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REARCHITECTING THE CAPITAL MARKETS

THE CLOUD COMETH

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This is a authorized reprint prepared specifically for Xignite and taken from the broader Celent report Rearchitecting The Capital Markets: The Cloud Cometh.

This primary research study has been conducted on a fully independent basis by Celent without restriction. The analysis presented has not been changed from that presented in the full report. For more information on the full report, please contact Celent at info@celent.com.

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EXECUTIVE SUMMARY

We are at a major inflection point in the capital markets. As capital-constrained and regulatorily burdened firms remap their future architectures and businesses, more and more are looking to create much more scalable, cheaper, and safer infrastructure via a cloud model.

The infrastructure renting or serverless model is gaining traction as firms consider their architectural future and the nature of their place in the changing capital market competitive environment.

The end game of the cloud is not doing things cheaper; it is the creation of a data-centric capital market competitor that has its data in an easily usable form for advance predictive analytics, AI, and machine learning.

Nearly every type of capital market firm is actively planning, using or conducting cloud POCs for portions, or significant parts of their future IT planning.

The most innovative firms are allowing their capital market clients to shed internal costs. Capital market participants are looking for clear solutions from providers that can solve their data concerns, regulatory demands, and specialized market access issues for new demand.

Innovative service providers are creating business models that allow buy side and sell side firms to focus on their core activities and not be bogged down on waiting for infrastructure and connectivity, developing better regulatory solutions or faster compliance tools, and offering easy scalability and agility.

Models for cloud delivery of specialized data, trading, and regulatory solutions for delivery of end-to-end, and cloud-based solutions are emerging in market data (Market Data as a Service) TradingTech (Trading Platform as a Service), and RegTech (regulatory compliance).

Firms of all sizes are looking for easy ways to access data and test theories in a low-cost, low-risk fashion whether they go into production in the cloud or within their own data centers.

The speed and impact of the public cloud are remapping the way CTOs are looking at their internal clouds, virtualization models, and infrastructure spending.

As firms map their present and future cloud strategies they increasingly focus on flexibility, around type of clouds, costing models, architecture, and connectivity. Increasing the flexibility in routing, topology, processing power, and costs are key considerations.

Regulation, data privacy, and security are the key questions for firms looking to managed offerings and cloud solutions. The irony is that many regulators already use public cloud for storing trade and execution data.

KEY RESEARCH QUESTIONS

- 1** *How is the cloud landscape evolving across the capital markets value chain?*
- 2** *What capital market use cases are leveraging the cloud, and who are the solution providers?*
- 3** *What are the dark regions and silver linings for cloud adoption in capital markets over the next 24 months?*

ABOUT THIS RESEARCH

In this report Celent follows up its recent overview of cloud trends (*The Cloud Comes of Age in Capital Markets: All Clear for More Cloud*, December 2016) with a detailed dive into how capital markets participants are leveraging the cloud for their front, middle, and back office processes. We pay particular attention to market data models, analytical solutions, trading and post-trade technology, and risk and compliance operations in the cloud.

INTRODUCTION

Business and regulatory challenges continue to reshape the capital market ecosystem, altering the traditional roles played by different participants in the buy and sell sides as well as market infrastructure providers. As these firms undertake critical evaluation on where to compete, which clients to serve, and what business lines to grow and divest, optimizing cost of operations and infrastructure is becoming a key challenge, as well as opportunity.

Traditional levers to cost-cutting such as outsourcing and offshoring have run their course, and are proving to be inadequate for many firms seeking to transform their operations in this phase of industry evolution. There is a steady shift away from the focus on internal control, fixed operational budgets, and heavy upfront investments to more variable costing, scalable, and flexible infrastructure, and agile systems to navigate highly volatile market conditions and constantly evolving regulatory environment.

This is giving rise to the renting economy, where firms are increasingly willing to rent infrastructure, computing power, and services from specialist providers. As a result, cloud is emerging as a key theme across the capital market value chain, and we are witnessing growing interest from several market participants around cloud adoption; numerous cloud-based use cases in the capital markets are emerging by the day.

Investment banks are remapping their fixed income for trading and market making, and analytical focus on client engagement. Similarly, sophisticated buy side firms are repositioning their infrastructure to best engage with these changes.

The cloud conversation is rapidly moving ahead from infrastructure, computing power, to increasingly application development, analytics and even cloud-based end-to-end managed services. In the capital market context, this is driven by the explosion in the data universe primarily coming from growing electrification of asset classes in fixed income, currency, commodities, and increasingly derivative trading. There is also growing desire to analyze different types of structured and unstructured data for various activities, starting from generating new trading ideas to conducting client due diligence for risk and compliance.

On the supply side, cloud is enabling the fintech revolution, and an ecosystem of solution providers are developing cloud-based solutions to support a range of capital market functions — beginning from cloud-based trading technology through to advance analytical capabilities, often using artificial intelligence and machine learning techniques.

Celent published a report titled *The Cloud Comes of Age in Capital Markets: All Clear for More Cloud* (December, 2016) analyzing several key aspects of cloud adoption in capital markets. Since then we have seen great interest from several market participants about cloud and increasing interest in learning about capital market specific use cases. This report builds on the previous report and analyzes how buy side and sell side institutions are adopting cloud, and discusses what specific use cases and vendor solutions are emerging.

MODELS FOR DELIVERY AND DISTRIBUTION IN THE CAPITAL MARKETS

Key Research Question

1

How is the cloud landscape evolving across the capital markets value chain?

The cloud is offering easier, cheaper, and better solutions to the front, middle, and back office. However, the journey to the cloud can be complicated and the end game has to justify a fundamental rethinking of architecture.

EVOLUTION OF THE CAPITAL MARKET CLOUD

We are seeing rapid development of the capital market cloud ecosystem. Growing focus around core data centers, specialized access, and how best to architect cloud models point to the following major themes regarding the industry's journey to the cloud and how it gets there:

The Big Picture

We are moving, as a society and as an industry, to lease vs. buy model in our engagement with services.

The End Game

The capital markets are not going to rearchitect their entire infrastructure just as a cost-cutting exercise, or for a simpler route to static data lookup. It is the innovation, flexibility, insights around data in the cloud, and its analytical prowess. **The end game is an automated AI-driven data-centric capital market firm**, with many of the tools for advanced machine learning (ML) being offered by cloud providers and open source solutions.

Creating a Viable Journey

- Nearly all types of firms from the largest asset managers and investment banks to one-person shops are on a cloud journey right now. They are striving to create a transition to the cloud.
- There are numerous proofs of concept running across major investment banks, hedge funds, and asset managers right now to create the cloud model for the next decade.
- Even in the tier 1 and upper tier 2 of investment banks there are substantial differences in committed resources and approaches to their cloud future.
- The largest banks are generally quite far along in their thinking and are announcing that they are going to move into multiple clouds. They are looking for the tools to ease the transition from their on-premise, off-premise environments into the cloud. That said, the multi-cloud approach puts significant strains on resources and optimization of cloud usage.
- Plan for data processed and stored increasing tenfold each four to five years.
- There are wars developing on the approach to integrating across infrastructures and the development of abstraction layers above a bank's infrastructure that would layer into the cloud. There are those that see this as a wasted step, and others that view this as the move forward. However, there is general agreement and demand for tools that allow ease of operational shifting between infrastructure and cloud providers.

- The large cloud providers are becoming deeply entrenched in tier 1 investment banks in several ways such as guiding the process, winning over those for whom jobs are at stake in cloud environment, and having them become part of the process and develop the necessary expertise.
- There is a substantial amount of technical expertise in the investment banks, some evolving from the shadow IT, and there is much more thinking about existing technology stacks and the next form of IT infrastructure via proprietary and open source tools like Docker and Terraform by Hashi.
- We are seeing more demand and more movement of key technologists from banks to the cloud providers and vice versa.
 - Cloud providers are bringing in investment banking enterprise expertise to build specifically what bank CIOs are looking for.
 - Most large investment banks now have cloud strategists who have had experience at the major cloud providers, especially those with migration experience.
- Some of the key areas of focus recently are beyond technology but on paths to monitoring cloud operations, security, and holistic operational risk assessments.
 - Firms are looking for flexibility in paths to encryption and decryption for resting data and data on the move.
 - Capital market firms are looking for control of their encryption key management.
- The ability to remove complicated manual tasks via native functionality and tools provided by certain cloud providers to allow easy access, creation and processing of data, or managing access policies is another compelling driver of adoption.
- The move to a true serverless architecture in the capital markets with no infrastructure or administration, zero spin up time, and no data loading issues is in very early days, but underway in certain areas.

VALUE CHAIN ON CLOUD

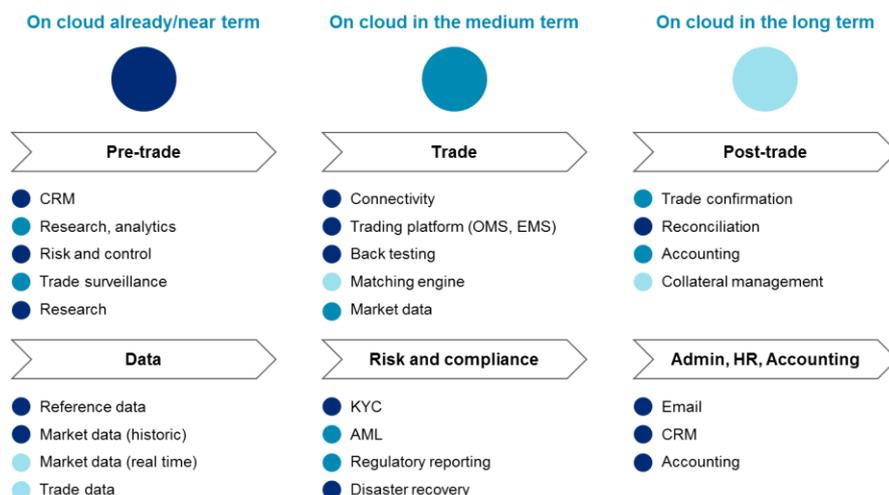
A new ecosystem is rapidly evolving that puts unnecessary spending and unnecessary infrastructure under a greater microscope. Resources need to be focused on core business solutions and creating a more effective model for client engagement.

Hence, there is tremendous pressure to reduce the cost structure within capital market firms. This path requires critical choices on where to compete, which clients to serve, what business lines to grow, and which business lines to divest. It has also brought into view the high levels of complexity that are resident in technology architectures and business lines.

This is all a backdrop to a rapidly changing technology cycle and rapidly maturing models for offering holistic solutions to client challenges. Access to connectivity, alternative business models, and acceptance, combined with the changes in the ability of firms to access capital and adapt to a global regulatory model that has focused on risk mitigation, have left the capital market in flux. There are many pain points for capital market firms, and a new generation of innovative firms is entering this space with point solutions, as well as visions of remapping the entire architecture. Innovative firms are striving to create a better and more robust financial center, impacting the core of trading, markets, and security servicing — the entire value chain.

Celent sees new solutions emerging and being implemented from front to back: from the creation of investment ideas, trading strategy testing market, analytical insight, testing, compliance solutions, regulatory reporting and post-trade analysis.

Figure 1: Capital Market Functions Moving to the Cloud



Source: Celent

HOW PARTICIPANTS ARE LEVERAGING THE CLOUD

Sell Side

Participants on the sell-side, such as investment banks and broker-dealers, have traditionally looked to retain high degree of control over their systems and processes primarily because they are highly regulated. The need for aggressive cost-cutting is a key impetus for cloud adoption for many of these institutions.

- Sell side firms, particularly the larger ones, typically begin their cloud journey with the private cloud looking to rationalize complicated infrastructures and siloed systems without losing control over proprietary data and internal processes.
- Rapid improvement in speed and security of cloud has made some in the sell side consider, and adopt, third party or even public cloud-based offerings for certain aspects of commoditized (i.e., non-sensitive) parts of operations — such as storage of market data, application development and testing, and risk calculations.
- Combination of the above two forces are resulting in the development of hybrid cloud infrastructure at some of the large sell-side institutions. Desire to diversify operations across multiple cloud vendors to avoid “vendor lock-in” is also contributing to this trend.
- In the next phase of adoption, cloud’s appeal evolves from merely variabilizing fixed cost of infrastructure to optimizing overall operations such as provisioning and demand flexibility on virtualized servers, application development and production in the cloud environment.
- While cloud is almost always the preferred mode for new application development, shifting legacy applications is still mired with operational complexities and organization inertia.
- Achieving optimal mix of operations also requires restructuring of resource pools (e.g., cloud developers, network engineers etc.). We are seeing large degree of cross-pollination as technologists leave cloud firms for banks and vice versa.

We see several areas within sell-side operations ripe for cloud adoption:

- The need to rapidly enter or exit key markets and asset classes for trading is giving rise to on-demand connectivity, market data, and associated infrastructure needs — many of which are now being offered on a cloud based, end to end, managed service model.

- Cloud-based voice over Internet protocol solutions allowing low-cost, secure, private communication without requiring hardware investments are gaining acceptance for trading in asset classes still dominated by voice-based trading, as well as for other enterprise communication needs for firms.
- Cloud-based distribution of market data on an a la carte basis is gaining traction as firms seek to move away from bundled market data offerings to pay for exactly what they need.
- In non-equity asset classes, such as fixed income, FX, cloud-based platforms connecting buyers, sellers, and intermediaries for low-cost price discovery mechanism is becoming popular.
- Meeting the regulatory requirement to store order and trade information for a long period and query them easily is most efficient through use of cloud.
- In areas of operational risk — such as surveillance, Know-Your-Customer (KYC), and Anti-Money Laundering (AML) — cloud-based solutions are being developed to run advanced analytics leveraging large volumes of structured and unstructured data.
- The trend of mutualizing cost and infrastructure for non-core areas (such as post-trade operations, regulatory reporting) is being enabled by cloud based central hosting of solutions, offered in many cases to multiple tenants.

Case Study: A Tier 1 Investment Bank

Previous approach involved writing business plan and presenting it to manager, for a budget to explore an idea — for approval. Ordering infrastructure, engaging IT to create this meant waiting period of 6-9 months for the server and then finding out that the \$250K and months of wasted time was not a great idea after all. The bank is now creating entire innovation infrastructure in the public cloud. Testing and decision-making has moved from months to days, increasing the desire to take innovative risks. DevOps is cloud-based, and production will be in the bank's own data center for the moment.

Case Study: An Asian Retail Broker

A retail broker in a leading Asian market did not renew its contract with its market data provider. Instead they set up cloud-based market data distribution for its retail clients. They collect market data from the local stock exchange and store it on a public cloud, where it is distributed in real time to its clients.

Buy Side

Generally, the buy side is much more inclined toward service-based models, acquiring technology over building in house (except a few very large players) and eager to utilize hosted solutions for most systems, including their trade management systems. Many buy side players, who used to get technology support from their broker-dealers, are being left out as many broker-dealers shrink such offerings and/or focus only on large, profitable buy side clients.

The buy side is dealing with a wave of new regulations, constant competitive pressure, and the need to remap their business for simplicity. They are faced with a wall of new costs, and are trying to lower costs as waves of changes sweeps industry. They are open to outsourcing everything except their core expertise and are facing regulatory and operational costs that could quadruple over the next decade according to BIS. Most of the buy side is looking for managed services and full solutions as a service, and are comfortable with these services being offered over the cloud. They are seeing the value of models that leverage managed services regardless of the cloud model: hybrid, public, or vendor's internal cloud.

- Hedge funds, active managers, and quant funds are keen on developing insights as quickly as possible, testing and implementing their investment research and

decisioning. Many of the most sophisticated hedge funds have deeply integrated systems for their research, trading and risk. These hedge funds are running proofs of concept to develop tools for testing investment and trading strategies on far larger data sets, running simulations and factor analysis in cloud infrastructure.

- Similarly, the buy side is leveraging the cloud in the running of sophisticated portfolio construction and what-if scenarios with massive data sets.
- In some of the core trading and OMS/EMS systems buy side firms have run through third party systems, vendors are remapping systems for private managed clouds; the savvy firms are ensuring that they have a path to other types of clouds as well.
- There is a rise of buy side firms that are choosing cloud solutions when offered deployed or cloud, and in many cases it seems that vendor-hosted clouds, while long tailed in certain cases, are an intermediate solution over the next few years.
- Smaller buy side firms find public cloud much more appealing due to lack of resources for managing internal cloud, higher cost saving potentials, and relatively fewer concerns around privacy and security. They are also very favorable to managed service offerings because those further relieve them from having to manage even public cloud operations internally.
- As firms look at the operational and regulation burdens, they are looking for cloud-based interactions with counterparties, reporting tools, and anything else that transforms a costly and lengthy implementation to a rapid build with subscription fees.
- There is considerable expectation and demand for more core portfolio accounting systems to be purchased by asset managers as a service.

Case Study: Tier 1 Asset Manager

In order to deal with the derivative collateralization rules implemented in Europe and the US, an asset manager had to choose among a proprietary build, deployed vendor solutions, and a cloud vendor solution.

The proprietary build was immediately dropped because it was offered at 50 times the price of an annual subscription of the cloud solution, and the cloud solution could be set up and run 15 times faster.

Principal Trading Firms

We are seeing tremendous leveraging of cloud for prop trading firms. Some of the most innovative moves in leveraging cloud models to gain the data centralization, analytical ease, and cost reduction have been trading firms and often principal trading firms with no client and hence the complicated regulatory burdens associated with client business. Here are some notable discussions, areas of usage, and ways in which firms are utilizing the cloud.

- Low-cost data ingestion and storage, and tools performing nearly their entire end of day (EOD) and T+1 analytics internally or those provided by cloud providers. In many cases, as performance in the cloud, increases, moving their analytical infrastructure, to not real time but nearly so. Hence, a path to moving to non-low latency but near real time in cloud for front office.
- Specialized providers of analytical and high performance databases have moved their infrastructure to run in cloud for massive reductions in computing time and costs.
- Specialized providers are offering full infrastructure as a service for all middle and back office and increasingly offering market data and market access via the cloud.

Case Study: A Leading US Market Maker

All transactional data — equity, option, ETDs, FX, and fixed income — is being ingested directly into public cloud.

They leverage both existing analytical infrastructure and tools available from the cloud provider for their EOD and T+1 analysis.

They are on the path to intraday analysis (not necessarily at line data speed but creating analysis in time intra-day time buckets (1 hour, 15 minutes, and even more rapidly), rather than just EOD.

Market Intermediaries

Some of the leading market intermediaries of the world — such as CME, Nasdaq, DTCC, Euroclear, and Deutsche Bourse Group — have been using private clouds for their internal operations for quite some time. Some players have highly sophisticated technology arms offering technology solutions to the marketplace, and they are now building cloud-based solutions for their clients, leveraging private and at times even the public cloud.

Market data is a key area for exchanges; leading players are developing solutions and analytics for point-of-trade and historical data for better investment deaccessioning, algorithm development, and risk and margin calculations. Some players are building cloud-based solutions in the areas of broker technology, surveillance tools, and collateral management solutions, as well as in the areas of regulatory compliance and reporting.

Cloud is enabling emerging market infrastructure providers to leapfrog the decades-long technology evolution curve followed by developed market players. In many emerging markets where the capital market ecosystem is burgeoning and infrastructure support is still developing, the need to offer scalable yet low-cost solution is making cloud a valuable proposition. Some of the emerging market players are working with their developed market counterparts to deploy cloud-based exchange, central clearing counterparty (CCP) and central services depository (CSD) technologies. Some have gone a step further and offer cloud based multi-tenant solutions to local market players, such as broker technology and surveillance tools.

Software Vendors and Service Providers

With growing adoption of cloud in the capital markets, the community of software and service providers are adapting their existing solutions and new players are emerging.

- Vendors need flexibility in offering clients deployed and cloud solutions of a variety of stripes. Vendors that can offer deployed, private, managed, and public cloud solutions are gaining market share relative to solely deployed solutions.
- Incumbent providers are developing cloud based delivery channels for traditionally on-premise solutions; in some cases they are being forced to expedite their cloud programs, driven by demand from their largest clients. This evolution has allowed the development and proliferation of Software-as-a-Service (SaaS) model.
- Some providers are offering lighter versions of their existing solutions to downstream segments. For example, trading or post-trade technology components traditionally offered to large institutions on an on-premise basis are being offered as packaged solutions to mid-tier or smaller institutions,
- Cloud's high scalability and flexibility are allowing development of solutions leveraging advanced analytics such as artificial intelligence and machine learning, as well as other big data tools leveraging structured and unstructured data.
- A diverse ecosystem of incumbents and start-ups is emerging, but cloud is really the lifeline for the start-up community because it very low cost, and ease of deployment is essential for their survival.

- The incumbent providers are reacting by forming partnerships with upcoming providers, and in some cases establishing innovation labs themselves that work closely with their existing solution divisions.
- Some of these players are using private clouds to serve their client community, while others are partnering with public cloud providers.

CAPITAL MARKET USE CASES

**Key
Research
Question**

2

What capital market use cases are leveraging the cloud, and who are the solution providers?

The cloud is driving innovation across the capital market value chain, remapping data, analytics, trading, and risk operations. A range of providers from incumbent vendors to new entrants are coming up with cloud based solutions solving specific capital markets problems

In this section we explore use cases across the capital markets value chain with a focus on data distribution, trading, and operations. Table 1 is an overview and describes the areas in which Celent explores in the reshaping of the capital markets.

Table 1: Capital Markets Cloud Use Cases

AREA	BENEFITS
Market Data as a Service	<p>Lower cost, scalability, redundancy</p> <p>A la carte offerings of data.</p> <p>Ease in processing and analyzing.</p> <p>Data gravity lends itself to better cheaper analytics and ML.</p>
TradingTech as a Service	<p>Ease, cost, flexibility of connectivity, market data and trading at single point.</p> <p>Scalability, ease in costing on massive storage. Ease in expanding strategies and markets for analysis.</p> <p>Opportunities to create new data/trading strategies as more of trading infrastructure moves to cloud.</p>
Post-Trade Processes as a Service	<p>Cost, ease of implementation. Flexibility in leveraging for internal and clients.</p> <p>Focus on core expertise and outsourcing noncore processes.</p>
Risk-Compliance Solution as a Service	<p>Ease in access and leveraging native tools.</p> <p>Ease in merging disparate data sets (market data, reference, and proprietary data).</p> <p>RegTech as a Service.</p>

Source: Celent

MARKET DATA AS A SERVICE

Xignite

Xignite is a provider of cloud-based market data, distributing market data, sourced directly from exchanges and data vendors, to financial institutions, FinTech start-ups, media and software companies. This model is a significant departure from traditional market data distribution mechanisms such as terminals and legacy data feeds that require significant infrastructure investments and deployment time.

Xignite collects market data covering all key asset classes from over 150 global sources. The data, received in disparate formats, is then cleansed and normalized

(which is traditionally done by in-house staff at market data vendors), and stored in the public cloud of Amazon Web Services. It is then delivered via REST APIs; users have several delivery options from streaming real-time and delayed quotes directly to client apps, or getting intraday, end of day or historical prices. Users can also specify they type of data need such as quotes, ticks and bars, or fundamentals, and can buy data for a specific region or worldwide. All of Xignite's web services include unlimited usage and are offered as an annual subscription.

The cloud based distribution approach relieves user institutions significant infrastructure investments for storage and streaming of data, while use of AWS allows for massive scalability. Users can deploy and independently operate the Xignite platform in their own cloud environments. This also allows for easy development and running of new analytics based on this data – a feature that is becoming increasingly important as financial institutions look to run new analytics to generate alpha, and developers seek to build new applications leveraging cloud APIs. Xignite is developing a growing catalog of APIs for manipulating market data; for example, its CloudAlerts API provides exception-based alerting for market events through automated real-time monitoring of market developments; it allows users to easily create, search and delete alerts associated using this API.

Some users have gone a step further: rather than building and operating data infrastructure themselves, they are delivering data from Xignite directly to their customers' devices. Its CloudStreaming offering is targeted at institutions who want to stream real-time or delayed market data directly to client apps but do not want to spend the time or money to build out and manage production infrastructure.

Current latency levels of public cloud allow use of such data to capital market functions that require seconds-level of latency – such as in algorithm development and testing, risk calculations. Xignite's current clients are using its data for several of such activities in wealth and portfolio management space, robo-advice, research and analytics, retail brokerages, compliance as well as in back-office processing.

Additionally Xignite has developed a managed platform – Market Data Cloud – that gives financial institutions full transparency on reference and market data distribution (four main data types: master, real-time, historical, and fundamental). Here Xignite centralizes and catalogs first-level real-time and reference data that firms license from vendors or contribute internally. It then tracks every data request inside the firm that helps in intelligent usage and consumptions analysis, and elimination of duplicate requests optimizing data usage efficiency and cost. Centralizing data also facilitates responses to new regulatory demands. The Market Data Cloud platform is hosted on AWS and does not require any hardware or software allowing easy and quick deployment.

FORECASTING CLOUD ADOPTION: ALL CLEAR FOR MORE CLOUD

Key Research Question

3

What are the dark regions and silver linings for cloud adoption in capital markets over the next 24 months?

Data security, regulatory guidance, operational complexities and organizational inertia can be roadblocks to cloud adoption; improving security features, better understanding, and successful use cases will demonstrate that cloud's benefits clearly outweigh the concerns.

BARRIERS TO MORE CLOUD

Data security and sovereignty issues continue to be causes for concern for many players in the industry. Lack of specific regulatory guidance over operational aspects of cloud, especially while outsourcing cloud operations to third parties, is another challenging issue for some firms. Integrating cloud-based infrastructure and applications with banks' other parts adds to operational complexities. Lastly organization culture, inertia, and "generational gap" in embracing the new technology are slowing down the pace of adoption.

COMPETITIVE SHIFTING

Given the desire to move to the cloud, it puts pressure on firms that are in the business of selling infrastructure as opposed to renting it. The mind set of moving to a sharing economy and serverless infrastructure is forcing fundamental changes to vendors — increasing the pressure for them to offer cloud-based models for deployment.

Furthermore, a wide array of tool providers that support everything from network analytics, performance measurement, and data tools to analytics and visualization, are coming under direct attack from native offerings by the cloud providers.

THE JOURNEY TO CLOUD NINE

We see several approaches and initiatives underway to alleviate the challenges and pave the way for more cloud adoption.

- Cloud providers, including providers of public cloud, have significantly strengthened their security features. The amount of investment in encryption technology and decryption techniques is exponentially increasing, and cloud providers are natively addressing this. Providers are creating more options for data residency within national borders if that is required. The resources available from specialized cloud service providers will dwarf what firms can do on their own.
- Personal privacy and locality concerns are being addressed as regulators see various cloud models as another outsourcing process. In many cases regulators such as FINRA in the US and FCA in the UK are coming up with clearer guidelines on cloud usage and/or leveraging public clouds for their own data storage.
- On the European side, the lack of clarity around the General Data Protection Regulation (GDPR) and its enormous scope and potential for large fines is creating a situation where firms are treading very carefully.

- Finally, huge cost pressures are forcing many firms to overcome inertia and organizational bottlenecks.

With increasing cost pressure and exploding data volumes, we see a secular shift toward more flexible infrastructure in the capital markets. Electronification of newer asset classes and digitization of information will accelerate this trend. The challenge for established technology firms and market operators will be to find the correct means of collaborating with new business models and innovative technologies.

In addition to the several use cases discussed in the report, we see new cloud-based solutions and models emerging by the day. The aversion to cloud from some of the key constituents of the industry has clearly given way to great interest and increasing adoption, though there can be great variations in state and rate of adoption across the industry. The buy side is ahead of the sell side, new functions are easier to test and produce in the cloud than tackling legacy operations, and commoditized noncore areas are more likely candidates for cloud than proprietary and core competitive functions. We expect the migration to cloud to have a long tail, but cloud will be an essential ally to leaders and early adopters in easily navigating and adapting to the industry evolution.

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Typical projects we support related to capital markets include:

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Business practice evaluations. We spend time evaluating your business processes, particularly in Securities & Investments. Based on our knowledge of the market, we identify potential process or technology constraints and provide clear insights that will help you implement industry best practices.

IT and business strategy creation. We collect perspectives from your executive team, your front line business and IT staff, and your customers. We then analyze your current position, institutional capabilities, and technology against your goals. If necessary, we help you reformulate your technology and business plans to address short-term and long-term needs.

SUPPORT FOR VENDORS

We provide services that help you refine your product and service offerings. Examples include:

Product and service strategy evaluation. We help you assess your market position in terms of functionality, technology, and services. Our strategy workshops will help you target the right customers and map your offerings to their needs.

Market messaging and collateral review. Based on our extensive experience with your potential clients, we assess your marketing and sales materials — including your website and any collateral.

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