wants to focus.

New service aims to help with ESG risk assessment

Big Questions to be Answered

Interest in ESG as an investment strategy is increasing, with firms even creating new roles for it. Man Group, for instance, named its first chief investment officer for ESG this month. However, the reliability of ESG reporting has come under scrutiny for the lack of regulation surrounding it, and with a lack of common standards and definitions, there is even doubt about the simplest question: What exactly is ESG?

Analysts say that a lack of standards around what constitutes ESG makes it easy for companies to make misleading claims about their environmental or social impact, and regulators are currently grappling with how to hold companies accountable for their claims. In October 2019, the European Council adopted two regulations that will affect investment managers on disclosure and low carbon benchmarks.

> "The ESG landscape is evolving rapidly, and investors are increasingly looking for comparable, decision-useful data."
> **Lynn Martin, ICE Data Services**

Another key initiative, the Taxonomy Regulation, has been delayed, and is now scheduled to come into force in 2022. The Taxonomy Regulation is intended to create a framework under which activity can be classified as environmentally sustainable or not.

Michael Goldstein, managing partner at Empirical Research, said: "If you look at the providers of ESG products and what they call ESG, they are in no sense the same. I don't think anybody even knows what it is… I tell our clients that we don't have an investor that is not an ESG investor. But the flows into dedicated ESG funds are trivial. It seems there is a very big gap between the rhetoric and whatever the reality is going to end up being."

Goldstein was speaking at the first-ever meeting of the Securities and Exchange Commission's (SEC) asset management advisory committee. With him on a panel was Ben Phillips, a principal and the investment management chief strategist within the Casey Quirk practice at Deloitte.

Asked by commissioners if he thought the SEC should regulate ESG standards, Phillips responded: "I don't know if any regulator should be in the role of saying what the ESG standards should be. [But] somebody has to be responsible for puncturing the claims of people who say they are, and aren't."

It's this role that regulators around the world are trying to step into, he said, especially the Europeans.

"The biggest problem for breaking fiduciary trust will be if firms say they are compliant with some sort of ESG standard that they are putting forward and they're actually not, or the standard doesn't make sense," Phillips said. "How greenwashing is addressed and punished is probably the principle regulatory question that the Europeans are grappling with right now." wt

Additional reporting by Joanna Wright.

Nasdaq Updates Surveillance Tool to Build Trader Profiles to Catch Spoofing

The company is combining different data sources to help users spot market abuse and manipulation.
By Hamad Ali

Nasdaq has been updating its surveillance offering to allow clients to build trader profiles that can help investigate cases of spoofing and other forms of market manipulation.

Michael O'Brien, vice president of product management for global risk and surveillance at Nasdaq, says the company has been updating its surveillance system with new features that can capture spoofing.

"The data is there to create really deep and rich profiles of how a trader trades: What's the typical order flow, what type of asset classes do they normally trade, what's the order-to-trade ratio, what's the order cancellation rate?" O'Brien says. "So once you get that as a benchmark, and you can start pulling that data out of data discovery, and start putting it through different forms of analytics, that can be a really effective way to raise red flags around where trading behavior changes."

Nasdaq has released two spoofing alerts and a depth visualization feature in the past 18 months, allowing the company to create what it refers to as the "signature" of spoofing—the consistent pattern that spoofing activity makes and that its visualization tool is aimed at capturing. The company also launched a data discovery tool last week within its Trade Surveillance service.

O'Brien says order book manipulation is at the forefront of concerns for bankers and brokers because of the significant fines, and even jail terms, levied by authorities against perpetrators in recent years, and the fact that corporations can be penalized for not catching spoofing within their organizations.

But spoofing can be a complicated activity to identify, he says. "Spoofing as visualized through Depth, one of Nasdaq's order book visualization tools, has a particular look and a particular identity," he says.

> "The data is there to create really deep and rich profiles of how a trader trades: what's the typical order flow, what type of asset classes they normally trade, what's the order-to-trade ratio, what's the order cancellation rate."
> **Michael O'Brien, Nasdaq**

A spoofing trader submits and then cancels bids or offers on a trading platform before they can be executed, with the intention of artificially moving the market to benefit the trader's positions. Part of the problem with identifying spoofing activity is that there are legitimate order types that can closely resemble spoofing.

Once trading behavior that has the appearance of insider trading or spoofing has been identified, the next stage of the investigation is to establish intention. Market activity could have the appearance of spoofing, but proof is required of what was in the mind of the trader, O'Brien says.

Successful prosecution of spoofing in the US has involved the combination of identifying suspicious trading behavior that looks like spoofing or insider trading with other forms of electronic communications.

Silo Obstacles

A challenge for Nasdaq clients is that compliance functions within organizations are typically siloed, O'Brien says. "So your trade surveillance is in one silo with one team and one system. You've got your anti-money laundering teams, and typically they're very siloed and there's no cross-communication and no cross-sharing of data. Our customers are seeing the inefficiencies in that, and they are seeing the value in bringing these datasets together in a meaningful and targeted way. That's what we're working on doing with them."

A lot of spoofing is done with algorithmic trading techniques, and O'Brien says algorithms deployed in legitimate trading are starting to learn to spoof the markets themselves.

"One of the interesting things we are seeing now is how artificial intelligence and machine learning are being applied," he says. "To some extent, you can see that the algorithms themselves are learning how—from a trader's perspective—to take advantage of a particular market or situations that you could say are crossing a line into manipulation [and] spoofing. So we're starting to see that algorithms can learn to spoof the market." wt

Oracle Leverages Deep Learning to Detect Financial Crime

Oracle is using deep learning to find matching patterns for graph analytics within its compliance platform. By Hamad Ali

Oracle has been developing its Financial Crime and Compliance Studio (FCC Studio) using deep learning and graph analytics, which is the process of analyzing data in a graphical format using data points as nodes and relationships as edges. The enhancement looks to allow users to detect repetitive patterns in graphs of data on individuals in order to help know-your-customer (KYC) and anti-money laundering (AML) activity.

The automated functionality in the FCC Studio platform looks at scenarios not previously classified as threats in order to find patterns. As analysts provide more feedback, the risk score associated with an individual's profile over time can then be reduced. "Deep learning is at the heart of what we're trying to do," says Frederic Boulier, senior director and global head of financial crime and compliance management (FCCM) solution consulting at Oracle.

Boulier says analysts look at data to find anything that might compromise an individual. If the analyst finds nothing suspicious, the system will learn from the analyst. If the same graphical patterns happen again, the system will dismiss them. This will make onboarding more efficient by reducing the number of times individuals are flagged as suspicious.

Neural Networks

Deep learning uses a computer system that mimics the workings of the human brain, called a neural network. Deep neural networks are opaque, but they can process massive amounts of data and can essentially "learn" on their own. Each layer of nodes in a neural network builds on the previous layer—the more layers, the deeper it is. They require massive volumes of data, and when at their best, they can find non-linear correlations.

> "You could be looking at a guy that you're investigating and find out that this person is connected to a politically-exposed person or to a sanctioned individual, by virtue of some data points."
> **Frederic Boulier, Oracle**

When a bank onboards a new client, know-your-customer and anti-money laundering specialists need to be able to connect data on this individual with data the bank might already have, as well as external data. For example, Boulier says the data points can be combined with publicly available information, such as the Panama Papers, the 2015 Swiss banking leaks, or last year's leaks from Mauritius, to provide extra data with which to investigate the individual.

Boulier says there are limitless scenarios in which graphical patterns are applicable. "You could be looking at a guy that you're investigating and find out that this person is connected to a politically exposed person or to a sanctioned individual, by virtue of some data points," he says.

You could make this connection if the two individuals have the same street address or IP address, for instance. Or perhaps you find that two individuals have the same highly complex password, and deduce that those two individuals are actually one person using an alias. This kind of anomaly in the data could signal fraud or anti-money laundering risk for a bank.

Entity Resolution

Boulier says Oracle is also working on entity resolution, an approach that allows users to recognize when two data points relate to the same entity, despite appearing different. Entity resolution aggregates data from multiple sources to create accurate customer profiles, taking into account errors or slight variations in the data and determining whether or not they relate to the same person or entity.

"If you are mixing two different people who have nothing to do with each other, then you're basically creating the wrong profile and you're protecting against the wrong profile," Boulier says. "So that's why entity resolution is very important and the quality thereof is very important." wt

California's New Privacy Rule Set to Impact Financial Institutions

The CCPA came into force on January 1, and while it exempts some consumer data from its scope, firms that have business data on state residents will be pulled in. By Joanna Wright

Financial institutions are not exempt from California's landmark new data privacy regulation just because they already have data controls in place under federal law.

The California Consumer Privacy Act (CCPA) went live on the first day of 2020. The law gives California's residents unprecedented controls over their personal data, including the right to tell companies to delete it.

Under the Graham Leach Bliley Act (GLBA) of 1999, financial firms that offer products and services such as loans and investment advice already face stringent requirements to safeguard the user data they hold. The CCPA recognizes this, and exempts GLBA data from its scope. But GLBA only applies to consumer data, not business data.

"There are exemptions [in the CCPA] for information that is covered by the GLBA. This is consumer information used by FIs, including broker-dealers. But there is not a broad exemption that just takes out the entirety of data maintained by capital markets firms. The GLBA applies to a bank or broker-dealer that is providing a financial product or service to a consumer, and the consumer has to be using that product or service for personal, family, or household purposes," says Mike Nonaka, co-chair of the financial services group at Covington law firm.

Nonaka explains that if an individual were to apply for a credit card online with a bank, the data generated by that interaction is covered by GLBA and counts as personal purposes. However, if that same person went to that same bank to take out a loan because they wanted to start a small business, the GLBA exemption would not apply and that data would be covered by the CCPA.

Residents of California can now demand that companies disclose what information they hold on them

Under the CCPA, residents of California can now demand that companies disclose what information they have on them. They can demand that the company delete that data (subject to some exemptions). And they can opt out of the sale of their data to third parties. The definitions in the regulation are broad and prescriptive, Nonaka says. The definition of what constitutes personal data under the CCPA includes names, social security numbers, geolocation data, biometric data, and IP addresses.

The complexities begin for FIs in figuring out exactly what data they have on individuals and then determining whether it falls into the scope of the CCPA. They will have to understand for what purpose the data was obtained. They will also have to be able to find and delete that information if the consumer demands it.

"You have this waterfall you have to do in order to determine that financial data in an institution's hands is subject to the CCPA; you apply the different exemptions to the CCPA overall, and then there are exceptions to the different specific rights in the CCPA. So it becomes a very layered analysis," Nonaka says.

The CCPA applies to all companies that do business with residents of California and that exceed certain thresholds, such as having over $25 billion in revenue. It applies to companies outside of the state and even outside the US—they just have to be doing business with Californians. The practicality of enforcing the statute has been debated, but the state attorney general has existing powers to pursue violations.

The law has drawn comparisons with Europe's ground-breaking General Data Protection Regulation (GDPR), and Nonaka says it will set a precedent, as GDPR has done.

"This is a very significant development, both in terms of the specific requirements and for what it signals about what other states may do in future. It is a very prescriptive privacy framework, similar in some ways to GDPR, and it is prescriptive in a way that most US companies haven't had to deal with," Nonaka says.

He believes other states will probably follow suit—which will compound the complexity for large organizations.

"If you think what California has done in enacting its own regime is complicated, just imagine what it would be like if 15, 25, or even 35 states move forward and enact their own version of the CCPA, and how complicated that would make privacy regulation in the US." wt

OPEN OUTCRY

What the key figures in fintech are saying this month

"Currently, vendors who write to the FDC3 standard are ensured that their applications can share context within a desktop environment. That was a huge accomplishment for 2019; however, in order to get their application running inside a desktop interop platform such as Finsemble, OpenFin, or Glue42, a vendor currently must still package their application for each platform. For instance, code currently needs to be written in order to import that platform vendor's FDC3 library, and then the vendor must distribute separate versions of their app for Finsemble, OpenFin, and Glue42." **Dan Schleifer, ChartIQ**

» *see page 16 for full feature…*

"I mean, I personally have been involved in technology investing for 20 years and I think that 5G is the biggest investment theme that we've seen probably since the inception of the smartphone. We know that that is going to be a critical part of any technology and really any investor's outlook for the next year or couple of years." **Michael Marrale, M Science**

» *see page 44 for full feature…*

"We are putting all our real-time data into Google Cloud, and converting all our Market Data Platform (MDP) channels into a Google service called Pub/Sub, so anyone can access them via Google from anywhere on the planet. The specific use case for this is how do we take advantage of native cloud services to lower the barrier to accessing our data. …We are creating a low-cost global transport solution for all our market data." **Adam Honoré, CME Group**

» *see page 32 for full feature…*

"That is the issue that is starting to unfold now as everyone is realizing it's pretty easy to put three letters on a marketing campaign and off you go." **Ben Phillips, Deloitte**

» *see page 10 for full feature…*

"In terms of a long-term future state, I think there is a drive in the capital markets to look at financial market utilities. There is a drive towards a model where utilities are performing most of our post-trade activities and [if we can leverage] this mutualization of the cost, it will be a big benefit for the industry. Using standards is obviously the right path for that and so is using common utilities." **Lee Braine, Barclays**

» *see page 22 for full feature…*

"There should be one new consolidated data plan to promote the application of consistent policies, procedures, terms, fees, and conditions that would be more transparent and easily understood across all data products offered." **SEC Consolidated Tape Proposal**

» *see page 7 for full feature...*

"It's something that's ongoing; though with artificial intelligence, I don't think you're ever done-done. Ideally, you want to start early-ish in terms of what you want to do. It does need training to be better, so we are ingesting the data forms and then seeing the outcomes, and then comparing that to what we do already to get a better solution." **Mike Dargan, UBS**

» *see page 38 for full feature…*

"Our history governing markets through NMS plans is hardly encouraging. One need look no further than the Consolidated Audit Trail to see what happens when the Commission replaces real regulations with mere hope that stock exchanges will act against their own interests," said Jackson, who is one of two Democratic commissioners." **Robert Jackson, SEC**

» *see page 9 for full feature…*

NEWSDESK

WatersTechnology's roundup of headlines that hit the wire this month from around the industry

BlackRock Seeks Partners for China Push

BlackRock's head office in New York

Asset management giant BlackRock is looking to leverage partnerships with local firms in mainland China to take advantage of the country's increased accessibility, after the government opened up its markets to foreign participation.

Geraldine Buckingham, chair of Asia-Pacific at BlackRock, said there is interest in manufacturing investment products for Chinese consumers now the country's regulators have eased rules on ownership and operating controls by foreign financial institutions.

"We are looking to form partnerships with some domestic banks for distribution and so on, to ensure that we can distribute product as it comes online," she said.

Buckingham was speaking on a panel at the Asian Financial Forum in Hong Kong.

Colt Cuts Japan–HK Latency to Sub-41ms

Tokyo Stock Exchange

UK-based network provider Colt Technology Services has reduced latency on its network between the Japan Exchange Group (JPX) and Hong Kong Exchanges and Clearing to around 40 milliseconds.

The vendor has operated an ultra-low-latency network between the two exchanges since 2010. The route has undergone several optimizations to provide the fastest connectivity for high-frequency traders.

James Hardcastle, capital markets director for Asia at Colt, says the firm guarantees latency of 40.86 milliseconds or less to its clients under its service-level agreement. "We should be inside that, because obviously if we're not, we're in breach of the SLA," he says.

Colt sees increasing demand for its ultra-low-latency routes. One of its most popular routes is between JPX and CME Group, while connectivity between each of those markets and the Singapore Exchange is also in high demand, Hardcastle says.

Charles River Integrates ChartIQ for Traders

Visualization tools boost productivity

Charles River Development has integrated ChartIQ with its Charles River Investment Management Solution to provide institutional traders with visualization tools.

ChartIQ's advanced charting tools are data-agnostic, customizable, and can be integrated on any desktop, tablet, mobile, or web-based platform. The solution helps traders conduct pre-trade technical analysis, gauge in-trade market impact, and better understand post-trade execution quality.

Charles River says that by integrating with solution providers like ChartIQ, its order and execution management system allows traders to be more productive in their trading and de-risking decisions across asset classes.

Broadridge Advances Cloud Strategy with IBM

Broadridge Financial Solutions and IBM Services are collaborating to provide new cloud-based solutions to Broadridge's financial services clients. First, Broadridge will create the Broadridge Private Cloud, supplied by IBM, and will subsequently transition a significant portion of its global infrastructure to IBM.

IBM will help modernize Broadridge's infrastructure to provide automated private cloud services for its critical workloads. Broadridge will gain new application development capabilities, which will help it accelerate its product roadmap.

Broadway Adds Repo to FICC Trading Platform

Broadway Technology, a provider of fixed-income and FX front-office solutions, has rolled out functionality for repo trading on its FICC trading platform, introducing automated workflows for trading, hedging, and collateral management. This functionality, called RepoTrader, encompasses connectivity to multiple repo markets, order routing and management, and execution tools. Coupled with Broadway's fixed-income functionality, it enables users to trade repos and the bonds that are used as underlying collateral on a single platform.

BMO Financial to Acquire Clearpool

BMO Financial Group has entered into a definitive agreement to purchase Clearpool, a New York-based provider of electronic trading solutions and broker-dealer. The transaction is subject to regulatory approval and other customary conditions, and is expected to close in the second quarter. Terms of the transaction were not disclosed. The company joins the BMO Capital Markets division, but will remain an independent offering with information barriers to secure clients' confidential information.

Refinitiv Joins Future of Sustainable Data Alliance

Refinitiv has founded a consortium that aims to accelerate sustainable finance through data in conjunction with the World Economic Forum and United Nations, among others. The Future of Sustainable Data Alliance will work to channel capital toward the UN Sustainable Development Goals and mainstream climate and environmental data into capital markets. It was inspired by Refinitiv's partnership with the UN Secretary General's Task Force on Digital Financing of the SDGs and the *Future of Finance* report.

For the App Interoperability Movement, 2020 Will Be a Big Year

While progress was made in the desktop application interoperability space in the last year, Anthony Malakian says 2020 is likely to see some major developments that will help to push this movement forward.

I believe tremors of a tectonic shift are beginning to ripple throughout the capital markets, caused by the desktop application interoperability movement. If I'm right, the trader interface is going to radically change. I know, I know, you've heard this before, but this time is different. The mechanisms of change, taken as a whole, represent a true revolution, even if the technologies themselves are not new.

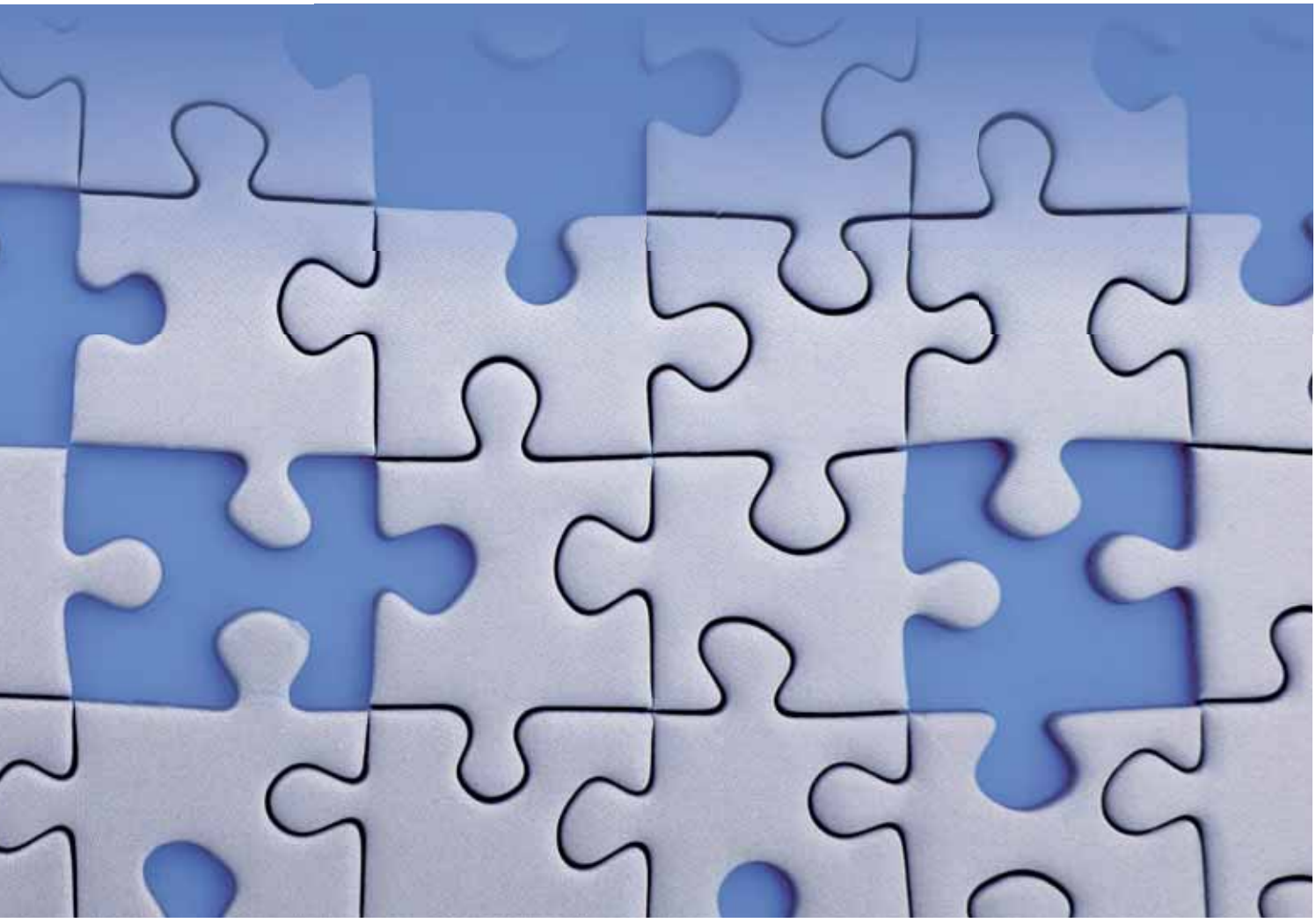
First, a vast sea is rising every day—alternative data. Firms want to be able to easily tap into these datasets and experiment, then incorporate or fail fast. There's also growing frustration over the cost and lock-in of traditional order and execution management systems. We've already witnessed a change here, as these traditionally siloed platforms are merging to form the proverbial OEMS.

Digging deeper, technology is democratizing in many ways. The widening adoption of public cloud providers—and the various big data and analytics libraries and services they provide, from Google BigQuery to Amazon Redshift to IBM Watson—is allowing users to affordably store and analyze exponentially more data, from minutes to seconds in some cases. In an era of tightening margins, surging costs and the rise of passive investing, the hunt for alpha depends on the ability to harness data to create unique insights.

Tied to cloud adoption is the so-called "as-a-service" model, whether for software, platforms, infrastructure or any other component you can affix to the "aaS" acronym. At the same time, Wall Street firms are embracing open-source tools, thus allowing for more collaboration and quicker time to market, and making these tools crucial components to the application interoperability movement.

To say the era of on-premises hardware is almost over would be a big overstatement, but there is certainly a sea change underway. So what do these trends—which are distinct but also overlap—portend for the capital markets?

As I see it—and this is informed by people far more intelligent than me—underpinning all of this is the idea of desktop application interoperability, which uses containerization



Five Milestones

While advancements were made in the app interoperability space last year, it's still very early days as it pertains to adoption.

I recently spoke with Dan Schleifer, ChartIQ's CEO, to see what needs to happen in 2020 to help the app interoperability movement progress. He pointed to five milestones.

First, in 2020, the Financial Desktop Connectivity and Collaboration Consortium (FDC3) initiative is set to make true plug-and-play desktop interoperability a reality, he says.

Dan Schleifer
ChartIQ

"Currently, vendors who write to the FDC3 standard are ensured that their applications can share context within a desktop environment," he says. "That was a huge accomplishment for 2019; however, in order to get their application running inside a desktop interop platform such as Finsemble, OpenFin, or Glue42, a vendor currently must still package their application for each platform. For instance, code currently needs to be written in order to import that platform vendor's FDC3 library, and then the vendor must distribute separate versions of their app for Finsemble, OpenFin, and Glue42."

In 2020, FDC3 will be formalizing "namespacing," which will allow vendors to write code that is completely agnostic, Schleifer says. All of the platforms support a technology called "preloading," which makes this possible. Vendors will now only need to write a single version of their software and be guaranteed plug-and-play compatibility with all of the desktop interop platforms. "Firms don't want vendor lock-in—that's the promise of interoperability, right? Plug-and-play the apps you want; ditch one, replace it with another."

Schleifer also says he expects to see more widespread adoption of FDC3's App Directory in the New Year, which defines a standard way for desktop interop platforms to discover and install apps. Before the App Directory, vendors couldn't get an application onto desktops without packaging it up as an installable-executable service. Now, platform providers can bypass packaging and installation and gain a quicker path to users' desktops, without having to pay a vendor to license any technology.

More on the hopeful thinking side, Schleifer would also like the see the big market data terminals and OEMS providers open up and create a bridge into their platforms, as well as to support standards so their apps "play nicely" with all the other apps on a trader's desktop.

"There's actually some incremental progress happening here, but for a 2020 milestone, I'd want to see at least a couple of the big guys go really open," he says.

Fourth on the list is for interop standards to go mainstream in the middle and back offices. "Most of the buzz and the investment has been in front-office sales and trading, which makes sense as a starting place," Schleifer says. "But interop's [cost savings] value in middle and back office will be huge. As far as milestones, I would be looking for vendor announcements (vendor workflow for trade breaks, etc.), firms showcasing their deployments (likely off the record), and standards around the data objects and workflows relevant to those parts of the business."

Finally, while FDC3 removes the technical roadblocks to interoperability, there are still some mindset changes that can go a long way to ensuring that interop is successful with users. Perhaps the most important consideration is what Schleifer calls "form factor."

"If you think of a web application, it usually has its own menus and navigation, is designed with lots of open white space, etc. In a world of desktop interop, vendor applications share a user's desktop with other applications. In this arrangement, a vendor application ends up with a smaller amount of screen real-estate than most developers assume. It's kind of like responsive web design where an application needs to display properly on both web and mobile. For professional financial applications, there are now three form factors to be accommodated: web, mobile, and desktop. Vendors should design their applications to look good and be usable when running in a small form factor."

Opening Up

The vendor that has arguably made the most progress in the desktop app interoperability space is the one that has been laser-focused on the issue for the last decade—OpenFin.

I caught up with CEO Mazy Dar in the New Year, and here's what he had to say about milestones the vendor is looking to hit in 2020. At the top of the list for Dar is continued education around the Financial Desktop Connectivity and Collaboration Consortium (FDC3) initiative. The API standard is set for some big milestones this year, but Dar adds that as interop standards seep into everyday life, it will help financial services firms overcome obstacles.

For example, Dar points to a recent story from *The Verge* on the ways "Apple, Google, and Amazon are teaming up to develop an open-source smart home standard that's meant to ensure that devices work together, make the development of new devices easier, and keep everything secure in the process." This would mean that no matter which smartphone or voice assistant you use, they will be able to seamlessly communicate together without any heavy lifting on the consumer's part. Where capital markets are (or should be) concerned is how to take that same principle and apply it to their own internal and industry efforts.

Dar is also hoping to hit a critical mass of apps using FDC3 standards in a production environment. "This is something we're working on at OpenFin, and we have some initiatives we're planning this year to help accelerate the process," he says. "Also, large firms like FactSet are already using the standards in production and that will help encourage others."

In November, FactSet and OpenFin announced they were coming together on the FactSet Workstation in a move that will allow FactSet users to integrate and leverage its data and workflows alongside their own internally developed and third-party applications.

The decision to deploy the OpenFin OS on top of Workstation was the result of intense client interest, Gene Fernandez, chief technology and product officer at FactSet, told *WatersTechnology* at the time of the announcement.

"We're increasingly trying to augment what our clients do," Fernandez said. "We've got so much data in the Workstation, and that's only increasing. So we're putting a lot of energy into personalizing it so that the user can see what's important to them at the forefront and go from there."

FactSet is also leveraging the Finos-developed Financial Objects, a program focused on identifying standardized structured objects that support industry workflows. So, for example, if you're monitoring a watchlist on FactSet using certain tickers, Fernandez said, you can click on a ticker, and that identifier will be broadcast to all other open windows, and all FactSet windows will render in context.

"If you have a news window up, and you click on one of your companies—let's say Apple—related news comes up in the other window. Same thing with third-party applications [and] internal applications," Fernandez says. "They can listen in on the broadcast, and then they can change in context as well. It gives the user an experience that's connected despite the applications being built by different companies."

Finally, Dar says it's necessary for business decision-makers to make interoperability a fundamental design requirement internally and for their vendors. Obviously, OpenFin would like to see traction through FDC3, but he also says that "vendors should be encouraged and rewarded by banks and the buy side for supporting the standards," and that firms shouldn't wait for everyone else to start first. "Establishing a true standard requires the industry to pull together," he says.

techniques to build a browser specific to the unique needs of a financial institution. Firms like OpenFin, ChartIQ, and Glue42 are already working on solutions in this space, and it's likely that more will look to enter or partner.

While mobile phones have figured out to some degree how to commercialize app interoperability, it's been a tough nut to crack for the capital markets due to a lack of standardization and protocols, competitiveness, latency issues, and security concerns. Those barriers, though, are coming down.

This year is likely to see some major developments from true plug-and-play interoperability and increased participation from the major market data providers (*see Five Milestones on page 17*) to the spread of interop efforts in the consumer tech space and a critical mass of firms embracing industry standards (*see Opening Up on page 18*).

Below I list why I predict that this evolution in the market is going to prove massive and what needs to happen in the near future to make that prediction become a reality.

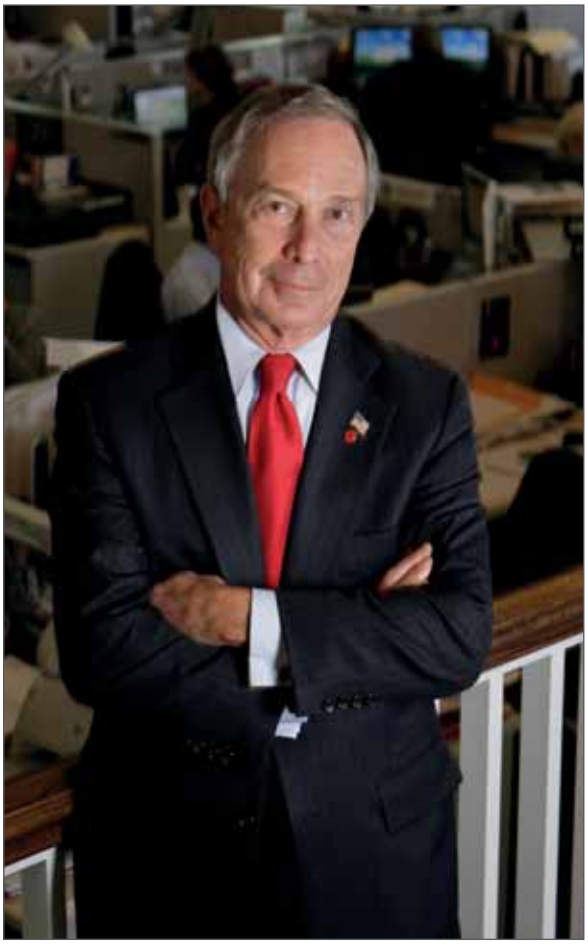
Changing Empires

At this point, it's important for me to say that I'm not predicting the deaths of the stalwart OEMS providers. Some will merge, some will be sold to a bank or asset manager, others will evolve their offering. But trading platform providers cannot ignore the change that is underway. Many have written about the death of the Bloomberg Terminal (the launch of Symphony comes to mind) and many were wrong. It is true, though, that trading platform providers—as well as analytics and data delivery vendors—need to get lighter and diversify the way they provide their services.

I've been covering capital markets technology for a little more than a decade. In that time, more impressive pieces of technology have come to the forefront—notably big data analytics platforms, quantum computing, and machine/deep learning. But the ability to allow different applications to communicate and interact with one another allows for freedom in the ability for firms to adjust and try new things with those aforementioned technologies.

The Bloomberg Terminal and the ancillary services that make up the Bloomberg ecosystem, are ubiquitous in the capital markets. There's a reason for the lofty $20,000-plus price tag—a cost that many—more than 325,000 subscribers—are willing to pay. No one has been able to fully crack that nut, but many have tried, with varying degrees of success.

But even for Bloomberg, storm clouds are gathering. Founder Michael Bloomberg is running for president, making a bid to win the Democratic nomination. Super Tuesday—when more than a dozen states/territories will hold their primaries—isn't until March 3, so this conversation is premature, but the former New York City mayor has said that he will either sell his Bloomberg LP empire or put it into a trust should he become president.



Michael Bloomberg

Even for great technology companies, things can change fast. Remember when Thomson Reuters seemed poised to overtake Bloomberg? Well, TR sold off its Financial & Risk business at the start of 2018 to a consortium led by Blackstone, and then—after being rebranded as Refinitiv—was sold yet again to the London Stock Exchange Group (LSEG) in July 2019. No one knows what the future holds for Refinitiv.

It should also be noted that a sale does not spell death for the Terminal. But if Bloomberg LP is sold to, say, a company like Microsoft, the Intercontinental Exchange, BlackRock or Berkshire

Hathaway, those companies that are paying $24,000 for a single Terminal subscription will have to assess their future relationship with the tech and data giant. It's only natural.

As *WatersTechnology* first reported in August and followed up on with a deep-dive investigation in November, Fidessa has seen its workforce slashed by more than 400 people—mostly through resignations—in the year following its acquisition by Ion Group.

Here are some things that actual Fidessa users told us, which can help highlight the precariousness of acquisitions:

> "The fact we lost a major layer of relations between the firms as a result of this attrition over the last six to 12 months—I think that has essentially caused this lack of transparency around releases."
>
> "We're lucky we implemented the software when we did. They've become a little bit slower to deliver on some of the things they promised. They have fewer people."
>
> "I do expect those [contract] conversations to get a little ugly. Fidessa's obviously a leading system on the Street, so there's no question [Ion] will be looking to further monetize it."

This is all to say that banks and asset managers are finicky. In the past, it was difficult to rip out and replace a trading platform. An OEMS is sticky—it connects to every aspect of an organization, and it can take two to three years to fully replace one of these systems. That's why Ion bought Fidessa, LSEG bought Refinitiv, State Street bought Charles River, and SS&C bought Eze Software.

The mergers in this space are complicated because integrating the various systems—from trade execution to risk management to analytics platforms to charting software to compliance and reporting workflows to customer relationship management systems—is complicated, to say the least. But what if technological advancements, along with new standards and protocols, help to make interoperability easier? What if the traditional OMS and EMS model—the model of the last 20 to 30 years—is dying?

Mazy Dar, OpenFin

Adapt, Improvise, Overcome

The ability for banks and large asset managers to change has traditionally, to put it mildly, not been great. Capital markets firms were slow to embrace the cloud, they lag behind consumer companies when it comes to the adoption of machine learning, and they're still trying to get their heads around alternative data.

This is why banks and asset managers are embracing many of these desktop app interoperability efforts—they want greater flexibility, they want to avoid vendor lock-in, and they want to experiment with new tools and datasets in an easier, more cost-efficient manner.

In 2019, OpenFin, which founded the Financial Desktop Connectivity and Collaboration Consortium (FDC3) initiative, closed out its Series C round of funding, raising $22 million. The round was led by Wells Fargo, and also included Barclays, JP Morgan, HSBC, Bain Capital Ventures, and Pivot Investment Partners.

At the start of 2019, ChartIQ, which oversees Finsemble, its desktop integration platform, raised $17.4 million in a Series B round of funding, led by German private equity firm Digital+ Partners, and it counts ValueStream Ventures, Social Leverage, Tribeca Angels, and Illuminate Financial as backers.

And while not a desktop app interop provider, the Fintech Open Source Foundation (Finos) has played a major role in the trend's development, as a nonprofit organization that contributes to FDC3 and looks to help financial services firms adopt open source software, standards, and best practices. Members include Citi, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JP Morgan, Morgan Stanley, RBC, UBS, as well as OpenFin, ChartIQ, and Glue42.

Again, it's important to reiterate that it's still early days and there's a long way to go. But if 2020 can see some of the major data and OEMS providers get involved, if more banks buy into the FDC3 standard, and if the banks start putting some pressure on their brokers and vendors, a tipping point could come sooner than even the most ardent proponents might expect. wt

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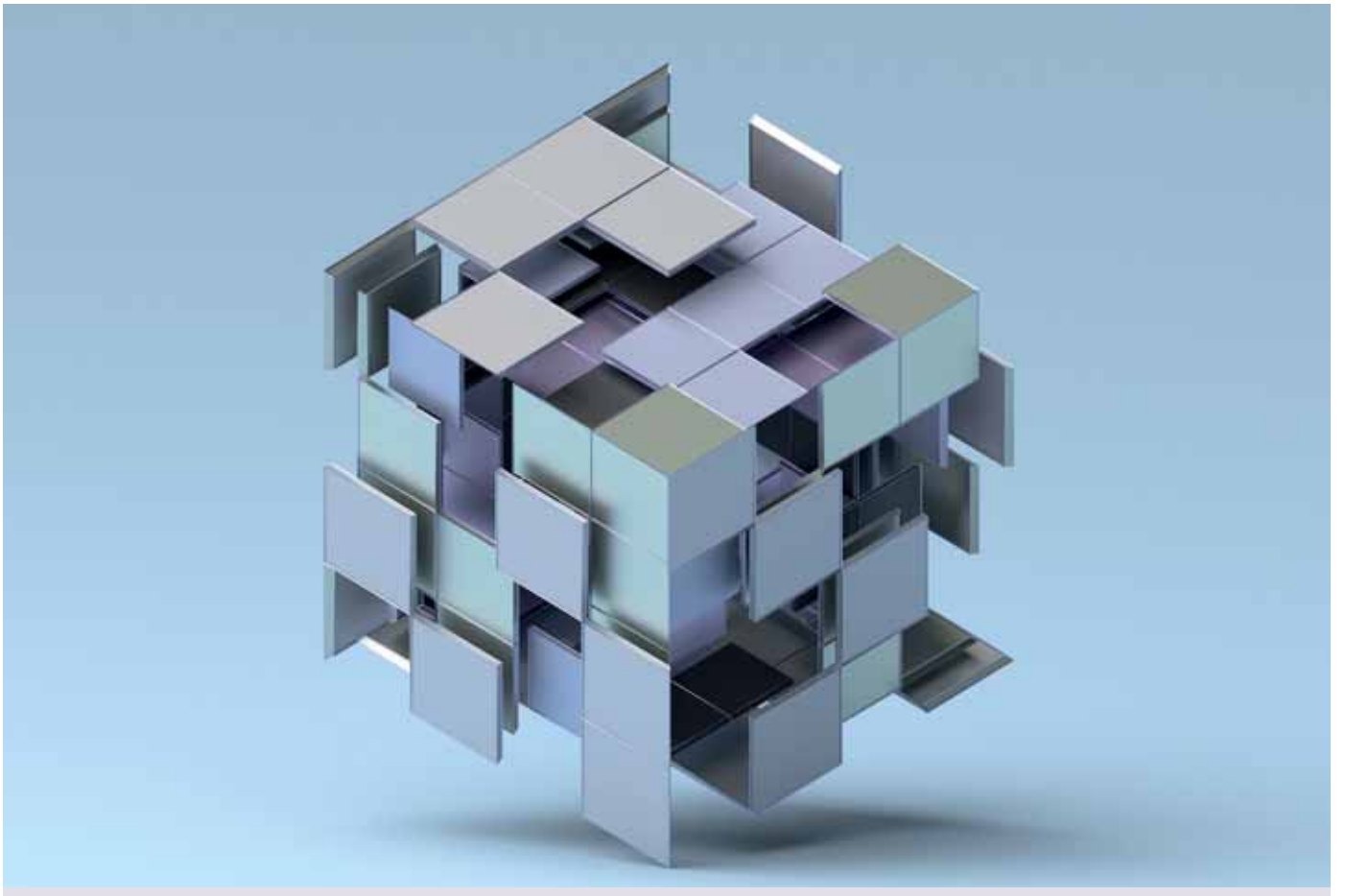
Blockchain in the Capital Markets: Slow Progress in 2019



While real blockchain rollouts are still few and far between, some firms made progress in 2019. Here are 18 projects in some stage of development. By Anthony Malakian

If we're going to have an honest conversation about blockchain—used in this feature as a catchall term for distributed-ledger technology (DLT)—we must first acknowledge that, at least as it pertains to the capital markets, it has not yielded the results many had initially hoped for.

At the beginning of 2019, I wrote an opinion piece about the death of blockchain hype. To be fair, there's still a lot of hype out there, but the conversation is changing. There are some experimental blockchain projects still plugging away because of ego and the desire not to be wrong (or unemployed), but over the last year the scope of what blockchain can achieve seemed to narrow. So, in 2020, rather than experimentation and trial and error, we need to see some real results that can be proven and rolled out at scale—otherwise, what's the point?

In 2019, there were some notable blockchain developments in the capital markets. What follows are details about some of those major projects and how they have progressed over the last 12 months.

This is by no means a definitive showcase of all blockchain use-cases on Wall Street, but these are some of the more interesting projects that *WatersTechnology* covered in 2019. They are not listed in any particular order.

Commerzbank

Main Incubator, Commerzbank's research and development arm, is currently engaged in handing over DLT prototypes to the bank. According to Matthias Lais, founder and managing director at Main Incubator, his team will be working to guide the bank so the implementation of the technology runs as smoothly as possible.

"Currently we are in the process of handing the DLT prototype over to Commerzbank," Lais says. "We have the proof that the technology works and that there is demand from our customers for such a solution—that is what counts.

Going forward, Commerzbank will scale out the technology for wider adoption. Following this process, it will be in a position to offer relevant products to its clients."

The incubator has carried out nine different DLT-based pilot projects with different partners. The most recent project, called the Euro Commercial Paper pilot, took place in January 2019 and involved manufacturer Siemens and automotive giant Continental. During the pilot, Main provided the Corda-based blockchain that supported a test transaction between the two firms: processing a money-market security with a term of three days on the blockchain for the first time.

"Normally you have settlement time of T+2, and this was [settled in] T+0," Lais says. "This was a prototype, but the transaction was real. So there was a commercial paper issued and bought by the investor. Three days later, the money was paid back."

Nasdaq

Nasdaq says one of its blockchain projects, which is meant to track the lifecycle of a digital asset, has moved beyond the proof-of-concept phase. The offering, the name of which is unconfirmed, tackles the question of how to tightly connect from the initial issuance of an asset into a marketplace to efficiently trade tokens or assets.

"Where we see [this product] primarily fit is within the bilateral over-the-counter markets, where you don't currently have a trusted central operator in place. I think we more or less have left the proof-of-concept period," says Johan Toll, head of digital assets at Nasdaq.

Once assets have been traded and matched in Nasdaq's matching engine, they can immediately be settled back on the private, permissioned underlying blockchain, Toll says. "We can do both the custody and the settlement on the blockchain, and we can even manage both the payment side and the asset side within the same blockchain. You can then guarantee the atomic settlement and finality of those transactions."

For the initial project, Nasdaq partnered with start-up Symbiont, in which it led an investment of $20 million in January. Other investors in that round included Citi and merchant bank Galaxy Digital. Nasdaq is working on a number of other blockchain-related projects, including a product to use in e-voting for corporate elections and annual general meetings, and a collaborative initiative involving the Swedish bank SEB that focuses on mutual funds.

DTCC

One of the bigger DLT projects underway in the capital markets is the one being undertaken by the Depository Trust and Clearing Corp. (DTCC), which is replacing its Trade Information Warehouse (TIW) system with a blockchain-based platform jointly built by IBM, Axoni and the industry consortium R3.

The implementation has faced several delays over the years, mostly because the technology is so complex. The TIW deadline has been pushed to March 2020 due to client requests as the DTCC braces for a series of far-reaching global changes from Brexit, along with the Commodity Futures Trading Commission's review of its swaps regulatory framework in the US and the re-architecture of DTCC's North American datacenter, impacting swaps reporting in the US and Canada.

Jennifer Peve, head of business development and fintech strategy at DTCC, says a core challenge of the technology is its ability to run complex processes, such as the structuring of credit events for credit default swaps. Performance capabilities have long been cited as one of the main barriers to the adoption of DLT for large-scale, multi-party implementations. However, as the TIW project evolves and industry firms continue to provide feedback, Peve says DTCC continues to learn the best applications for the technology.

"Over the course of the deployment and interim user acceptance testing environment, we have developed an understanding of which processes are better suited to on-chain versus off-chain because those types of decisions ultimately impact performance, a key consideration when evaluating suitability for production," Peve says.

The agency has also developed a governance tool, DLT AdMon, that provides a view into ledger activity and performance on a node inside a DLT network. Robert Palatnick, chief technology architect at the DTCC, says the tool was developed with open-source code from the Hyperledger Explorer module. The agency modified the Hyperledger code to work for other protocols specific to the particular business case that the DTCC is working on. The tool was mainly developed for the DTCC's new TIW platform.

Jennifer Peve
DTCC

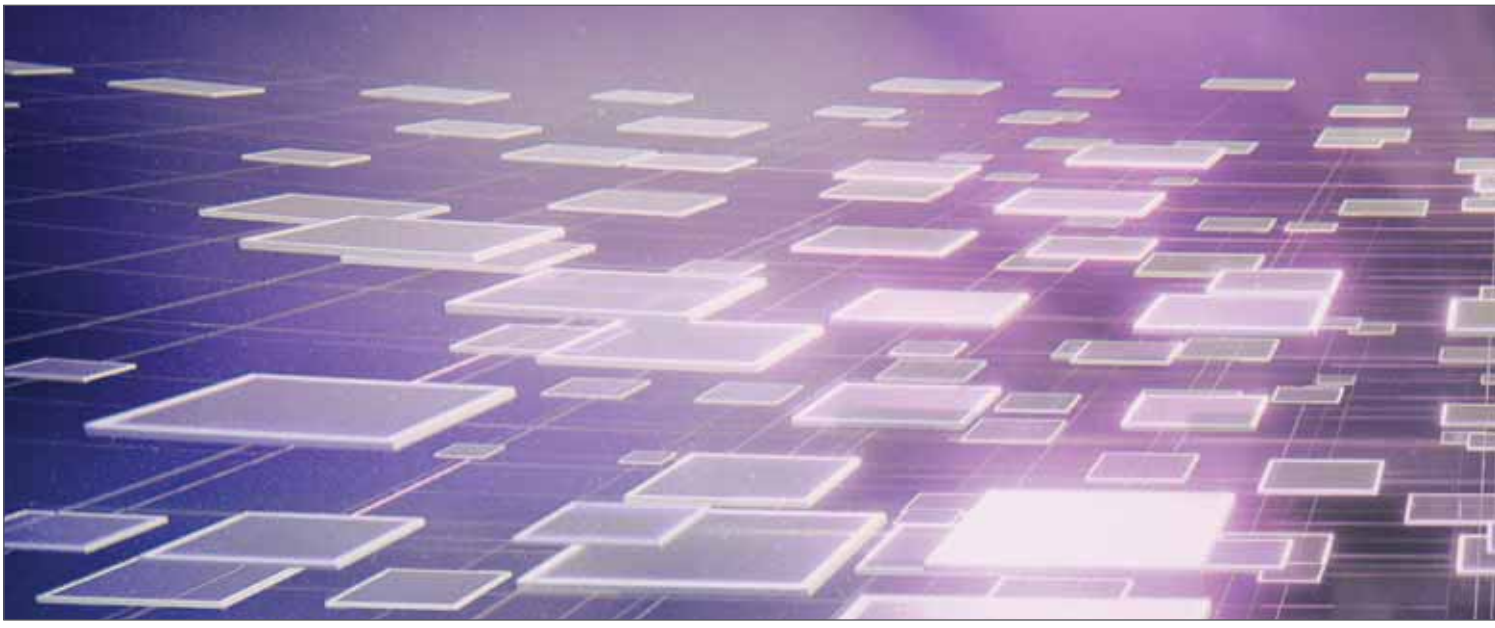
Barclays and Others

Lee Braine, director of research and engineering at Barclays Investment Bank, says that as financial firms look to modernize post-trade processes, they are discussing the development of a common utility platform for industry-wide clearing and settlement.

"In terms of a long-term future state, I think there is a drive in the capital markets to look at financial market utilities," he tells *Waters Technology*. "There is a drive toward a model where utilities are performing most of our post-trade activities and [if we can leverage] this mutualization of the cost, it will be a big benefit for the industry. Using standards is obviously the right path for that and so is using common utilities."

Braine said the main challenge is around the type of model structure the industry agrees on and what responsibilities will be given to utility providers. One potential option is that the DTCC could function as a central counterparty that governs and maintains the distributed financial market infrastructure, which could be built on a distributed ledger. In this example, it could be a post-trade utility platform. The idea is that DTCC would provide centralized governance over a decentralized technology platform. The firm would be responsible for the functionality, deployment, and testing of the DLT network.

"A key choice with distributed ledger technology is where to host nodes," Braine said. "For example, for a day one go-live, the financial markets infrastructure could host all the nodes and the banks could just connect into them using existing interfaces and capabilities."



JP Morgan

At the beginning of May 2019, JP Morgan and Microsoft signed a memorandum of understanding to form a strategic partnership to accelerate the adoption of enterprise blockchain. As a result, the Quorum platform, which is built on the Ethereum ledger, will be the first distributed ledger available through Azure Blockchain Service, thus allowing JP Morgan and Microsoft customers to build and scale blockchain networks in the cloud.

"Customers will be able to vastly simplify Quorum network deployment and operations, integrate with a portfolio of blockchain app development tools, take advantage of built-in governance and an open and flexible design that reduces the burden of managing blockchain infrastructure, and empower developers to focus on application logic and smart contracts," says Marc Mercuri, principal program manager of blockchain engineering at Microsoft. "The partnership will enable enterprise businesses across all industries to shift their focus from infrastructure management to application development, ultimately driving transformative business value."

He adds that the bank will also offer "a set of differentiated tools and services" specific to building with Quorum, which will be integrated with Azure Blockchain Service.

JP Morgan is just the first domino for Microsoft as the tech company will look to include more ledgers in the future.

"While this partnership will drive preference to Quorum, Microsoft will remain platform-agnostic and plans to expand Azure Blockchain Service in the coming months to include additional ledgers and add new capabilities for ledger interaction and token creation," Mercuri says.

Microsoft

Further to Microsoft's plans, the tech giant launched the Azure Blockchain Workbench in May 2018, and has since released a new tool to verify and analyze smart contracts used on the Ethereum blockchain, while its Azure Blockchain Service is being used by Bond.One to migrate its debt issuance and trading platform to blockchain technologies. Mercuri says Microsoft believes trade finance is a sector that could benefit from blockchain adoption.

Mercuri says multinational corporations currently expect to get paid between 30 and 90 days after shipment or receipt of goods sent to their customers via what's often referred to as open-account trade finance. At its core, sellers provide short-term financing for buyers as part of the trading process. As a result, sellers will often take out short-term loans on those receivables to manage their cash flows. But this is a largely manual, paper-intensive process that involves multiple parties. Because it is so complex, it can be a costly endeavor.

Mercuri says banks will often look to solve these problems with standalone, proprietary systems, but these workarounds can result in limited visibility into their corporate clients' trade processes, payables and receivables.

"Not surprisingly, they struggle to achieve scale in their operations," he says. "The complexity also limits the market as the costs and toil impact thousands of small and medium import/export businesses that can't do business with either the multinational corporations or trade banks because of the overhead."

He says when designing a network to connect the entire trade ecosystem, firms will try to create a centralized "Mega Ledger" for a single view of assets, liabilities and open-account equity. However, there are still problems with an open-account "Mega Ledger." First, who owns a trade ledger in a multi-bank, multi-corporation world? Second, what is the mechanism of trust for the array of banks and corporations? Third, how can firms mitigate the risk of a single point of failure? And fourth, what happens to the "Mega Ledger" during trade wars, like the one currently unfolding between the US and China?

"By distributing control yet providing consensus to deliver a single source of truth, a blockchain-based trade finance

network could enable each counterparty visibility into the actual status of the credit instruments while simultaneously avoiding the problems of the 'Mega Ledger,'" Mercuri says.

Bond.One

As mentioned above, Bond.One wants to unite the old and the new by putting the debt capital markets on the blockchain using Microsoft's Azure Blockchain service. Bond.One was one of a handful of companies allowed to test Azure in its beta stage in the first half of 2019, and the Microsoft platform has allowed the company to build and implement solutions that can solve issues with fragmented market structure and inconsistent datasets in the fixed-income markets.

Still, the actual development hasn't been easy. When Bond.One set out, it began building on Ethereum Mainnet before having to reroute to Quorum, the blockchain protocol developed by JP Morgan, when it encountered three problems: unpredictable fees, long queues and encrypted, anonymous identities.

"We're operating in the most regulated marketplace in the world, like financial securities, so you do need some control over account information, and you do need to know who you're transacting with," says John Mizzi, Bond.One's chief strategy officer. "The throughput issue is solved for because we have the entire Microsoft Azure cloud, which provides a very scalable infrastructure. The transaction costs are controlled because we're just paying Microsoft for data processing on their traditional cloud business model."

Bond.One was preparing to execute its first bond offering by the end of May 2019 and is in talks to partner with other diversified financial institutions to help them develop their distributed-ledger technology in tandem with their existing systems by next year.

Isda

In May, the International Swaps and Derivatives Association (Isda) announced the deployment of its Common Domain Model (CDM. 2.0) to support financial institutions' test phase two of the digital regulatory reporting (DRR) pilot for derivatives.

ISDA has worked on the CDM for two years with input from buy-side and sell-side firms and technology providers. Phase two of the DRR began early in 2019. Other participants in the pilot include Barclays, Credit Suisse, HSBC, NatWest, Santander and Lloyds.

Digital Asset

Digital Asset is integrating its newly open-sourced DAML programming language with two external blockchain platforms as it further opens up its features. The company announced that the VMware blockchain platform and Hyperledger Sawtooth will now support DAML, allowing users of those platforms to build smart contracts with DAML's privacy features. It is the first time DAML, a functional programming language that was previously only available for Digital Asset blockchain projects, is being made available to a platform other than its own.

Kelly Mathieson
Digital Asset

Furthermore, Isda and Digital Asset have announced an open-source reference code library, which they say will accelerate the adoption of Isda's CDM digitization project. The initial form of the library is focused on DAML. "The specification module we have built is a reference library that we've created using DAML that will simplify and standardize the generation of those lifecycle events for a derivatives transaction," says Kelly Mathieson, head of enterprise solutions at Digital Asset. "By doing that, it will allow developers to unambiguously construct lifecycle events with a machine-executable specification."

Broadridge

Broadridge is working with distributed ledger technology provider Digital Asset Holdings for several of its projects, including its proxy voting creation, which is one blockchain use-case that has shown early promise. The blockchain proxy-voting proof of concept, which Broadridge conducted with Northern

Trust, Banco Santander and JP Morgan, was completed in 2017. Broadridge and Banco Santander announced the two had executed the first investor vote using blockchain in 2018. Broadridge executed proxy voting using blockchain technology in Japan in January 2019.

The company also has a blockchain pilot program around repurchase agreements with Digital Asset. The project is meant to provide a single source of truth around repo trades and reduce custody and transaction costs. So far, the platform was able to process repo transactions for 19 primary dealers.

Despite these projects, however, Broadridge is not going to be a creator of blockchain technology, but rather use the technology to enhance its network value, says Tim Gokey, CEO of Broadridge.

"On blockchain, we have invested in Digital Asset Holdings, but we're not going to be a fundamental creator of new blockchain technologies. What we're going to do is harness blockchain. When you think about it, to get the real benefits of distributed ledger technology, you need a network of people on it. We're really looking at where are the places we can bring that network and, therefore, add value though proxy in the governance space, both global proxy and North American proxy, and fixed income," he says.

One aspect of blockchain that Broadridge is interested in is exploring how it can provide services around crypto

Tim Gokey
Broadridge

Peter Cherecwich
Northern Trust

assets. The company acquired post-trade cryptocurrency and derivatives solutions provider Shadow Financial Systems in early October. Gokey says the rationale behind buying Shadow is not to make a judgment on the viability of crypto assets, but to be able to provide customers who are interested in the space the ability to do post-trade activities.

"There are two things about Shadow that were interesting to us—they serve an interesting set of clients that we haven't served as much, so getting access to those clients is certainly something that is interesting to us," he says. "They have some capabilities and IP that we think will be beneficial either to continue being served on the Shadow platform or to bring into our own core platform. We don't need to make a call on where crypto is going to go, but we definitely have some clients who want to pursue that, so being able to assist them and have capabilities around that is certainly a plus."

Northern Trust and ASX

Northern Trust started 2019 working with one client on its private equity blockchain and after adding some new features and running a successful capital call on the platform, it will look roll it out to a wider audience in 2020.

"On the private equity side, we have a client that is live on our blockchain application. We've been moving along prudently in adding new features and capabilities with that client," says Peter Cherecwich, head of the corporate and institutional services business at Northern Trust. "We will start rolling it out in earnest next year. We do believe that blockchain for private equity is absolutely fit-for-purpose and a very good use-case that we are embracing."

Cherecwich says bank executives are trying to decide whether to release functionality in pieces to clients, or bring in a partner firm "to invest with us and go faster" on rolling out the platform. "We are exploring it and we should know more in the January/February timeframe about what our plan is," he says.

The other blockchain project it has in the works is tied to the Australian Securities Exchange's (ASX's) decision to replace its Clearing House Electronic Subregister System (Chess)—its equity clearing and settlement platform—with a blockchain platform developed by Digital Asset Holdings. While that project is still progressing, the exchange has already delayed the scheduled roll-out date from the fourth quarter of 2020 to March or April of 2021.

Northern Trust has two people in Australia working "very closely" with ASX on the project, according to Cherecwich. He believes that this blockchain will change how the institution operates as a global custodian. Today, Northern Trust has to hire a sub-custodian, which deals directly with the marketplace in Australia.

"In the future, we will have a node on the blockchain and that sub-custodian may only do things like corporate actions posting and other types of asset servicing functions for us, potentially, but holding the security they won't have to do anymore because we'll have a node on the blockchain," he says. "So it could dramatically change the cost structure [and] the timing of information that's available to all of our customers because everyone has a direct node and direct access."

ASX

While the ASX has delayed its blockchain rollout, it will spearhead the use of blockchain to settle trades by offering the service free as an initial inducement to banks, instead of using industry-standard connections via Swift and AMQP. The exchange, which has been working to replace the creaky Chess clearing and settlement platform, would offer the teaser rate on blockchain beginning in the first half of 2021 for three years.

The project is viewed as a litmus test for installing distributed-ledger technology at scale inside a large financial infrastructure. Customers would get into the ledger via a "node." Access beyond the initial three-year period will be discussed with participants at least 12 months before it ends.

Alongside the rollout of blockchain will be the introduction of the ISO 20022 messaging system, an industry standard for electronic data interchange and a break from ASX's current 25-year-old communications system based on the External Interface Specification standard. The ISO option will permit AMQP and Swift messaging, and will go live at the same time as ASX's blockchain option.

Those using the AMQP protocol will pay a monthly fee of A$495 ($349.60) to connect to ASX's own telecommunications network, ASX Net. AMQP is an open-source protocol developed by JP Morgan Chase in 2003 that is supported by banks including Barclays, Credit Suisse and Goldman Sachs.

The second option is Swift, the world's biggest financial messaging system—but this will cost more. Besides an administration fee, any costs ASX incurs in meshing with the Swift platform will be passed on to its users on a pro rata basis. They may also be charged a setup and connection fee if they connect via Swift after the go-live date.

World Bank

Blockchain technology could cut trade settlement time from days to seconds, a World Bank officer says.

"I think practical transactions allow you to see the potential benefits [of blockchain], such as the reduction in settlement time," says Paul Snaith, the multilateral lender's head of operations for capital markets, speaking to *Waters Technology* ahead of the one-year anniversary of the bank's issuance of the first blockchain bond, Bond-i.

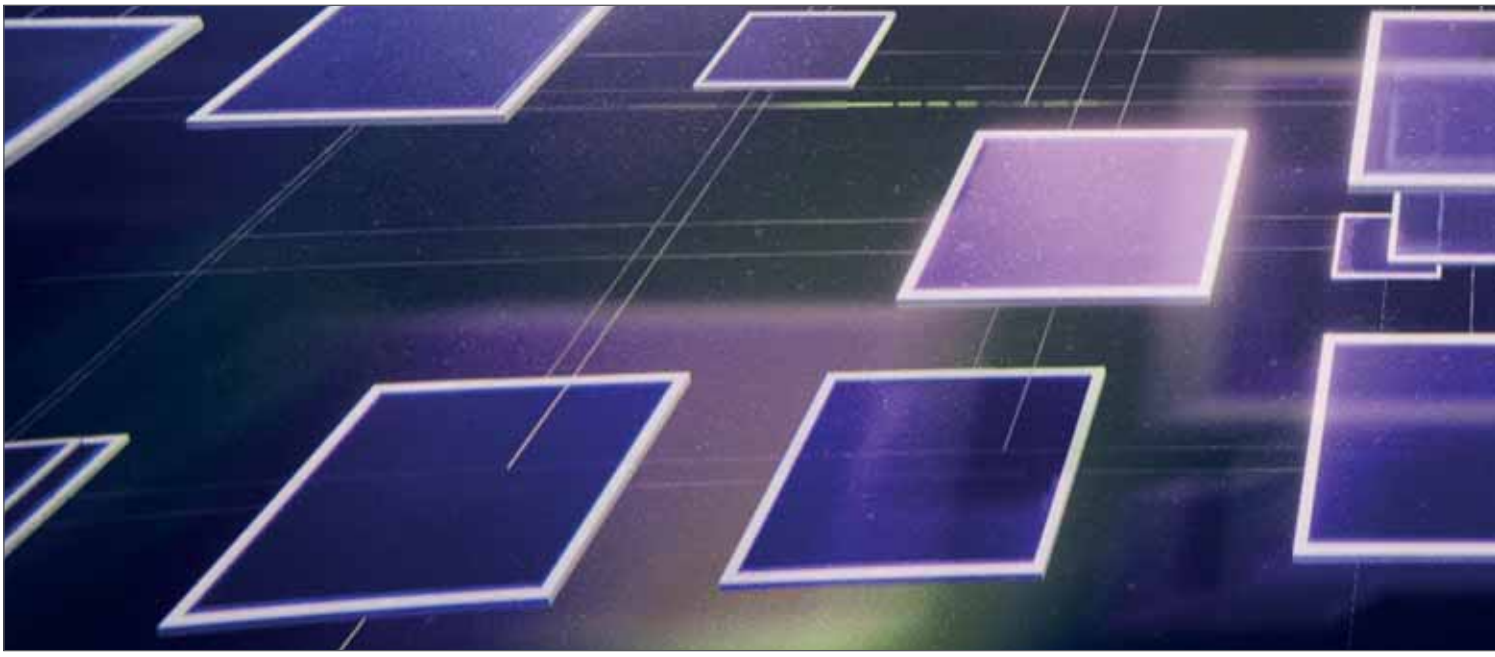
"You could have near simultaneous settlements if you have tokens of appropriate value. That would change some of the mechanics of how liquidity is positioned for a transaction and—this is one of the things we said about Bond-i—instead of a settlement times being T+X measured in days, it could be T+X measured in seconds," he says.

The World Bank partnered with the Commonwealth Bank of Australia (CBA) to build a platform on the Ethereum blockchain, and issued Bond-i in August 2018. The partners announced in May 2019 that they had successfully enabled secondary market trading of the bond, making this the first bond whose issuance and trading are recorded using distributed-ledger technologies.

Snaith says the technology behind Bond-i clearly enables individual participants to directly trade securely, and that the potential for costs savings and efficiency is huge. Settlement, which usually takes two days, could be finalized much more quickly in the future, reducing settlement risk.

Bond-i faced some legal considerations during its development, Snaith says, often related to the fact that current regulations that are designed to protect investors reflect the technological structure of markets as they are today.

With Bond-i, only the security registration is on the blockchain. The parties considered using digital tokens for settlement, but decided against it because of



regulatory constraints and tax complexity. Bond-i issuances are settled using Swift's payment network. CBA acts as the issuing, paying and calculating agent.

The platform was built on a private version of the Ethereum blockchain. It was independently validated by a blockchain engineering team from Microsoft to ensure it was fit for purpose. The validation was then presented to investors to make sure they were comfortable with it. The World Bank runs two nodes on Microsoft's Azure Cloud, while CBA runs on the Google Cloud. There is also potential for regulators to run a node in the future, allowing them to have a real-time view of the transactions on the ledger.

In April, the World Bank also launched a quasi-cryptocurrency called "Learning Coin" with the International Monetary Fund for internal usage. The currency doesn't have monetary value and is intended to deepen understanding of blockchain technology. However, Snaith says the World Bank will not be issuing its own cryptocurrency.

ISO

The International Organization for Standardization (ISO) expects to come out with its first standards for blockchain technology in the next 18 months. ISO/TC 307, a committee within the body that was set up to work on standards around blockchain and DLT, is likely to release its first standard on terminology, and will also be coming out with a technical report on smart contracts on a shorter timeframe—possibly within a year, says Craig Dunn, chair of ISO/TC 307.

"Having a common language and a common understanding of terms and the use of terms in a particular area is important, including for developing further standards in that area," he says. "So terminology is likely to be the first area of publication standards in this space, perhaps followed by [standards for] reference architecture."

Dunn isn't able to reveal the specific terms within blockchain that are currently under the scrutiny of the committee. However, given the plethora of diverse projects being developed on blockchains by companies of all kinds, there are plenty of terms that are problematic.

Warsaw Stock Exchange

The parent of the Warsaw Stock Exchange is entering the capital-markets technology arena, with a focus on blockchain technology. The exchange's supervisory board has approved the GPW Tech project, a strategic initiative of GPW Group.

The project team intends to develop blockchain-based tools. The Warsaw Stock Exchange currently buys its technology from providers such as Euronext and Nasdaq. According to Marek Dietl, CEO of Warsaw Stock Exchange, it decided to create the technology arm after studying the market and realizing that the bigger stock exchanges derived around 10% of their revenue from different technologies. "We also looked at what the exchanges were acquiring recently," he says. "[In the] last eight years [exchange acquisitions] are mainly tech companies, so there are very few exchange-to-exchange mergers."

Universal-Investment

The Frankfurt-based fund administrator is working on an ambitious project to build a solution that will allow clients to purchase funds as conveniently as readers buy books on Amazon. Right now, the process of buying a fund is slow, says Daniel Andemeskel, head of innovation management at Universal-Investment. Different intermediaries, such as banks, transfer agents and custodians, are involved; their processes are still manual and paper-based, and settlement cycles can take up to two days.

The service is going to be based on the Ethereum blockchain—though it might use other protocols in the future—and will use predictive analytics to identify clients' interests and allow sales person-

nel to offer them better options. It will begin beta-testing the platform in 2020, but the project also needs regulatory approval.

Fundament Group

Fundament Group, a Berlin-based end-to-end issuance solution provider for tokenized assets, is looking to partner with asset managers to tokenize assets and digitize the fund issuance industry. In October, it launched its first blockchain-based real estate bond with an issued volume of €250 million ($276.93 million). For this, it partnered with German real estate firm Bauwens, which has more than €7 billion ($7.75 billion) worth of both residential and commercial real estate properties in the pipeline.

Florian Glatz, co-founder of Fundament, says the company is looking to partner with more assets managers to tokenize assets. "These are the people that actually have the pipeline, [as well as] management and investment experience to generate value," he says.

The security tokens it issues are on a public, permissionless blockchain—namely Ethereum. Investments can be made with fiat currency, but also with cryptocurrency. Fundament will onboard asset managers as its clients, and structure the financial product with them, as well as draft the prospectus. Then it will submit it to the German regulator, the Federal Financial Supervisory Authority (BaFin), for approval. Once the fund is approved, Fundament will set them up on its issuance platform, which is available on mobile and desktop. In July, Fundament became the first company to receive approval from BaFin to issue a tokenized real estate bond. The tokenized fund consists of a portfolio of German commercial real estate and will generate a planned annual yield of 4% plus returns from potential sales revenues.

For the real estate token, currently 90% of volumes are institutional money, while retail makes up for the remaining 10%. Glatz believes in the future it will be balanced at 50:50. Fundament is planning a tokenized private equity fund next, followed by a venture capital fund.

Tradewind

Tradewind, which offers a precious metals trading platform that incorporates distributed-ledger technology, is looking to expand to assets other than gold and silver while opening up to buy-side clients. In addition, Tradewind is also set to expand information found on its DLT to better track the supply chain and origin of precious commodities like gold and silver before the year's end.

Michael Albanese, CEO of Tradewind, says the goal is to expand access to metals trading to a larger sector of the market.

"When we launched, our focus was really on dealers that had a retail client base; but what we've been able to do is start to expand to institutions. These are regulated trust companies, mutual funds, buy-side institutions that also invest in gold and silver," Albanese says. "What's interesting about this segment is not only do they want to buy gold and silver, but once they buy it, there are a lot of things they want to do with it, like borrow cash against it. We're going to help those institutions take that gold and use it as collateral in the ecosystem."

Tradewind's DLT-based platform VaultChain was launched in March last year. VaultChain—which began with gold in 2018 and expanded into silver later that same year—allows dealers and other institutions to buy, store, and then trade precious metals. The gold and silver is vaulted by the Royal Canadian Mint, who also confirms ownership of the physical product. Ownership records and delivery information are logged into VaultChain's distributed ledger. The platform connects a network of liquidity providers and dealers. wt

As Public Cloud Gains Traction, Concerns & Challenges Grow

WatersTechnology looks at more than 20 cloud-based projects and initiatives to see how banks, asset managers and vendors are embracing public providers, and the inherent problems they face. By Anthony Malakian

I've said and written this before, but when I started writing for *WatersTechnology* a decade ago, the idea of banks and asset managers turning to public cloud providers for important data functions was anathema. Ten years later, the tide has certainly changed. Not only are capital markets firms increasing their reliance on public cloud providers—namely, Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP) and IBM Cloud—but they are now increasingly employing a multi-cloud strategy. And even for those laggards who have yet to embrace the cloud, their vendors almost certainly have.

For this story, I'll look at some interesting public and hybrid projects that we wrote about in 2019, and look at some of the challenges capital markets firms have faced in their efforts to migrate to the cloud. This is by no means meant to be a definitive showcase of cloud projects on Wall Street, but these are certainly some of the more interesting endeavors that we wrote about over the last year. Hopefully, this list helps to show just how the industry is embracing the cloud and potentially create some ideas to kick around with your teams.

The Use Cases

One of the bigger projects undertaken in 2019 was the pairing of IBM and Bank of America, which are combining forces

> "A lot of our clients are moving their machine learning or statistical analysis processing into the cloud. Therefore, having large volumes of historical time-series data available to them in native format is very important. That is the next big set of milestones on the roadmap."
> **Tony McManus, Bloomberg**

to build a public cloud specific to the financial services industry. While BofA has successfully built its own private-cloud environment, this endeavor will serve as the next evolution of BofA's cloud journey.

According to the bank, in 2012, which is when its private-cloud project began, it said that by the end of 2019, 80% of workloads would be run on its own private cloud—that was accomplished in September. As a result, BofA once had 200,000 servers and roughly 60 data-centers. Now, it has pared that down to 70,000 servers, and more than halved its datacenters to 23. The bank now spends $2.1 billion less per year on infrastructure costs than it did in 2012, due in large part to the private cloud, it said.

But this latest announcement is not an about-face. Executives at the company have noted in the past that at some point in the future, the scale and finances of the public cloud will eventually catch up as more users adopt public-cloud services. This endeavor is to help the bank prepare for the future. And this IBM–BofA partnership is not exclusive to the Charlotte, NC-headquartered bank; rather, the service will cover the entire financial services market, from institutions focused solely on retail banking, to banks and asset managers in the wholesale capital markets.

No specific launch date has been set, but the two intend a gradual rollout of different components—the bank, and other participating parties will be able to deploy their workloads incrementally, from the most mundane to advanced instances such as data science, model development, and deep learning, says Curt Leeman, IBM's managing director covering Bank of America.

ALSO OF INTEREST was CME Group's announcement that the exchange operator is making real-time market data from all its venues available via Google Cloud. The exchange hopes to expand its client base and the reach of its data by using a new connectivity model to simplify data access for end users.

"We are putting all our real-time data into Google Cloud, and converting all our Market Data Platform (MDP) channels into a Google service called Pub/Sub, so anyone can access them via Google from anywhere on the planet," says Adam Honoré, executive director of data services at CME. "The specific use-case for this is how do we take advantage of native cloud services to lower the barrier to accessing our data. ... We are creating a low-cost global transport solution for all our market data."

LOOKING AT A more niche implementation, Scotiabank initiated a project that would allow it to use cloud GPUs to run its valuation adjustments (XVA) program. With the project gaining traction, the results have been impressive.

According to the bank, the runtime for risk calculations and derivatives pricing using cloud GPUs is 30 times faster, allowing brokers to deliver more accurate derivatives pricing in 20 seconds, which would previously have taken 10 minutes. It also allows for more nuanced risk analysis thanks to more detailed risk scenario modeling that can assess more than 10 times the number of previous scenarios.

"The scale of XVA means that we need to lean on the scalability of public cloud for compute power and couple that with data at scale from our internal global data platform," says Stella Yeung, chief information officer at Scotiabank Global Banking and Markets. "This combination lets us deliver, in real time, to the traders the information that they require to serve our global clients."

Ann Neidenbach
LSEG

Andrew Green, managing director and lead XVA quant at Scotiabank, says the bank already had a cloud-first policy in place, even before they started this particular overhaul. When combined with a public cloud infrastructure—for valuation adjustments, Scotiabank is using the Microsoft Azure cloud and its NC24 virtual machines—GPUs are better equipped to handle these type of computationally intensive calculations than traditional CPU cores.

ON THE CUSTODIAN side of the Street, Northern Trust has adopted a cloud DevOps framework to allow it to more efficiently develop technologies, including its recent front-office solutions for managing the investment lifecycle of family offices and endowments.

The technology was built in collaboration with an undisclosed start-up on AWS and over the summer went live with its first beta client. The firm leverages the scalability of the cloud and has the ability to spin up an environment in around 10 minutes. The adoption of the cloud framework enabled Northern Trust to go from product idea to market in nine months, a fraction of the time it took when using traditional development processes and architectures, says Joerg Guenther, CIO of Northern Trust.

"The scale of XVA means that we need to lean on the scalability of public cloud for compute power and couple that with data at scale from our internal global data platform."
Stella Yeung, Scotiabank

For the project, the firm recruited a head of product and an external tech team to work alongside existing members of Northern Trust's development team to build out the front-office product.

AND WHILE THE vendor community has long embraced the cloud, the biggest data players made some big moves in 2019. For example, Bloomberg is in the process of shifting its entire data estate and commercial offerings to the cloud as part of what it is calling its One Data strategy. Tony McManus, chief information officer and global business manager of enterprise data at Bloomberg, says the migration process will be done in incremental stages and the company expects to release its first batch of datasets on to the cloud in the first quarter of 2020.

"A lot of our clients are moving their machine learning or statistical analysis processing into the cloud. Therefore, having large volumes of historical time-series data available to them in native format is very important. That is the next big set of milestones on the roadmap," McManus says.

Additionally, Bloomberg also announced on September 12 that its flagship real-time market data feed, B-Pipe, will be rolled out globally through AWS's PrivateLink, which is designed to eliminate exposure of data to the internet and to offer private connectivity between on-premise and virtual environments. Bloomberg says B-Pipe streams 35 million instruments across all asset classes, including data from 330 exchanges and 5,000 contributors through a common API.

BEYOND THAT, Chicago-based data and investment research provider Morningstar has revamped its tick data delivery architecture into a cloud-based solution. For the project, it is partnering with Australian big data technology platform vendor RoZetta Technology.

The new version of Morningstar's Tick Data Solution will go live at the end of July, using a platform built by RoZetta, running on Amazon's cloud environment. Morningstar hopes the revamp will make it quicker and easier for clients to access tick data from the vendor.

Morningstar's existing Tick Data service stems from its acquisition of London-based ticker plant and data-feeds vendor Tenfore Systems in 2003. Since then, Morningstar has collected and stored—and in most cases, commercialized—around 2.5 petabytes of tick-level market data, which is growing exponentially year-on-year, covering 200 stock trading venues, or roughly 99% of global equities coverage. The dataset includes historical tick

> "Part of the challenge other banks and [that we also] have is that we have lots of data pools, but if you don't tag that data and index it, how do you find it again? So that is part of what we have built, a reusable data asset. And this has been a significant undertaking over the last year."
> **Chuck Teixeira, HSBC**

data back to 2003, with 10 years of US composite data, exchange messages and outage information, and the ability to filter by symbol or exchange, and to view market-by-order or market-by-price. Data points include trade date and time, exchange time, volume, trade price, last bid and last offer.

"Our challenge was to get that into the hands of clients—and the way that the data was traditionally stored made that challenging," says Matt Spedden, global head of equities and market data solutions at Morningstar, citing the vendor's legacy storage and extraction environment, which used older technologies and typically delivered data via flat file or physical media, such as hard drives, for large volumes of data.

IN A SIMILAR vein, SmartStream Technologies is following in the footsteps of Morningstar—and Trading Technologies and MarkitSERV—when, at the 2019 Sibos conference in September, it launched SmartStream Air, the vendor's cloud-native, AI-enabled reconciliations platform. The platform will allow it to better deploy machine-learning tools.

ALSO, BUREAU VAN DIJK, which is owned by Moody's Analytics, is beginning a full-scale rebuild of its risk management platform, Compliance Catalyst. In 2020, the vendor plans to move the offering to the cloud. A handful of customers have been testing the revamped product in beta since August, and the new tool features automated and enhanced customer due diligence screening for anti-money-laundering (AML), know-your-customer (KYC), and anti-bribery-and-corruption (ABAC) rules, which will also look to incorporate machine-learning techniques to improve alerts and analysis.

AND THE ABILITY to leverage artificial intelligence has proven to be a boon for the cloud community. HSBC, for example, is in the process of implementing a large-scale project that entails using machine-learning technology to measure the quality of its data across five different dimensions—accuracy, completeness, uniqueness, validity, and consistency—and uses granular details to link correlated data together.

It is no small task, as the firm is pulling information from multiple systems across several business lines and jurisdictions. The data will be viewable on data quality dashboards, where the user can view critical data elements and identify the real value of the data that the system aggregates. Chuck Teixeira, chief administrative officer and head of transformation at HSBC's global banking and markets business, explains that its data management teams are leveraging AI to index and tag data from trillions of transactions and external sources to build a reusable golden source of data.

"Part of the challenge other banks and [that we also] have is that we have lots of data pools, but if you don't tag that data and index it, how do you find it again? So that is part of what we have built, a reusable data asset. And this has been a significant undertaking over the last year," he says.

In the second phase of its transformation project, HSBC began migrating the data to a cloud-based data lake in June to be able to utilize it for a variety of use-cases, such as to build a client intelligence utility on the cloud. The platform will use the cleansed data, captured from trade lifecycles and external sources, to better understand the needs and requirements of its clients. It will ultimately act as a single part of a more comprehensive client services project, Phoenix, in which HSBC intends to collaborate with AI partners.

Andrew Green
Scotiabank

People Problem

As many tech executives say, there's another reason to embrace the cloud: talent acquisition and retention. And it's true—there are few (if any) talented programmers and engineers that want to work on Cobol-architected legacy platforms. But one thing that firms are learning is that there is both a shortage when it comes to finding talent, and changing the hearts and minds of existing employees is rarely a smooth process.

The London Stock Exchange Group (LSEG) is moving forward with an ambitious program where 60% of service delivery and corporate computing will operate in the public cloud by 2021.

While speaking at the Extent Conference in September, hosted by Exactpro, Ann Neidenbach, chief information officer for the LSEG, noted that the company has already moved 40 workloads to the cloud, but it has encountered something of a people problem, as this project aims to institutionalize a DevOps methodology for cloud deployment going forward.

"As you have that culture transition, it is hard for the developers to go through this transition," Neidenbach said. "'What do you mean they rejected my code? Why can't I move this server? Why can't I do this, this, this in order to pass our chief information security officer's checklist?'" a developer may now ask, she added.

Howard Boville, Bank of America's CTO, also points to the human-capital element of the project as key in making this work. He advocates creating a governing body—which will be appropriate for even small institutions—that includes "representation across all areas of the enterprise, while remaining customer-focused and managing risk appropriately."

Additionally, he says it is necessary to create an education program, since this is a significant paradigm shift. "Cloud migration and implementation is a cultural change requiring full training and communication planning to support the migration strategy," Boville says.

Blackstone CTO Bill Murphy adds that moving to the cloud is "all about creating velocity in our technical deployment." As such, it is vital to have people in place who have done this before, and sometimes that means needing to bring in outside experts to help move the process along; otherwise, momentum will be hindered. Blackstone has looked to both hire developers with cloud expertise and it has also invested in a cloud specialist, Cloudreach, to help it move its cloud-development project along more quickly.

Meanwhile, Axa's head of data services, Edosa Odaro, says that the struggle to make optimal use of cloud computing is changing. "The battlefield has shifted from technology to talent," he says. "That is why you see the competition out there for the best." When asked how to avoid common pitfalls, Odaro says: "If it was a single word, it should be 'talent.' You need to have more focus around getting the right people and the right mindset, helping you actually deliver, whether it's data or technology."

Firms have been focusing on getting the tools and technologies right, thinking, "You just buy a new tool, a new shiny thing, and it will just happen," Odaro says. "Unfortunately, that is not the case."

HIGH-FREQUENCY trading (HFT) firm Grasshopper has partnered with GCP to build out its quantitative research and data-processing platforms to improve its trading capabilities. By leveraging GCP tools such as TensorFlow, an open-source machine-learning library; BigQuery, the same data warehouse on which everyday internet users search Google; and Cloud DataFlow, which is used for processing both batch and real-time data streaming, the Singaporean firm and the cloud giant have worked closely on several internal projects.

One of those projects is the firm's in-house Java application, Ahab. Named for Herman Melville's fictional whaling captain, it allows traders to "listen" to live market data and make better and faster trading decisions. It is built on Apache Beam, the open-source programming model.

Tan T-Kiang, who holds the dual-title of chief investment officer and CTO for Grasshopper, says the data that flows through the application can be thought of as fish, gobbled up by a bottomless whale. Moby Dick metaphor aside, Ahab sources its data directly from exchanges, and calculates, in real-time, the value of order books, or the lists of buy and sell orders at any trading venue, and how that can impact a stock's price. The data is tied into GCP's Solace PubSub+ tool, which handles and sorts information from multiple sources, thus eliminating the need for Grasshopper's engineers to deal with basic network connectivity. The resulting data log then gets stored inside BigQuery.

"One of the biggest things we've been trying to solve is that when you start off, let's say, 10 years ago, you built a database, and the market was probably 10 times smaller in terms of data. That system was fine, and then a few years later or even a year later, you have to re-tool because it's not good enough anymore," Tan says. "Or you, as a hedge fund or an HFT firm, decided to add five more markets to what you're covering. And what you're storing now is maybe 50 times or 100 times more data."

Bill Murphy, Blackstone

FINALLY, THERE was also a major acquisition that happened, in part, because of the need to move to the cloud. In October, Pittsburgh-based Confluence Technologies announced that it was buying StatPro, the cloud-based UK firm that offers portfolio analytics through its software-as-a-service (SaaS)-delivered tools. Its flagship Revolution platform uses a hybrid cloud model that leverages both AWS and Azure architectures.

As one executive told *WatersTechnology*, StatPro was "very gutsy when they built Revolution from the ground up as a pure SaaS solution. They effectively end-of-life'd their existing legacy-deployed solution (StatPro 7) and went all-in by investing in a next-generation, cloud-based system, betting that they would end up with increased revenue to offset the loss of revenue from their legacy product line. No other firm in the asset management software business has been so daring," they said after the acquisition. "Competitors have implemented 'faux' SaaS offerings by putting boxes in datacenters and letting firms remote access them. So I think the sale is cashing in on this initiative. Going private will make it easier for StatPro to continue with this strategy without having to answer to the markets."

IT'S ALSO important to remember, though, that these cloud migration projects are not simple. While they are absolutely necessary in order to help a firm future-proof itself, there is a certain bit of Band-Aid ripping involved, unforeseen hiccups, and stubborn client migrations. While MarkitSERV and Trading Technologies have been used as examples of ambitious projects, they both have experienced delays.

> "We are putting all our real-time data into Google Cloud, and converting all our Market Data Platform channels into a Google service called Pub/Sub, so anyone can access them via Google from anywhere on the planet. The specific use-case for this is how do we take advantage of native cloud services to lower the barrier to accessing our data."
> **Adam Honoré, CME**

Trading Technologies was an early mover when it looked to sunset its flagship X_Trader order management system in favor of the new TT platform. As such, the migration has been slow, but is progressing. The trading platform provider has since launched its infrastructure-as-a-service (IaaS) offering. Earlier this year, TT announced Graystone Asset Management as the first formal client of its consolidated IaaS product.

MarkitSERV, IHS Markit's post-trade processing business, has gone live with its cloud-based TradeServ platform, first going live with foreign exchange (FX) for non-deliverable forwards (NDFs). The plan was to launch credit on TradeServ in the first half of 2019, but that rollout has been delayed.

"The re-platforming of our trade confirmation and processing service for credit derivatives is one of the largest and most complex upgrades ever offered to the market," says a spokesperson. "A large group of dealers, asset managers and infrastructure players, including clearinghouses, are currently conducting testing to validate the interaction between participants and other credit market systems. The time and rigor we are putting into testing will help ensure that the launch is as seamless and as transformative as we know it can be."

On the plus side, as of mid-October 2019, the new TradeServ platform had processed about 1.4 million NDF trades for clearing and 34 financial institutions are active on the platform for FX.

NOT ALL CHALLENGES are internal. As firms are increasingly turning to public cloud providers for help, regulators around the globe are starting to take notice.

To show how the ball is starting to roll on regulation, financial companies in Europe must now maintain a register of all their outsourcing arrangements under new guidelines, as regulators are worried that cloud services are concentrated among just a handful of companies.

The European Banking Authority's (EBA's) new guidelines on outsourcing came into force at the end of September, replacing the existing 2006 guidelines and some 2017 guidance on cloud outsourcing. They apply to a wider range of companies than before: any firm that falls within the EBA's mandate, which means credit institutions and investment firms like banks and hedge funds, as well as payment and electronic money institutions, a category that will pull fintech companies into scope. The guidelines don't apply to insurers.

ONE ONLY NEEDS to look at Google to see how the regulators are already forcing tech giants to reconsider how they work with financial services institutions. While speaking at the Google Next conference in November, Suzanne Frey, GCP's vice president of engineering, noted that her company is taking an industry-specific approach to service-level agreements, such as writing audit rights into its contracts to adhere to EU guidelines on outsourcing that were updated this year and demand that outsourcing contracts set out the rights of users to audit providers' premises, including devices, systems, and networks.

"We have tweaked our contracts to be very specific to industries and even in some cases the regions in which we are working. We have been working with financial regulators in Europe and worldwide on engagement and audits to expose the full depth of our operations, how we handle information, how we handle business continuity, and the like. And then we are continuing to invest in various compliance regimes," she said.

THE REGULATORS, themselves, are in a bit of an awkward position. On one hand, they need to do a better job of monitoring cloud proliferation and understanding what kind of risk that brings to the markets. On the other hand, they need to evolve technologically alongside those they oversee, and that means embracing the cloud. So, for example, the Financial Conduct Authority (FCA) is turning to the cloud to improve its analytics capabilities and to—potentially—streamline the reporting process.

Over the last few years the FCA has moved almost all of its technology estates to the cloud, thus allowing it to roll out a major data analytics pilot program across the organization. The FCA can leverage huge amounts of data from the roughly 59,000 firms under its purview. Over the course of 2019, the FCA has brought together all the data initiatives that were happening across the organization, using data lakes and new methods of data collection. The idea now is to reduce areas of overlap and find pockets of resistance.

"We are constantly being asked for greater efficiencies, to be more effective around monitoring that broad sweep of sectors that we have," says Steven Green, head of central data services at the FCA. wt

Machine Learning Takes Hold in the Capital Markets: Some Examples

WatersTechnology looks at 16 projects in the capital markets that involve machine learning to show where the industry is heading.

Let's be honest: The term "machine learning" has been bastardized in recent years as some companies try to use it interchangeably with artificial intelligence (AI), or even just to describe a souped-up Excel spreadsheet. But machine learning (ML) is a specific type of AI, with subsets for supervised learning (regressions, decision trees and random forests), unsupervised learning (clustering, principal component analysis—various forms of neural networks fall into both supervised and unsupervised) and reinforcement learning (Monte Carlo algos and the Markov decision process). And to be honest, there are lots of gray areas and bleeding and combining, which can make the subject of machine learning all the more confusing.

In 2019, WatersTechnology.com published over 100 stories about machine learning. Some of these articles were deeper dives into the technology while others covered it more tangentially, but I believe that in the capital markets, the spread of machine learning is the most profound evolution in trading technology after the cloud.

This is not always true of emerging technologies. While, for example, blockchain is an overhyped hammer-looking-for-a-nail that has yet to yield much value, machine learning is revolutionizing what traders, compliance professionals, portfolio managers, risk managers, regulators, and research associates can accomplish. It truly is a technology that, at its best, augments what an individual can accomplish, rather than wholesale replace the individual. (Though, let's not be naïve: That happens, too.)

90%

With a tool that uses supervised machine learning and predictive analysis, Brown Brothers Harriman has reduced 10,000 daily exceptions to under 500 and eliminated 90% of false positives.

What follows are some actual use-cases that *WatersTechnology* wrote about in 2019. This is by no means meant to be a definitive showcase of ML-driven projects on Wall Street, but these are certainly some of the more interesting endeavors. This list is in no particular order, but groups the projects by entity type: end-users, regulators and vendors.

These use-cases demonstrate just how prevalent machine learning is becoming and hopefully generate some ideas to kick around with your teams.

> "We are interested in looking at the problem of whether last night's stock price, which jumped up, is going to continue or whether it's going to fade away in the morning. We're looking at the problem of whether there are too many people saying the same thing in the market and we're looking to use machine-learning techniques to identify that." **Kerr Hatrick, Morgan Stanley**

Nasdaq

The exchange operator has rolled out a new market surveillance tool for finding patterns of abusive behavior. Underpinning the tech are three subsets of machine learning: deep learning, for analyzing extremely complex relationships and understanding hidden insights within massive data sets; transfer learning, which involves training new models based on older ones to allow scale and save time; and human-in-the-loop learning, which requires human interaction to weed out noise from signal, especially where it's not cut and dried.

Currently, the tool covers only US equities, but Nasdaq has already run some trials on fixed income and with other exchanges, which have shown promise. The project had been in the works for more than a year and was born from the company's initial forays into machine learning, which were focused on alert scoring in the Nordics.

"We had very positive results; we had a lot of learnings, and we deployed that," says Tony Sio, head of marketplace regulatory technology at Nasdaq. "Based on that experience, we felt we could do a lot more. So after that, we really pushed the deep learning project against the low-level data coming from our trading system to detect patterns of abuse."

But those first explorations into machine and deep learning bumped into another project. A separate team was working on how to create a visual picture of spoofing, and the missing ingredient also lay somewhere in machine learning.

Andreas Burner
SmartStream

"We called it the signature of spoofing," Sio says. "We showed it to a lot different people, and people said, 'Yes, I look at this picture, and I see it.' And that coincided with some of the ML technologies out there, which are really about taking those visual patterns and being able to find them in the data. It's two separate initiatives starting to overlap."

JP Morgan

JP Morgan is using a new system that dumps conventional modeling techniques such as Black–Scholes and replication, in favor of a purely data-driven approach that is underpinned by machine learning. In 2018, the bank began using the new technology to hedge its vanilla index options books. For 2020, it plans to roll it out for single stocks, baskets, and light exotics.

Hans Buehler, global head of equities analytics, automation and optimization at JP Morgan, was one of the co-authors of a recently published paper on deep hedging. The research is part of an ambitious project at the bank aimed at using machine learning to hedge positions multiple time-steps ahead.

"The real advantage is we are able to increase volumes quoted—because we are faster," he says. "If you have to manually manage this, you have to divert somebody's time and sit them down to focus on it."

One senior quant calls JP Morgan's approach a "base-level rethink" of hedging, which he says will benefit illiquid markets in particular. He estimates the technique has the potential to cut hedging costs for certain commodity derivatives by as much as 80%.

> "With artificial intelligence, I don't think you're ever done-done. Ideally, you want to start early-ish in terms of what you want to do. It does need training to be better, so we are ingesting the data forms and then seeing the outcomes, and then comparing that to what we do already to get a better solution."
> **Mike Dargan, UBS**

UBS

The Swiss bank is undertaking a project that uses machine learning to match information and find anomalies in customer information for know-your-customer (KYC) and anti-money-laundering (AML) reporting. UBS is working with unnamed partners to couple machine learning with natural language processing (NLP) that takes in data from public sources (disclosures and newswires, for example) and automatically connects it to customer information to find anomalies.

"We're working with a few partners on this—I actually prefer not to disclose names, but we are already working with them," says Mike Dargan, group chief information officer at UBS. "It's something that's ongoing; though with artificial intelligence, I don't think you're ever done-done. Ideally, you want to start early-ish in terms of what you want to do. It does need training to be better, so we are ingesting the data forms and then seeing the outcomes, and then comparing that to what we do already to get a better solution."

He says the project—which has been underway for about a year—will eventually be rolled out to the whole bank and cover many of its activities while its partners are looking to offer the KYC platform to other banks, possibly as a utility.

Brown Brothers Harriman

BBH is looking to bring greater efficiency to its net asset value (NAV) review process through the use of supervised machine learning. Securities pricing is reconciled each day at market close to make sure that the NAV figure is accurate, and the prices are reviewed to discover any significant variation day to day. Kevin Welch, managing director for investor services, says the process, when performed with traditional methods, resulted in a high proportion of exceptions, most of which were not true anomalies, but that nonetheless had to be reviewed by analysts.

Traditionally, if a security moved by a certain percentage, it generated an exception that needed review. Upon conducting an audit, they found that "we probably had 10,000 of these false-positives every single day that we had analysts going through," he says.

To address the issue, BBH created a tool that uses supervised machine learning and predictive analysis to show how a security has moved against 800,000 others historically. "It will only generate an exception when the price is truly moving. So we have gone from 10,000 exceptions every single day that analysts needed to review, to under 500. We have eliminated 90% of the false-positives. This has been a key tool for us," Welch says.

The algorithm is fed with historical data over several years that shows how the movement of a certain stock should correlate to all of the other securities in the bank's fund accounting system. It then reviews all of the intra-day movements of all those securities versus one they expect to go up or down in price. If an anomaly occurs—say a stock price drops by 5% when it was expected to do the opposite—only then is it flagged for analyst review. Welch adds that having that correlation removes the need to spend a lot of time investigating normal market events, such as stock splits and responses to earnings reports.

ING

ING is in the process of spinning out a financial technology arm that will commercially produce its bond discovery platform for asset managers, a year after ending a phase where the bank was testing it out internally. The platform, called Katana, was first produced for use within the bank and launched in 2017.

Katana uses machine-learning algorithms to scan the European and UK bond market for possible pairs that have out-of-the-ordinary spreads or behave abnormally. It aims to help bond traders and asset managers find investment opportunities they otherwise would have missed. Santiago Braje, global head of credit trading at ING and the founder of Katana, says that in a pool of even just 2,000 bonds, there can be almost two million potential pairs, and a machine-led platform finds these opportunities much faster than a human can.

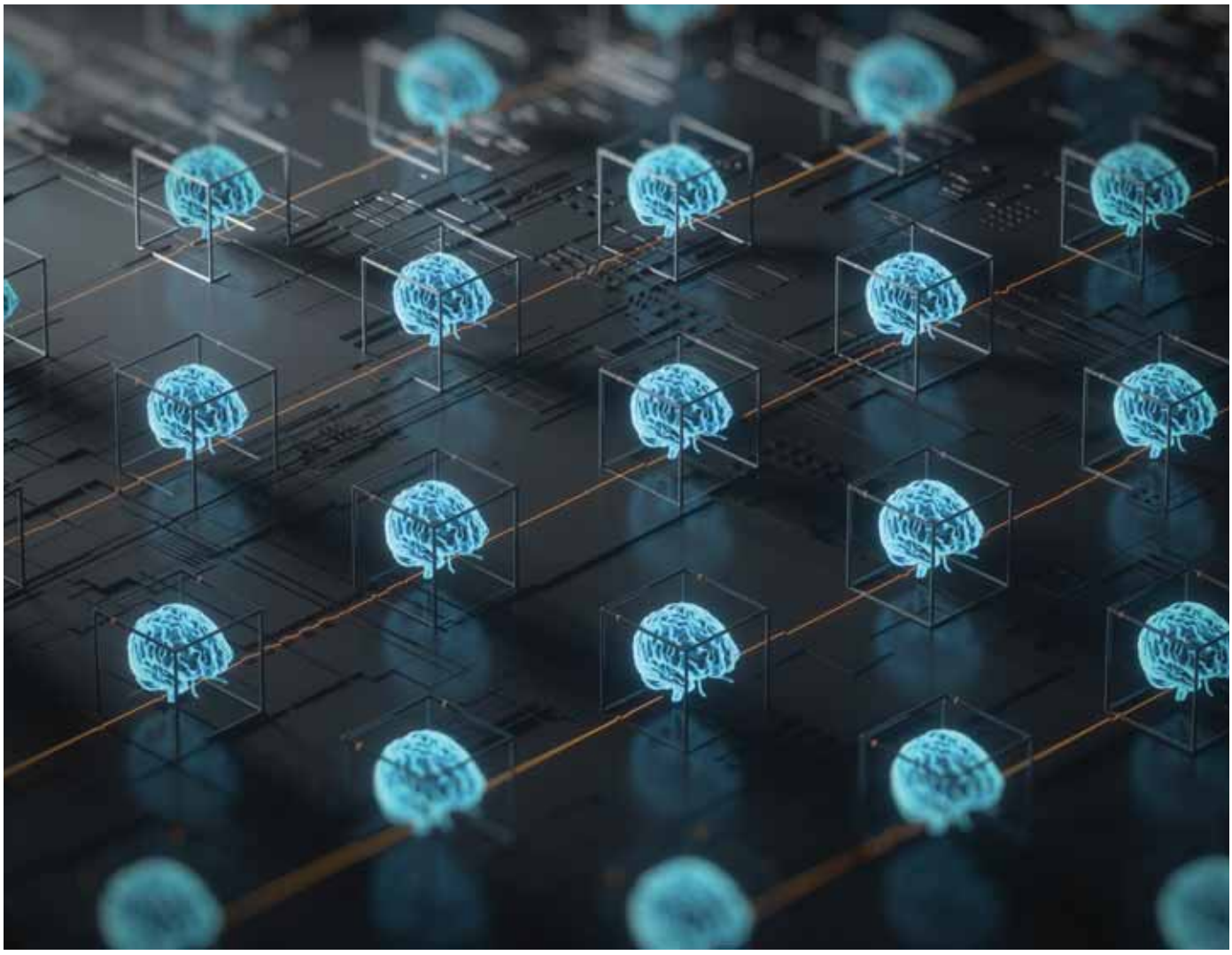
The platform uses data analytics and machine learning to find abnormal bonds and learn if these patterns could be an investment opportunity that an asset manager might be interested in. It looks at the historical prices of the bond and compares it to others in the portfolio. Once it's identified potential investments, the trader gets an alert and it's up to them to decide to pursue that trade.

"That alerts investors of possible opportunities and the impact is that investors find opportunities faster to start with and also find and execute trades that they would otherwise miss," Braje says. "It's impossible for the human mind to really go through all of those possibilities fast enough, to detect what actually requires attention or what seems like an interesting opportunity."

Franklin Templeton

The mutual fund giant's fixed-income team is working with vendor H2O.ai, using its Driverless AI product, which builds machine learning models that estimate the default risk of underlying loans in fixed-income assets, like mortgage-backed securities. Franklin Templeton wants to use the tool to predict bond defaults and model cashflows on other types of loans.

The fund manager came across H2O.ai after Franklin bought a machine-learning credit investment firm that was using the vendor to analyze credit risk on small loans, says Tony Pecore, a senior data science expert at Franklin Templeton. "We really appreciated how they combined machine learning methods into their investment process," he says.



Northern Trust

The custodian has developed a pricing engine that uses machine learning and statistical analysis techniques to forecast loan rates in the securities lending markets. "For this project, our data scientists applied a time-series algorithm to the problem of securities lending. Specifically, we have used some techniques inspired by Google technologies," says Chris Price, a specialist enterprise architect at Northern Trust.

Time-series analysis harnesses a set of machine learning and statistical tools for predicting future conditions based on past data. Northern Trust's algorithm uses market data from various asset classes and regions to project the demand for equities in the securities lending market. The firm's global securities lending traders can combine these projections with their own market intelligence to automatically broadcast lending rates for 34 markets to borrowers.

While securities lending is largely automated, the pricing component for a subset of these securities is very labor intensive, as traders need to look at a particular line item of a security and understand where they should price that relative to supply and demand. Automation is required when traders need this process to be done on tens of thousands of assets. The key is to find the appropriate AI to fit the exact need of the trader, rather than trying to use machine learning as a solution looking for a problem.

Morgan Stanley

The bank is experimenting with machine learning and other forms of AI to figure out which techniques are best for making suggestions as to which algorithms to use to trade equities in a particular market condition. "We are also interested in looking at the problem of whether last night's stock price, which jumped up, is going to continue or whether it's going to fade away in the morning," says Kerr Hatrick, executive director and quantitative strategist at Morgan Stanley Asia. "We're looking at the problem of whether there are too many people saying the same thing in the market and we're looking to use machine-learning techniques to identify that."

It is also looking at trade-volume curves to better understand when to trade with the least friction. They want to use algorithms to "understand what is going to happen to the price over the

> "We have used machine learning to make sure that the handling and disposition of the alerts has a higher level of certainty in that judgment. We are training the machine to do what the humans do in terms of their initial judgment and intuition and let the algorithm do that. That's exactly where we're at."
> **Steve Randich, Finra**

next event, the next second, the next minute, the next half hour. And it may well be the different kinds of [AI] techniques that will be useful to tell you this," he says.

Morgan Stanley is also using machine-learning forms to intelligently suggest indications-of-interest (IOIs) to clients, based on their expected investment behavior.

The Federal Reserve Bank of New York

The New York Fed and those companies it oversees often have to go back and forth to hammer out misreporting that needs to be corrected. The regulator is looking to use machine learning that takes into account historical reporting from banks, as well as peer-to-peer comparisons to "triangulate and be able to predict" instances of misreporting and to streamline the correction process, says Sri Malladi, senior director of the regulator's data and statistics group.

"We want to be at the point where we know that distribution expert reports can say this percentage will likely misreport this way or that way on these different sections of the report, or different line items," Malladi says. "Right now, we are kind of at the point where we can squeeze out more. We're not there yet [but] we can be. So I think that's our north star, where we want to get to."

He says that because of resource constraints, they "can't look at every single piece of information" that is reported to the regulator. Machine learning's strength is looking at a massive amount of data and finding connections—when architected well. "So where do we focus our attention? Which data is potentially erroneous? So I'm looking at those capabilities," he says.

Finra

The Financial Industry Regulatory Authority (Finra) is in the process of expanding its use of machine learning for market surveillance as it continues to refine its algorithms to trace manipulation.

The regulator uses machine-learning algorithms to detect spoofing and layering activities. Steve Randich, chief information officer at Finra, says that the regulator plans to increase the use of AI for surveillance to handle easier-to-detect instances of fraud, thus freeing up human surveillance professionals to focus on more complex instances.

"We have used machine learning to make sure that the handling and disposition of the alerts has a higher level of certainty in that judgment. We are training the machine to do what the humans do in terms of their initial judgment and intuition and let the algorithm do that. That's exactly where we're at," he says. "Market manipulators are getting smarter so when they notice that they're being caught they will change tactics. That's why we still need humans involved. Our plan this year is to continue doing more on the behaviors most commonly used by fraudsters. The roadmap is to implement machine learning so that the human is doing less of the redundant, low-value work of invalidating false positives."

Finra, which handles cross-market monitoring, historically relied on human judgment to determine if there was potential market manipulation, but Randich points out fraud patterns are now spread among exchanges and trading venues. Human analysts may have a harder time spotting patterns as fast as machines can.

Universal-Investment

The Frankfurt-based fund administrator is using machine learning as part of a broader, ambitious project to build a solution that will allow clients to purchase funds as conveniently as readers buy books on Amazon.

Right now, the process of buying a fund is slow, says Daniel Andemeskel, head of innovation management at Universal-Investment. Different intermediaries, such as banks, transfer agents and custodians, are involved; their processes are still manual and paper-based; and settlement cycles can take up to two days.

The service is going to be based on the Ethereum blockchain (though it might use other protocols in the future) and will use predictive analytics to identify clients' interests and allow sales personnel to offer them better options.

"In the future, we will add to that with artificial intelligence based on the same setup that Netflix or Amazon has, [giving] recommendations to their end clients to support our salespeople having much more pointed and clear strategies to address our product offerings to clients," Andemeskel says.

It will begin beta-testing the platform in 2020, but the project also needs regulatory approval. And make no mistake about it—it's not just German regulators that are beginning to take long, hard looks at machine learning.

Linedata

Linedata is in the early stages of a project that will automatically fix system fragmentation using machine learning. The application will monitor fragmentation—or the level in which memory allocation is broken up within a system that causes slower performance, which presents security and performance risks—within a firm's technology infrastructure, and predict security failures.

"We started an innovation project mid-year—it kind of got a little taken over by the fact that we prioritized a different project in security services—but at the end of [2019], we're going to focus on this again. I hope that by February [2020] we will have a model to test," says Jed Gardner, senior vice president of Linedata's Technology Services unit. "We're looking to use monitoring toolsets to use machine learning to learn behaviors of changes in the technical environment to be able to apply fixes automatically without the intervention of an engineer—that's our next big push."

The vendor is experimenting with ML in other areas, as well. For example, one large banking client uses Linedata to identify patterns in trade pricing and position amendments, while others use its ML algos for cybersecurity services, particularly when it comes to monitoring access to end-user devices.

Nice Actimize

The surveillance and compliance technology vendor is in the process of testing out more machine-learning models to improve the results its Surveil-X surveillance and analytics platform produces. While this will include adding in more data points, charting capabilities, and visualization techniques, it is also using random forest, isolation forest, and variations of K-Nearest Neighbors algorithmic techniques to more accurately spot anomalies, which is being added to the platform. Lee Garf, general manager of Nice Actimize's compliance business, says that for the K-Nearest piece, the initial release of a new model "can take several months or longer."

Garf adds that machine learning will be the basis for many of the improvements in the analytics platform in 2020, particularly as the technology already underpins many of its surveillance capabilities. By tweaking the models, the company will be able to set better parameters on what can trigger an alert.

"We're not done with machine learning models—we introduced our third technique and we're adding additional techniques as we go and learn," he says. "A lot of it is experimentation to see what works well and what doesn't and obviously push forward with what works well."

That last piece is important: Machine learning experimentation involves a lot of trial and error, which can seem like wasted effort, but is absolutely vital to improving an ML-driven model.

SmartStream

At Sibos 2019, SmartStream Technologies officially announced the launch of SmartStream Air, the firm's cloud-native, AI-enabled reconciliations platform. The overall goal of the platform is to allow users to manage their reconciliation needs on an ad hoc basis, while simultaneously reducing reconciliations processing and configuration times.

Beyond that, though, this platform will also allow the vendor to better incorporate machine-learning techniques into its future rollouts, says Andreas Burner, chief innovation officer for blockchain and AI at SmartStream and head of the firm's Innovation Lab in Vienna, which was responsible for Air's conception and incubation.

"This is the birth of all our AI and machine learning products," Burner explains. "We've been working heavily in this area for the past 18 months and now we've productized it through SmartStream Air—our first real AI product. We have been working with clients on it with their data and it has worked really nicely during our beta tests."

Some examples as to how SmartStream is using machine learning include the ability to predict cash flows and liquidity, and they have a proof-of-concept that predicts when actual payments will settle and automatically deliver a timestamp for each forecasted flow.

Liquidnet

In 2017, Liquidnet acquired OTAS Technologies, a machine-learning specialist. In 2019, Liquidnet built a new business line that will combine OTAS with two other recent acquisitions: Prattle and RSRCHXchange. The new unit, dubbed Investment Analytics (IA), will combine Prattle's experience in the field of natural language processing, OTAS' use of machine learning in structured market data, and RSRCHXchange's investment research platform. The target audience comprises long-term investors and analysts, says Adam Sussman, head of market structure and liquidity partnerships at Liquidnet.

IA is still in its early stages, so the firm is experimenting with how best to fit the product within investors' workflows, and validate the concepts and models on which they are building. But some potential use-cases have already been defined.

Predata

Predata uses machine learning and predictive analytics to anticipate global events and market moves. The platform has an Amazon Web Services backend, is language-agnostic and can analyze websites in English, Arabic, Swahili, Persian and other languages. It tracks over 200,000 individual sources daily, organized by topics, countries, and issues. It uses machine learning—mostly sparse regression techniques and algorithms—to identify patterns in the data and detect anomalies, changes in behavior, where people are interested or concerned.

"Especially when dealing with a black swan event, we're not able to predict exactly what will happen, but we can quantify the level of interest around a group of websites related to this topic. Sometimes a hedge fund manager will have a hunch or a theory in their mind that they're trying to build their portfolio around or manage their risk; we help them quantify these ideas and get confirmation or falsify these convictions they have."
Hazem Dawani, Predata

Predata looks mainly at five sources of data: YouTube videos, which give an idea of interest around past events; Wikipedia pages for a sense of engagement around research; Twitter, which helps understand what people are interested in; individual websites to measure traffic levels on these websites; and Internet Service Provider data, which illustrates the actual flow of traffic. It doesn't care about the content of the video or story, per se, but instead looks at how many people viewed and shared it, and how that has changed over the last few days, weeks or months.

"Especially when dealing with a black swan event, we're not able to predict exactly what will happen, but we can quantify the level of interest around a group of websites related to this topic," says Hazem Dawani, CEO of Predata. "Sometimes a hedge fund manager will have a hunch or a theory in their mind that they're trying to build their portfolio around or manage their risk; we help them quantify these ideas and get confirmation or falsify these convictions that they have." wt

5G & IoT: Are You Ready for the Data Deluge?

The combination of these two revolutions will see data volumes skyrocket. As a result, Anthony Malakian says data providers will be able to find new datasets to package for clients, while investment firms can create unique investment insights.

When you work in tech and data, much of the job is just making sure that nothing breaks and trying to keep those on the business side of the organization as happy as possible. My father built and ran datacenters for four decades, and much of that time was just hoping to not get that 2 a.m. phone call alerting him that something burned down. For a man that served in the US Marine Corps, he seems to have an equal number of war stories about gearing up for Y2K.

This is all to say that it's easy to be laser-focused on what's in front of you and not worry about hypotheticals. Yet, it's important for firms to start taking stock of what 5G networks—in combination with the Internet of Things (IoT)—will mean for them going forward.

Last January, I wrote a feature about 5G, which, at that point, was still in the experimental stage. While companies were touting their advanced networks, they were, and still are, relatively rudimentary compared to what's coming. While 5G is slowly starting to bed in, we are still at least a few years away from its true power being unleashed. Just think about 4G: It arrived in 2008, but LTE networks didn't come around until 2011, and then it still took about three more years—so six years from the initial rollout—before mobile devices became the powerful tools we see today.

It's also important to remember that 5G is not merely the next evolution of 4G LTE. Connection density will increase from 100,000 connections per square kilometer to over 1 million—the IoT effect. LTE is limited in terms of how many devices it can connect to within a square kilometer. As Dan Littmann, principal at Deloitte, told me, "for all practical purposes, that limitation goes away with 5G."

A recent Opensignal report stated that in the US, the highest maximum speeds for 5G users (again, in limited cities, as of now) were approximately three times those of 4G users. And these early networks are not what's to come in the future. AT&T—which, along with Verizon, Sprint, and T-Mobile, is one of the biggest US wireless carriers competing for smart-device network supremacy—says latency will be cut from 10 milliseconds for 4G networks to less than 1 millisecond for 5G networks. By 2021, data traffic will jump from 7.2 exabytes per month to 50 exabytes. Peak data rates will grow from 1 gigabyte per second to 20.

And available spectrum will rise from 3 gigahertz to 30.

What does this mean for the capital markets? It's all about the data that will be created.

Think about all the challenges that firms currently face when trying to integrate newer and denser alternative datasets. Suvrat Bansal, chief data officer and head of innovation at UBS Asset Management, recently told *Waters Technology* that when incorporating alt data, it's a delicate balancing act where firms need to be able to adjust and try new things on the fly. Recalling alt data's countless hype cycles, he laughed. "It's the 'here-we-go-again' [moment]. We know for sure in traditional asset management, it's near impossible to use one source or, collectively, all sources. … There's something within there, but our view is you need the data, but not all the data all the time for all the investments," Bansal says.

5G, when combined with IoT devices, is where the revolution sits, Adrian Scrase, CTO at the European Telecommunications Standards Institute (Etsi), told me last year; that's where the new alt data opportunities will be created. "Once you get to that stage of having massive IoT, you then have massive data [which is inherently noisy], but the value is the information you could extract from these massive datasets," he says. "So you can convert technology into business and enterprise [solutions] by having the clever people who can find the value in information from the data you've collected."

Suvrat Bansal
UBS Asset Management

Data Collection

In mid-December, I spoke with Michael Marrale, CEO of M Science, which collects numerous alternative datasets to create reports and analytics. At the time, the company was just beginning the rollout of a 5G mobile handset measurement service, providing weekly updates on adoption. It will analyze sales trends among different phone models, and estimate 5G market share among handset manufacturers.

The offering will first look at devices running on Android software and will stretch to iOS devices as new iPhones enter the market.

Marrale acknowledges that adoption is "still very nascent"—5G technology is only available in less than 1% of cell phones currently on the market. But M Science already sees more than 10% of all smartphone transactions in the US and Canada—make, model, some specifics about each device—and more than 90% of all smartphone activations across China, and those are the two key 5G markets, according to Marrale. So the company anticipates that it will be able to provide unique insights into the rollout and adoption of 5G as it spreads over the next few years.

"We felt that we have the data, we wanted to put it out there because we think that 2020 is going to be all about 5G," he says. "I personally have been involved in technology investing for 20 years and I think that 5G is the biggest investment theme that we've seen probably since the inception of the smartphone. We know that is going to be a critical part of any technology and really any investor's outlook for the next year or couple of years."

Marrale expects that adoption of 5G will ramp up "very quickly," so M Science wanted to start getting information in front of clients earlier to be ahead of the curve. But just as importantly, Marrale wants to make sure the company is ready for new opportunities that arise from the increase of data available to be incorporated and analyzed.

"It's going to open up more opportunity for us in terms of data availability," Marrale says. "Our business is totally data-dependent, so our growth is either stimulated or not by data availability,

and 5G is poised to really increase data availability dramatically."

In Theory

I'm not sure that firms truly grasp just how much data is going to be created by 5G and IoT. According to consultancy IoT Analytics, there are currently more than 8 billion connected IoT devices—and that does not include computers, laptops, fixed phones, cellphones or tablets—and that number is expected to balloon to over 21 million by 2025. And 5G on its own will exponentially increase the amount of data being created. Verizon CEO Hans Vestberg, while speaking at CES 2019, had this to say: "When we think about 5G, we think about 10 gigabits per second throughput, we talk about 10 times battery life, we think about 1,000 times more data volumes in the networks. It's just radically different. I would say it's a quantum leap compared to 4G."

According to IoT Analytics, there will be more than 40 use-cases for 5G and IoT by 2025. Included in that estimate are vehicle telematics (vehicle diagnostics, location tracking); smart-grid automation (renewables into the power grid, messaging between micro-grids); mobile and collaborative robots (autonomous vehicles, industrial robots); and cooperative intelligent mobility (sharing of real-time information about traffic and road conditions among cars and other road users).

Another area that is likely to be supercharged is that of geolocation data, which hedge funds have been using for years to inform investment decisions. A mobile phone's location sensor is largely dependent on GPS, which is a technology from the 1980s, Wei Pan, co-founder and chief scientist

at alternative data provider Thasos Group, told me earlier last year. The phone is looking around for a cell tower to connect to, or a Wi-Fi signal to estimate where the phone is currently located—that won't be necessary anymore because of the increased connection density.

Similarly, satellite imagery relies heavily on very big, expensive satellites taking pictures from space of the ground. But what if cameras closer to the ground could improve that process?

"With 5G you can imagine that signal will be achieved by deploying a lot of very small, low-flying drones, or even some fixed cameras from tall buildings. And those cameras take pictures of small regions at a very high frequency to make up this big image of the land," said Pan, adding that this can create more real-time data, rather than relying on a satellite flyby. Now, take it a step further. You have a city saturated with cameras, monitoring traffic and people. This kind of surveillance isn't easily done with 4G because of those aforementioned connection overload issues. With 5G, that's not a problem.

"You can have as many video cameras as you want and you collect data effortlessly," Pan said.

> "It's going to open up more opportunity for us in terms of data availability. Our business is totally data dependent, so our growth is either stimulated or not by data availability, and 5G is poised to really increase data availability dramatically."
> **Michael Marrale, M Science**

The Genie's Out

While the ball is certainly rolling, it should be noted that despite the advertising efforts of the phone carriers, true 5G technology is still two to four years away, depending on the estimate. However, 2020 will see the first full-year push of 5G in the US, Canada, China, and several countries in Europe. And while this article has largely looked at the potential benefits of the technology, there are serious privacy concerns to be addressed and worries that 5G could create unforeseen health risks for humans and animals alike.

But, there's also too much money involved to stop—in 2016, Accenture estimated that "telecom operators [in the US] are expected to invest approximately $275 billion in infrastructure, which could create up to 3 million jobs and boost GDP by $500 billion." The simple fact is that countries are not going to look back.

So what does that mean for the capital markets? Alt data companies (M Science, Quandl, 7Park Data, YipitData), specialists (Thasos, SpaceKnow, Four Twenty Seven), and data giants (Bloomberg, Refinitiv, S&P Global, FactSet) will need to start to think about how to monetize this new sea of data. Banks and asset managers, on the other hand, will have to learn how to more efficiently incorporate alternative data to develop unique investment insights from this new wealth of information.

Once 5G and IoT fully connect, the dam of data will break quickly. While there are certainly other important projects that capital markets firms need to stay focused on, now is the time for planning. wt

Crédit Agricole Taps AI to Lure Swaptions Business

The machine learning model predicts client demand with high accuracy, giving traders an edge in pricing.
By Tom Osbourn

Crédit Agricole's Corporate and Investment Bank (CIB) is used to picking its battles. Like many of its peers, the French lender has been steadily shedding risk and cutting the capital it allocates to its once derivatives-heavy markets business.

That makes the job of Thomas Spitz, the bank's global head of hedging and investment solutions, rather difficult. But shrinking resources and a stout refusal to join the tech arms race sit at odds with the fact that the bank is now one of the largest counterparties to fixed income hedge funds in interest rate volatility products.

How did it get here? The first step was recognizing its limitations, says Spitz: As far as the market is concerned, the firm operates a medium-sized investment bank.

"A few years ago, we concluded that if we were to join the technology race among banks investing in very low-latency technology for high-flow products—electronic execution for businesses where we don't have a large market share or a differentiating capability for our clients—we would basically go down a path where we spent a lot of time and resources build-

"The idea behind it was to develop machine learning techniques that would help clients sort the whole universe of outstanding bonds. Machine learning techniques provide answers to non-linear problems. It has produced some very interesting results, some intuitive and others not, which ultimately brings a true economic added value to our customers."
Thomas Spitz, Crédit Agricole

ing a product that could not compete," Spitz says.

As part of a CIB shake-up last year, the bank restructured its markets division into two units, one focusing on financing and funding and another dedicated to hedging and investment solutions, including trading, sales, structuring and research.

Within the second unit, it also created two specialist technology teams focused on capital markets data and operational transformation. Their role is to ensure the front office can rapidly develop technical solutions to the problems and opportunities it encounters when dealing with clients.

"We try to have an environment in which—unusually for a very large organization—a group of four or five front-office bankers can work on an idea, get help from these experts, work out if its viable and, if it is, decide how to deploy it within our IT architecture," says Spitz.

"We try and get that convergence when people come to them with an idea. It's proving very successful. When you run a desk on a daily basis, you have lots of ideas; but you don't have a lot of time, and you have even less by way of means. So this is a nurturing approach: giving not only a framework but also the means to succeed, and the tools."

To start with, the team focused its attention on markets with rich datasets. Interest rate swaptions were the perfect testing ground.

On a daily basis, clients pepper the desk with thousands of requests for quotes (RFQs) for pay- and receive-fixed swaptions. "If all we end up doing is providing a price, great—if it's the best price, we trade—but the client won't remember us beyond that," says Spitz. "We believed that we could use those low-touch interactions with clients to build up a much more predictive approach to our relationship with them."

The bank built a dataset of RFQs and used a machine learning-based model—which relies on straightforward decision tree techniques—to divine patterns within it.

Pricing Advantage

But in an esoteric market, a pure machine learning-based approach can quickly run into problems. An algorithm will struggle to make sense of data unless it understands the context of the requests and what motivated the client to trade: the shape of the yield curve at that point in time or its rolldown on a particular day; the coupon's z-score (its standard deviation from the mean); implied versus realized volatility levels; or a news announcement. This information was manually curated and fed to the model—meaning it operates in a "supervised learning" environment.

The results were transformative.

Though most clients request prices for receiver and payer swaptions simultaneously to avoid showing their hand, 80% of the time a human trader can guess which way they want to trade. But the machines have started to beat them, with an accuracy rate of 85% on average.

That extra 5% has given the bank a crucial edge: The algo's ability to spot patterns and learn the client's typical behavior allows traders to preempt an inbound request, and be ready to show a highly competitive price at precisely the right time. Since it switched the tool on in April of last year, Crédit Agricole has become the largest swaptions counterparty to many fast-money clients, and the main provider of swaptions to one of Europe's largest asset managers.

This has created a virtuous circle. As it receives more RFQs and wins more trades, the algo's predictive power has increased to the point where it can almost always know which way clients will want to trade in the run-up to key calendar days, such as European Central Bank monetary policy meetings. This allows the bank to position its books accordingly so it has a natural axe to show clients a better price that day, resulting in even more trade wins and better data to feed the model.

The machine intel has also changed the way the sales team interacts with clients.

"Little by little, you can predict a market situation and a trade opportunity that perfectly suits the client. Then, instead of being a receiver of RFQs, we can build a strategy that we can proactively propose to our clients," says Spitz.

"Instead of spamming the client with 50 ideas per day, we give them one or two per week that we think are valuable. All of our analysis is helpful when we talk with clients: We can show them how that strategy will behave, and how we will hedge it in different market conditions. You build up a package of recommendations."

For their next project, the tech teams turned to bond repacks. With payouts on most investment-grade bonds in Europe jammed in low or negative territory, clients are turning to foreign debt hedged with cross-currency swaps for additional yield.

Crédit Agricole CIB has a sizeable franchise on the Spire platform—a joint initiative between a group of banks to standardize the terms on which such bond repacks are offered and issue notes from a shared special-purpose vehicle, speeding up time to market and cutting costs.

But with banks using a common platform, each has had to invent new ways of differentiating itself. Crédit Agricole CIB has done so by offering novel underlyings when it comes to floating rate notes, but its chief innovation has been technological: a bond recommendation engine.

The model—drawn from the collaborative filtering family of approaches—picks suitable underlyings by rating, sector, currency, maturity, price and coupon. Automating this process has allowed the bank to broaden its offering to some 500,000 actively traded bonds from issuers around the globe.

> "We believed that we could use those low-touch interactions with clients to build up a much more predictive approach to our relationship with them."
> **Thomas Spitz, Crédit Agricole**

"The idea behind it was to develop machine-learning techniques that would help clients sort the whole universe of outstanding bonds," says Spitz. "Machine-learning techniques provide answers to non-linear problems. It has produced some very interesting results, some intuitive and others not, which ultimately brings a true economic added value to our customers."

While the front-office quants take the lead in development at the bank, many of its traders are also fluent in Python and capable of programming. "When you are a French bank, a lot of the traders have a quant background," he says.

Spitz himself has a background in mathematics, which helps him bridge the gap between developers and the client-facing parts of the bank, though he no longer programs these days.

The direction in which the bank is going—tailored solutions to narrow market problems—is a far cry from the way the large derivatives houses made their money in the past, he notes.

"If you go back 20 years, everything related to statistics was seen as a boring part of the business," Spitz says. "Twenty years later, it's not the person capable of taking the biggest, most exciting position, but the person capable of using these new technologies and quant tools who is bringing the most value to the firm." wt

Human Capital

Guggenheim Partners Promotes Caban to CIO

Amie Caban has been named chief information officer (CIO) at Guggenheim Partners. Caban was previously the firm's deputy CIO, and will replace Jim O'Donnell, who is stepping back from his day-to-day operational duties but will remain as a senior adviser to help in the transition.

Caban joined Guggenheim in 2010, taking over responsibility for application development during the summer. She has also served as the firm's chief information security officer, and has previously held roles related to business continuity, enterprise technology governance, IT project management, and technical infrastructure and architecture.

Most recently, she has been working to "optimize [Guggenheim's] technology platform and move the organization towards the cloud," noted Tom Irvin in a press release. Caban will report to Irvin, who serves as chief administrative officer of Guggenheim Services and chairman of the Information Technology Oversight Committee.

Andrea Remyn Stone

Ade Cordell

Douglas Taylor

Caban also sits on the Steering Committee for Guggenheim's Women's Innovation and Inclusion Network and is a member of the firm's Vendor Diversity Advisory Council.

Andrea Remyn Stone Joins Refinitiv as Chief Customer Proposition Officer

Refinitiv has continued to expand its product strategy by hiring Andrea Remyn Stone as chief customer proposition officer. Stone will join Refinitiv's London office and report to chief executive David Craig.

She will work with customers to develop solutions in open platform technology collaboration.

Stone joins Refinitiv directly from Dealogic where she was chief strategy officer. Prior to that, she spent five years as Bloomberg's global head of strategy and corporate development.

Burton-Taylor Founder Departs, Sets Up New Consultancy

Douglas Taylor, founder of market data and financial technology research firm Burton-Taylor International Consulting, has left the now TP Icap-owned company to set up a new consulting firm, Douglas B. Taylor International Consulting.

Taylor founded Burton-Taylor in 2006 to provide competitive market research on the data industry. During that time, between 2010 and 2015, he also served as COO of EMIS, Euromoney's emerging markets information service. Before founding Burton-Taylor, he was managing director of Thomson Financial in Asia-Pacific, and spent one year as manager of partner engagement at Microsoft. Prior to that, he spent more than 15 years in various roles at Reuters, including global director of product management and marketing for the vendor's news business.

Taylor says his new consultancy will not compete with Burton-Taylor.

Flynn Trades Morgan Stanley for TD Ameritrade

Market data veteran Ed Flynn has joined TD Ameritrade as head of market data strategy, based in New York. Flynn was previously executive director of global market data sourcing at Morgan Stanley, where he spent almost seven years. Before joining the bank in 2013, he ran his own data sales and training consultancy, The Flynndex Company. He also spent 13 years as a senior director at Fidelity Investments, and nine years as an account manager at Interactive Data.

SEC Hires New CDO

Austin Gerig is to start as the Securities and Exchange Commission's (SEC) chief data officer on February 3. Dr Gerig is currently assistant director of the agency's office of data science in the Division of Economic and Risk Analysis, and has been with the SEC for over five years.

In his new role, Gerig will help to develop data management strategy and priorities, as well as data analytics and policymaking.

Prior to joining the SEC in 2016, Gerig was a senior fellow at the University of Oxford, a position he held for three years. In 2007, he was awarded a PhD in physics from the University of Illinois.

ICE Veteran Moves to Cboe Europe

Ade Cordell has joined Cboe Europe as its new European head of business development. This comes as Cboe

prepares to launch European equity derivatives. Cordell will work closely with customers of Cboe as well as the team, to deliver a European equity derivatives exchange.

With over 25 years of experience in financial markets, Cordell previously held the role of head of equity derivatives at Intercontinental Exchange, before leaving the job in June 2018. Prior to that, he was vice president of global equities eCommerce at Deutsche Bank.

Paresh Shah Joins BNY Mellon Markets as Global COO

BNY Mellon has hired Paresh Shah as global chief operating officer (COO) in its foreign exchange business.

Shah's previous role was as COO Americas for foreign exchange, commodities and corporate sales at HSBC. Before that, he held the same position at Deutsche Bank for 16 years. His wealth of experience in successfully driving business expansion in forex franchises will now benefit the BNY Mellon New York office.

Broadridge Hires Bus-Dev VP

Matthew Nelson has joined Broadridge as vice president, strategy and business development. His role will encompass strategic development of new business within asset management.

Nelson will be based in the Boston office. He will report to Betsy Stephens, global head of GTO strategy and business development.

In his previous job, Nelson was managing director of global business management at the Depository Trust & Clearing Corporation. Prior roles saw him working at TowerGroup and as global head of strategy at Omgeo.

LiquidityBook Names Two Hires

James Pearson and Abdullah Al Nasiri have joined the London-based team at SaaS-based provider LiquidityBook. Both will serve in the Europe, Middle East and Africa client services team; Pearson as a technical implementation analyst and Al Nasiri as a client services analyst.

At LiquidityBook, Pearson will be involved in onboarding projects, working closely with internal developers and external clients; Al Nasiri will work in the client support group.

Pearson was formerly head of IT at Schneider Trading Associates for the past 13 years. He began his career at Royal Bank of Scotland and holds a degree in computer studies and software development from South Essex College. Al Nasiri previously worked at Fidessa as a technical support analyst. He gained his degree in computer science from Queen Mary University of London.

NEW ROLE CREATED FOR ARNE STAAL AT LSEG

London Stock Exchange Group has appointed Arne Staal as head of research and product management, information services. The newly-created role will see Staal head the Information Services Division where he will be responsible for product strategy and product development.

Staal's previous role as global head of macro systematic strategies and macro risk at Aberdeen Standard Investments means that he brings a rich knowledge of analytics and data to LSEG. His roles before this saw him as: head of product research and innovation at BlackRock for iShares, European head of index products and strategy at Barclays Capital, and head of quantitative strategies at Standard Life Investments.

Arne Staal

Austin Gerig

FDIC Appoints New CIO, CPO

The Federal Deposit Insurance Corporation (FDIC) has hired Sylvia Burns as its new chief information officer and chief privacy officer.

Since joining the FDIC in 2018 as deputy CIO, Burns has led the agency's IT modernization plan, which is scheduled to be implemented within five years and includes shifting to a cloud-based platform.

Prior to her time at the FDIC, Burns served as the CIO of the US Department of the Interior, where she was responsible for an information management and technology portfolio worth more than $1 billion.

Frankfurt Exchange Appoints New Council Chairman

Following the departure of former chairman Michael Rüdiger, Michael Klaus will take over as chairman of the Exchange Council of the Frankfurt Stock Exchange.

Elected by the 18 members of the Exchange Council, Klaus's primary duties will include acting as a supervisory body of the exchange, which entails appointing management, issuing exchange regulations and the terms and conditions for exchange transactions.

Klaus is currently a partner at Metzler Bank and a member of the executive board of Metzler Holding.

Former Enso Financial CTO Joins Transcend

Transcend, a real-time collateral and liquidity optimization technology provider, has hired Kayur Parekh.

With 18 years of technology and financial markets experience, Parekh will focus on the advancement of cloud technology at Transcend.

His previous role as chief technology officer at Enso Financial saw him work on the technology transformation of the company in cloud and microservices-based architecture. Parekh has held a number of high-profile roles in this field, including senior technology director at NEX, which is now part of CME Group, and senior vice president at Citi. wt

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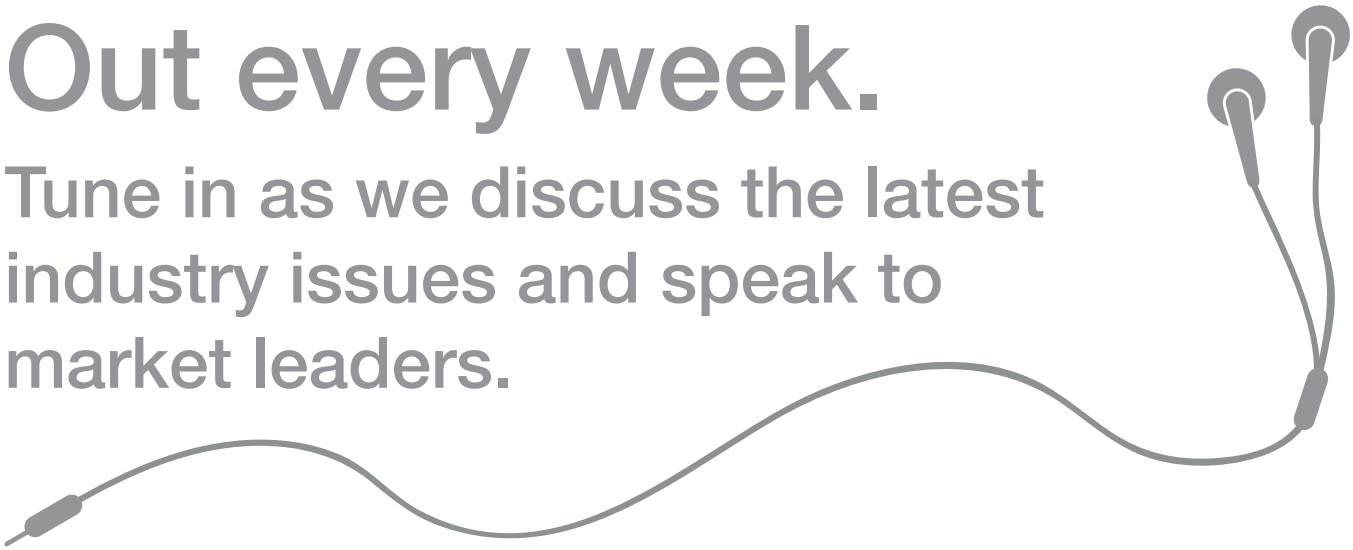

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