TradingTech Insight
From A-TEAMGROUP

Trading in the Public Cloud: Attitudes to Cloud Adoption in Capital Markets

Commissioned by:

Rapid Addition
Electronic Trading Innovators

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1. Introduction

Introduction

Capital markets have been slow to embrace cloud technologies and in particular the public cloud. Practitioners have been wary of issues around speed/ performance, privacy, security, and cost. All of which can dampen the appeal of cloud technologies for trading firms even before the complexity of migrating legacy applications is considered.

But broad acceptance of cloud by other industries is highlighting some compelling benefits (primarily in terms of scalability, flexibility, and time to market) forcing financial institutions to take cloud more seriously.

To assess where the marketplace currently stands on the use of public cloud in electronic trading workflow, trading technology specialist Rapid Addition commissioned A-Team Group to survey 20 leading capital markets firms from across the trading spectrum – from exchanges and sell-side banks to asset managers and interdealer brokers.

The survey was specifically designed with open-ended questions to elicit an 'under the hood' view of current thinking. And while it does not pretend to be a comprehensive analysis of the current state of play, it provides some fascinating insight into how trading organisations view cloud.

This report contains the findings of the survey, outlining potential benefits, assessing advantages, identifying potential obstacles, and examining which functional areas are best (or worst) suited for deployment in public cloud environments. Finally, it looks at the future and suggests what developments may be coming.

2. Today's Cloud Experience

Today's Cloud Experience

Multiple projects ongoing

The A-Team survey found a mixed picture of cloud usage, with most respondents saying their firms operate multiple cloud-based projects. Few, however, said they were reliant solely on cloud technologies. Most combine on-premises hosting and/or processing with a degree of cloud technology in a hybrid deployment that seeks to take advantage of the benefits of both.

Those companies that outsource significant parts of their trading workflows often leverage cloud-hosted third-party applications. This is especially the case among Tier 2 and Tier 3 buy-side firms. "We are dependent on the extent to which vendors place their trading and analytics into the cloud, and how/where they store the data we use in trading," said one.

Driven from the top, resistance from below

Many cloud initiatives are often driven 'top down' by organisations' senior leadership teams. C-suites are keen to announce cloud initiatives, adopting a "cloud first" public stance to demonstrate that their organisation is not being left behind by the wave of digital transformation. One respondent highlighted how his company's cloud strategy was publicly announced at an event co-hosted by a major cloud operator before being communicated more broadly within the firm.

However, a top-down approach has not always resonated positively within organisations. Some respondents suggested that while cloud technologies are being embraced at the senior level, "once you trickle down through the company there may be less enthusiasm" as the realities of deployment in the face of highly restrictive and complex capital market practices sink in.

> ***"People have embraced cloud under the misconception that it's by definition quicker to deploy and cheaper in terms of operational costs"***

Long-term play

Driven by corporate cloud strategy, many firms are exploring applicable use cases in trading because they view migration as a long-term play (even if the benefits are not immediate). A common sentiment was articulated by one respondent: "I'm not sure whether it will happen within the next 12 months, as we've been working on it for two years already."

Another suggested that cloud was offering fintech firms a platform to become disruptors without the overhead of legacy platforms. This has enabled them to build functionality more quickly. More established firms need to change their cultural mindset to allow developers to build fast, fail fast and move on.

This methodology will likely supersede existing approaches to IT and data management. The issues around cloud deployment, especially concerning latency and security, are not insurmountable, said one respondent. However, "it's a multi-year journey", they conceded. "Trading firms want to get out of the infrastructure business, but they need to do that while hanging on to liquidity. It will take time."

The 'agility lie'

The benefits of cloud have often been trumpeted, less so the challenges. Without careful planning, migration can be costly, time-consuming, and potentially high-risk. There are also security and regulatory controls that need to be considered when deploying a cloud-based strategy, which if not managed properly will lead to trouble ahead.

"People have embraced cloud under the misconception that it's by definition quicker to deploy and cheaper in terms of operational costs," said one observer. "But the reality is that the stringent controls required of financial services organisations – from regulators, management, and reputational considerations – mean it's far more expensive and much slower to migrate than expected or hoped."

Further, cloud is unlikely to suit all use cases or even organisations. Like all technology, there is no one-size fits all solution. The degree of agility offered by cloud, for instance, may depend on existing infrastructure architecture. As one respondent put it: "There is a big difference between 'lift and shift' of parts of the existing business to the cloud compared to the re-architecting of systems for cloud readiness. The current design state would dictate this."

Reining back on initial ambitions

The unsuitability of cloud to some organisations has led to pushback. While there is acceptance that cloud is here to stay, at least for certain elements of the trading workflow and adjacent activities, many are questioning its applicability to functions across the board. As a result, the initial enthusiasm for cloud is waning in some quarters, and it is no longer regarded as the panacea that many had previously believed it to be.

One respondent said firms were disappointed when they attempted a "lift and shift" approach for on-premises systems. They found that promised benefits did not materialize following the transition, and instead, they saw costs rise. Without simultaneous organizational transformation, those seeking to adopt agility and DevSecOps won't be successful.

Firms also lamented the lack of clarity from the major cloud operators, particularly around their plans to address latency issues and multicast. Data security and privacy issues were also a point of concern that several respondents felt had yet to be fully addressed.

"The hope is that trading firms can get out of managing their infrastructures," said one practitioner. "But the truth is that any latency-critical application can't run in the public cloud as of today."

3. Perceived Benefits of Cloud

Perceived Benefits of Cloud

While the real-world experience of transitioning electronic trading to the cloud may not be living up to everyone's expectations, firms are experiencing concrete benefits that are translating into more efficient workflows. These can be divided into primary benefits – those that have a direct impact on business operations – and secondary benefits, which may affect firms' wider agendas.

Primary Benefits

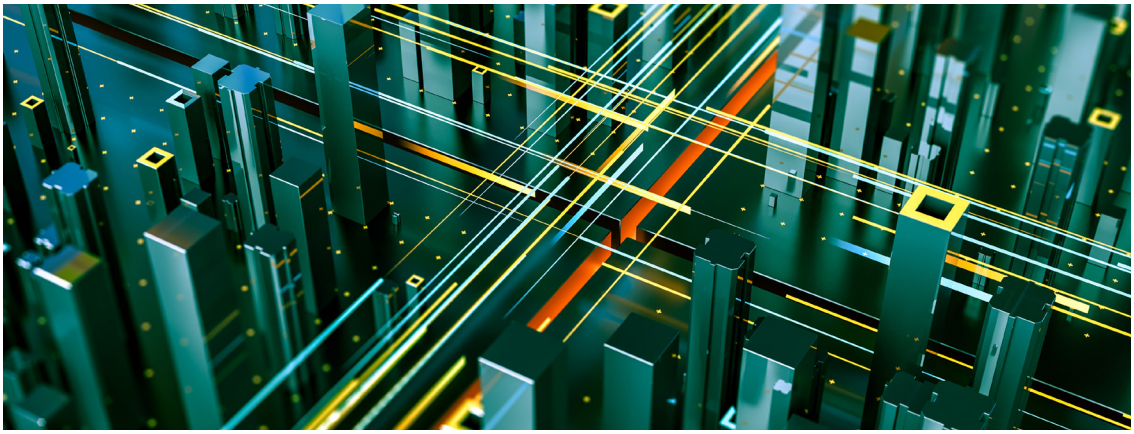
Agility/elasticity

Agility and elasticity were cited as key benefits of cloud, especially where firms want to rapidly deploy technology in support of new lines of business but retain the optionality to withdraw rapidly when needed. This was particularly useful when targeting regions where firms have no physical infrastructure footprint and are reluctant to invest heavily in new installations.

Common observations among companies are that cloud provides opportunities for easier upscaling and accelerated procurement, all via an easily accessible global infrastructure. In turn, that helps streamline the delivery of new services to customers and prospects, improving time to market.

Unplanned access to capacity

One of the cloud's most acknowledged benefits is its near-limitless storage and compute capacity, freeing companies from the often slow and expensive process of expanding on-premises infrastructure as business needs change. For many organizations, access to capacity outside of planning cycles is recognized as a key benefit, empowering them to be more responsive to customer and market demands. Being able to increase capacity and then reduce it as required, if managed properly, means improved cost control and potentially a higher risk threshold for innovation.



The ability to adopt an opex model (rather than capex) for experimenting with new business lines or markets can lower the bar for management and finance sign-off. Feedback suggests that this approach gives trading businesses more agility when responding to emerging opportunities, but also reduces the pain of exiting less successful ventures.

Spin up/down for testing

Indeed, several survey respondents cited the ability "to spin up or spin down" processing capacity as a key benefit, particularly for testing different aspects of their trading workflow. This offers firms the agility they often lack to quickly respond to new trading ideas, customer requests, or market dynamics.

Coordinating projects requiring additional physical hardware is challenging, whereas increasing cloud capacity is less reliant on lengthy procurement processes. Respondents cautioned, however, that firms need robust approval oversight to ensure costs don't get out of hand, warning of the dangers of staff spinning up environments without approval/budget or failing to spin them down again. Given the ease of increasing capacity, ensuring teams only subscribe to what they need is critical to managing cloud costs.

Catalyst for innovation

The capacity and scalability benefits of cloud give organizations the tools and space to innovate, unshackled by the limitations that an on-premises solution might impose. That liberates resources, including expertise, that can be dedicated instead to value-adding research and development, potentially giving a competitive advantage to organizations that adopt cloud.

One observer noted that the "on-cloud" ecosystem of vendors, market operators and trading firms "will accelerate and offer a higher order of value, and much of this will be more readily, or easily available within the cloud – this dynamic is similar to the old collocation pattern we have seen in fintech focused hosting centres".

Ease of Big Data Integration

Managing vast amounts of data is a key to digital transformation. It's the only way to unlock the full value inherent in an enterprise's data assets. But that isn't an easy task; it requires pre-ingestion cleansing, standardization, mastering and a host of other processes. Much of that can be automated, but certain data is less structured and trickier to incorporate without the use of advanced techniques.

Not only can cloud easily host the huge datasets needed by modern trading floors, but it can also support the computational power needed to process and manage that information. Cloud's ability to host AI capabilities such as Machine Learning (ML) and advanced simulation models was cited as key to collecting, processing

and analysing massive amounts of data. Indeed, ML has become a crucial part of automating workflows, particularly pre-trade analytics and stress-testing quantitative models and algorithms.

Data storage

A common cloud use case cited by many respondents was tick data storage. For on-prem setups, storage upgrades come at a cost, making for some tough choices when a firm's data needs outgrow its infrastructure capabilities.

To circumvent this, some organisations are leveraging cloud's elasticity to apply processing resources to large data sets for a relatively short burst for specific tasks across the trading value chain, such as analytics and risk modelling or regulatory compliance checks. Not everyone was convinced that this is a great benefit. One respondent argued that "if everyone who needed bursts requested them at the same time – as markets do – it would be a disaster."

Availability of expanded toolsets

Another potential benefit is more targeted capabilities for specific teams rather than the limitations of general-purpose on-premises infrastructure or expensive dedicated tech silos to support specific workflow. At one respondent's firm, this has extended access to ML and streamlined model development tools. While other companies have applied a hierarchical deployment of workflows, with teams requiring faster and more advanced tooling moving to cloud, where the latest and most powerful toolsets are available.

Potential infrastructure cost savings

Most respondents acknowledged that cloud deployment couldn't guarantee reduced infrastructure and operational costs. This is partly due to the nature of capital markets where peak transactional and data volume occur simultaneously (for instance, US market open, end-of-day auctions, non-farm payroll or regulatory requirements for operational resiliency), limiting the ability to spread workloads to times of lower utilization.

However, some did say that the potential does exist for cost savings, based on cloud's flexibility and elasticity compared to on-premises implementations, where hardware needs constant updating or is under or over-utilized. Cloud can eliminate cost by removing the complexity and staff overhead of managing on-premises environments or through pricing that cloud providers can achieve through economies of scale.

Pay-per-use structures that can be switched on and off when needed, giving the flexibility "scale up and down in line with flow" remove the need to invest in infrequently used capacity.

As mentioned, not all the benefits attributed to cloud migration will be experienced by adopters. Some respondents noted that the above benefits were only applicable to dynamic workflows, such as burstable loads. They don't, however, exist for static or predictable workloads, in which circumstances, said some, the costs are greater in the cloud.

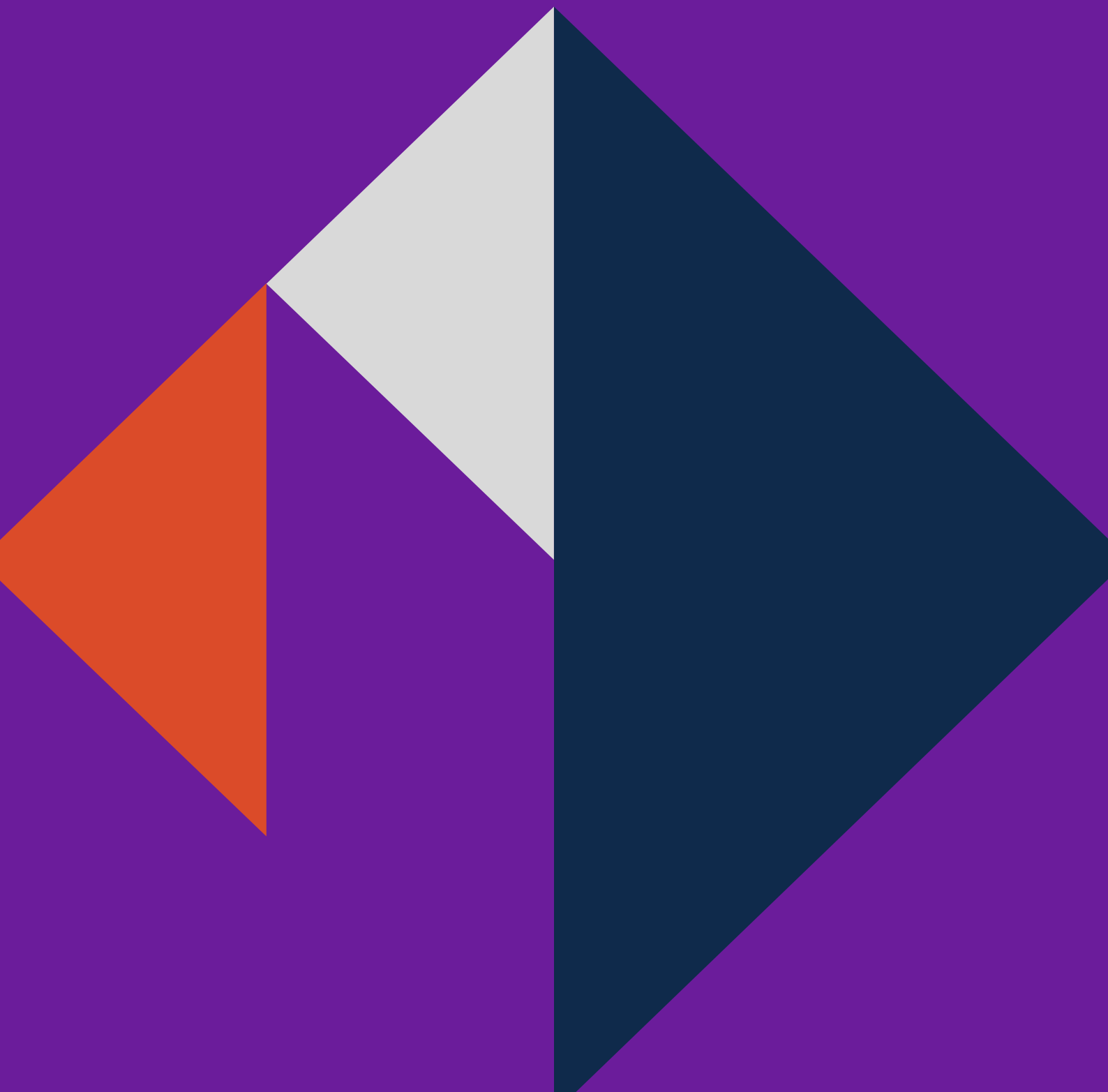
One respondent described a massive cloud infrastructure in production for the firm's US municipal bond trading operation. The firm found cloud to be an appropriate platform for rapidly deploying algo analytics for munis when it first entered the space and needed the flexibility and scalability to quickly scale up operations. However, with the business now established, the respondent questioned the ongoing need for cloud, suggesting that its now predictable workloads for pricing around a million securities overnight may better be suited to on-premises infrastructure since elasticity is less relevant. Such are the nuances of the applicability of cloud technologies to certain scenarios.

It is also worth noting that a direct comparison of costs can be challenging in larger firms where the true cost of ownership of trading infrastructure is often opaque or based on shared resources which don't dissipate if one function in the organization chooses to leverage cloud. Lack of transparency and centrally controlled cost allocation models can act as a handbrake for adopting cloud technology where the financial implications are unclear.

Secondary Benefits

Cloud may also offer tangible benefits as part of a wider corporate strategy. For instance, some respondents pointed out that the big cloud operators were further ahead in their environmental and sustainability programs than many financial institutions. Others mentioned that organisation-level 'cloud-first' strategies have been credited for helping the recruitment of technology staff, signalling to prospective talent pools that they will have the opportunity to work with modern, pervasive technology that can be career-enhancing.

4. Obstacles to Cloud Adoption



Obstacles to Cloud Adoption

Even for committed protagonists, cloud represents its own set of challenges. The survey respondents identified several obstacles to adoption that ranged from performance-related and practical issues to more strategic or political barriers.

Latency/determinism of performance

Across the board, latency and performance were identified as potential deal-breakers when it came to deciding whether to adopt a cloud-based strategy. A common view is that cloud is not yet capable of supporting the latency-sensitive demands of certain aspects of electronic trading. That doesn't, however, preclude the use of cloud for other parts of the trading value chain, which can be isolated and migrated using a hybrid model. For instance, a hybrid approach would be suitable for use cases where the data consumed or distributed is not actionable, one observer noted.

Underlying infrastructure poses a key limiting factor, said one respondent at a major global exchange. Referring to trade execution, he explained "latency requirements for highly liquid and active markets currently require engineering at the level of hardware," adding that typically such hardware is physically co-located with the trading venue's matching engine. "However, that leaves the vast majority (95%+) of systems and applications as fully eligible for cloud. As market operators create cloud co-location options by bringing cloud cross-connect to their physical data centres, this will also open hybrid opportunities for market participants to leverage physical co-location with cloud utility or trade-supporting applications."

> ***"We haven't managed to make a decision on using cloud for data backup. It should be a piece of cake to adopt the cloud to host backup data, but it isn't."***

Pre-trade risk filters and execution algorithms were among the functions respondents said could not be migrated to the cloud because they relied too heavily on the sort of speeds cloud cannot deliver nor ensure deterministic latency. That was especially true for high-frequency trading. Long-only institutions might be able to manage better in the cloud, but there are still questions regarding execution quality in liquid markets. As a result, not all respondents agreed that a hybrid approach is achievable.

Some respondents were doubtful that cloud's limitations could be remedied soon. Its inability to host multicast was cited as one reason:

"There are issues around real-time market data, which is difficult to do effectively without multicast," one said. "Currently multicast isn't possible because the big cloud operators use SDN for flow management and multicast doesn't work in a managed flow environment. The operators seem to think they can achieve multicast using TCP. I don't think they understand." This comment highlights the feeling in certain quarters that large public cloud providers haven't, at least in the past, focused enough on the specific requirements of capital markets users.

While it is true that achieving ultra-low, deterministic latency is challenging in a cloud environment, these concerns are perhaps viewed through the lens of highly liquid markets. Latency and performance may be less of an issue depending on the type of asset class and trading model. For instance, one respondent suggested a continuous auction model would eliminate the issue of latency, while fixed-income markets are already trading via RFQ models over cloud-hosted platforms.

Data security/privacy concerns

Notwithstanding cloud operators' state-of-the-art stance on data security, respondents were reluctant to place sensitive data into cloud environments. Many said their organisations were happy to designate their data as "hot and cold", the former of which would be kept in-house where security could be controlled by the owner.

Regulatory restrictions in some jurisdictions even prevent sensitive data from being held outside of the owner's own systems or jurisdictions, some observers noted.

Nevertheless, several respondents felt that the cloud providers offered better security than most banks and that the risks posed in using third-party architecture were probably no different to those presented by in-house infrastructure. One proponent argued that banks and financial institutions simply need to "get comfortable with security in the cloud and adapt current on-prem procedures and policies".

Organizations will have to determine whether this is a real or perceived risk, however, the level of IT security investment and expertise prevalent in the large cloud providers dwarfs that of any individual bank or exchange. Arguably, for many financial firms, cloud might reduce their cyber vulnerability.

Need for control

Another pause for thought when considering cloud migration is the desire to maintain control over trading infrastructure given its importance. There is a sense among respondents that cloud infrastructure takes away autonomy.

"We want to have more visibility down to the tin with regards to bursts and determinism," said one respondent. "Yes, we can do things in AWS but I want to

know where everything is, and I want absolute control. We want our own private area, not just assurances. I want to know so I can maintain accountability."

Other common concerns regarding cloud migration are loss of control over data protection and accessibility (especially for regulatory compliance), and the risk that comes with data concentration.

Complexity of migration

Perhaps the biggest challenge is the initial move to cloud architecture. Respondents cited the complexity of their own organizations and legacy applications as a major barrier to migration. Along with a lack of requisite skills, the cultural change needed to execute such a transition can be a significant handicap.

"Adopting DevSecOps and the requisite people, skills, processes, tools and cultural change needed to fully gain advantage from cloud, together represent a significant barrier," opined one participant. "To re-engineer existing applications - in many cases, this may require rewriting apps and re-skilling technology and product teams - you need to introduce an agile culture."

Specific IT skills are required to identify how a siloed on-premises setup can be successfully migrated to cloud. Moving legacy applications can be highly complex and becomes increasingly complicated for larger institutions as the scope broadens across asset classes and markets. The potentially substantial cost of hiring and training those skills needs to be factored into any change.

Cloud operators' lack of clarity

Cloud operators have been criticized for providing too little clarity about their own technology and business plans, and that has been a hindrance to respondents' efforts to assess the applicability of cloud for certain use cases.

Respondents suggested difficulties were encountered in seeking help or explanation for several migration-related issues. Among them were questions about reliability, support availability, system robustness and even data backup capabilities.

"We haven't managed to make a decision on using cloud for data backup," said one frustrated participant. "It should be a piece of cake to adopt the cloud to host backup data, but it isn't. This is down to the relatively vague statements of intent vis-à-vis what [the operator] wants to do as an organization."

Potentially higher operating costs

Attributes that make cloud a viable proposition for some have proven an impediment for others. Cost and scalability are among the most common reasons cited for companies adopting a cloud-based strategy. But observers noted that once

target levels of scale had been reached, cloud may cease to offer competitive value.

Having helped to initiate lines of business or enter new markets, the elasticity offered by cloud can become less necessary for some respondents, becoming economically less attractive. "Cloud has a role to play to get things started, but once you have scale its value is more questionable," said one.

Concentration risk

When data is concentrated in a single or limited locations, it becomes vulnerable to outages that impact business. The large cloud providers invest heavily in infrastructure and service continuity, but are not insusceptible to loss of service, as was demonstrated on June 13th this year during a short but wide-reaching AWS outage. While business suffers when systems drop, they can eventually be rebooted. That can't be said of the impact on reputations, which can result in longer-lasting damage.

The perception of lost control that some organizations already harbour regarding cloud can be compounded when systems unexpectedly go down, with little means of influencing service resumption.

"Concentration risk is the killer – the more we load in, the bigger the impact of an outage," said one respondent. "If we have 20 apps in the cloud, it feels like a major data centre outage if it goes down. Fundamentally, the model is flawed. It's like having everyone working on the same mainframe," suggested one critical respondent.

Others noted from experience that outages at cloud providers and operators have not been uncommon. Some questioned operators' boast that they can manage bursts, arguing that if each client executed this simultaneously, there would "be a disaster". Given the choke points in financial markets, such as US market open, end-of-day auctions, etc., it's easy to see why the financial industry may create some unique challenges.

This is further complicated by regulatory oversight. European Banking Authority guidelines and MiFID II insist that financial firms remain fully responsible for all the activities they outsource, while EU regulators have also tried to address this concentration risk by encouraging the development of multi-cloud services. Cloud interoperability is not straightforward, so it remains to be seen how practical this is. One trading venue highlighted that their response to this was the implementation of a hybrid cloud/on-prem business continuity model.

Individual firms will need to decide their approach and carefully consider whether building and running their own infrastructure is really any more robust than leveraging cloud services (particularly when budget and resource constraints are taken into consideration).

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5. Applicability: Which Areas of the Trading Workflow Are Most Suited to Cloud?

Applicability: Which Areas of the Trading Workflow Are Most Suited to Cloud?

With many firms seemingly intent on pushing as much of their operational footprint to the cloud as feasible, which functional areas represent 'low-hanging fruit' and which just aren't applicable either now or in future?

To some extent, the areas identified as potentially 'in-scope' by the survey aren't surprising [See Chart 1, Page 21], suggesting that trading firms want to retain control over the highly latency-sensitive components of trading workflow to ensure deterministic performance.

And yet, some respondents described projects that appear to break with this view. For instance, one firm said it was deploying a global equity order routing network in the cloud. While this is less latency sensitive than trade execution, it is a critical real-time link in the trading value chain, suggesting firms may be reaching further than is apparent on the surface.

Respondents also suggested that certain asset classes were fundamentally better suited to cloud-based applications than others [See Chart 2, Page 21]. This tended to correlate with the latency profile, with less liquid and more opaque asset classes like OTC derivatives and thinly traded fixed-income securities perceived as more cloud-ready than listed equity and derivatives markets.

Of course, the 'green-field' site' opportunity of digital assets and cryptocurrencies is seen as a prime example of how to build workflows in a cloud-native environment. But even practitioners in traditional asset classes see cloud as an opportunity to rethink existing practices. One major global equities exchange described using the public cloud to spin up a new area of business, initially for testing but ultimately for full-production trading.

> ***"People don't want to be trailblazers," focusing on specific initiatives - say a tick data project - may be the way to go."***

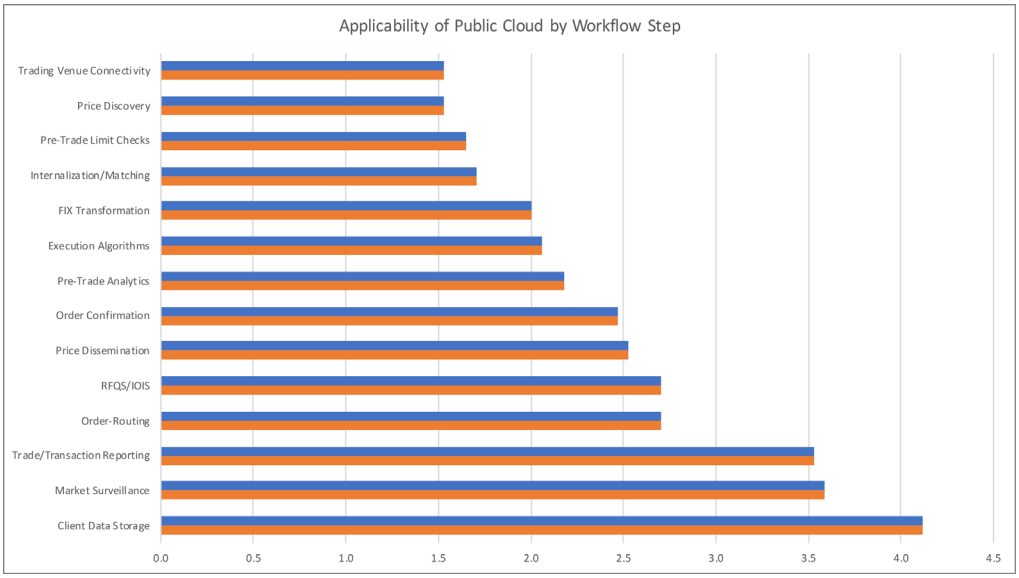

Chart 1: Applicability of Public Cloud by Workflow Step

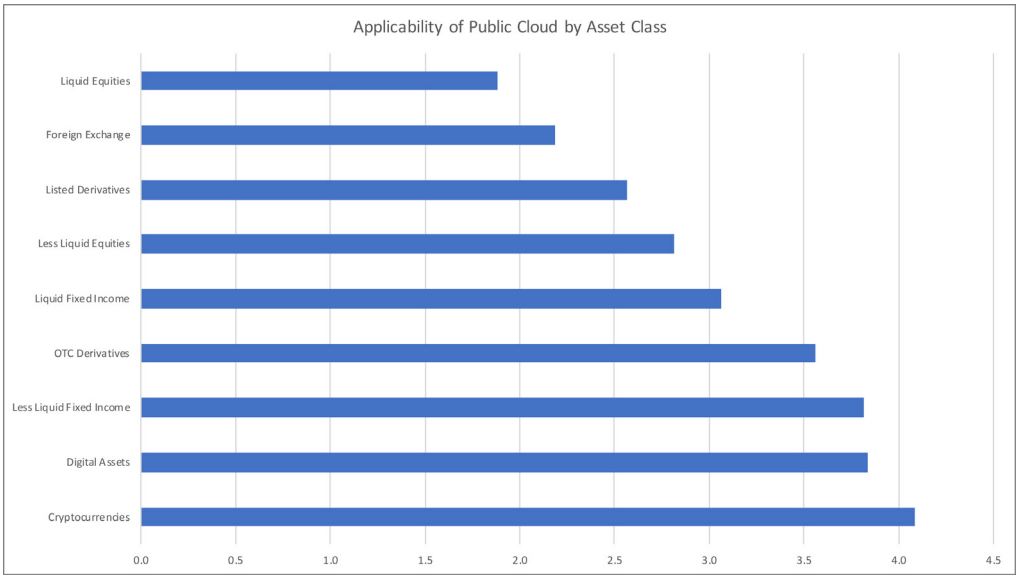

Chart 2: Applicability of Public Cloud by Asset Class

6. Industry Approaches So Far

Industry Approaches So Far

Given the opportunities and challenges identified by survey respondents, how are practitioners approaching the deployment of trading-related functions in the public cloud today?

Understandably, the response was mixed. At one end of the scale, a representative at a US broker said his firm had invested significantly in a major project based on public cloud infrastructure for part of its trading workflow. Others, meanwhile, had made less progress, dipping their toes with pilot projects often for use cases involving high volumes of static data and low requirements for speed of outcome.

"We expect to see greater adoption, but some services will stay off public cloud," said one respondent at a major UK bank, underlining that not every function may be applicable for migration to the cloud.

Whatever the appetite, several common characteristics of cloud infrastructure emerged from the research:

Elasticity as a key determinant of applicability

One key message is that cloud works well for elastic workloads, but advantages may taper off once the elasticity element no longer applies. This relates to the initial cost advantages and low-risk approach cloud affords to new initiatives, where the business outcome is perhaps uncertain. Once an idea has proved itself to be viable – and the processing capacity required is understood – the economic benefits may no longer be clear-cut.

Said one respondent: "We have algo analytics in the cloud for one of our trading operations. However, my guess is that they would shift off cloud if they could get physical servers to handle it themselves. It was a new business and they needed the flexibility of cloud to get started. Now that they have scale, the economics have changed, so the elasticity element no longer applies."

Acceptance of the hybrid model

For capital markets firms where low latency is a factor, the hybrid on-premises/cloud model represented a common approach for optimising their trading technology stacks and access to adjacent services such as analytics.

Under this scenario, latency-sensitive functions including real-time market data, venue trading connectivity, and pre-trade risk checks were seen as functions unlikely to move away from specialised platforms (such as FPGA solutions in colocation sites) any time soon. But practitioners surveyed are increasingly using the

public cloud for testing algorithms and other analytical applications, especially those requiring large data sets.

The control challenges and potential costs of maintaining such a hybrid environment were recognized by survey respondents. For these practitioners, the question remains whether the blended cost of piecemeal cloud adoption is beneficial, and what control over performance/resiliency the trading entity retains.

Respondents, though, felt that the cloud operators were attempting to make life easier for those requiring a hybrid approach. Said one respondent at a major US exchange: "Some of the need for on-prem hybrid may be addressed by the cloud providers offering to extend cloud to customer data centres - AWS Outpost is an example - as the cloud providers themselves create hybrid solutions. The advantage to customers would be private hardware and the use of physical equipment fully integrated within the cloud provider and full use of their management tooling across the whole hybrid environment."

Incremental approach

Many survey respondents said they preferred to take small bites, initially targeting less critical or readily applicable projects adjacent to the primary trading workflow. "People don't want to be trailblazers," said one respondent, "focusing on specific initiatives - say a tick data project - may be the way to go."

Others saw a major opportunity to reduce their on-premises footprint by transferring support services to the cloud, benefiting from reduced management overhead and improved tooling. Said one: "Many of our trading support applications (non-real-time) are currently deployed to cloud, or currently moving to cloud."

Control is paramount

Control was seen as a prerequisite for cloud acceptance. Respondents said the markets' future appetite for public cloud may depend on the level of transparency around their cloud infrastructure and the extent of control afforded to them.

7. Looking to the Future

Looking to the Future

If the picture of cloud adoption by trading firms and market services providers is a little grey today, is the outlook brighter tomorrow?

Several respondents suggested the mixed appetite for public cloud could change if one of the major providers made a significant play for the financial markets. Said one: "I still wonder what would happen if, say, Google came in and made a play for the entire global FX marketplace," said one. "But could they be bothered?"

On the surface, it appears that Microsoft could be bothered, considering its 4% investment in the London Stock Exchange Group (LSEG) and the potentially transformative shift to cloud hosting that could usher in. But the initial emphasis of the LSEG/Microsoft arrangement is on back-end architecture and integration of LSEG's processes with Microsoft's applications, particularly its Office suite. However, both partners have suggested that they could go further in future.

Latency-sensitive applications such as algo execution and real-time market data may never make the crossover, according to some practitioners. "Very latency-sensitive markets and specific applications that are racing to zero in terms of message latency are less likely to have advantages in moving to cloud," said one exchange respondent. Conversely, "other applications, if engineered appropriately, will benefit from infrastructure-as-code, ease of disaster recovery, better resiliency, scalability, capacity scaling and scheduling, enhanced security and application visibility, change and innovation agility."

But sifting value from these possibilities may itself represent a challenge as firms move forward with their cloud plans. One survey respondent warned of the need to differentiate between "false drivers; cost, perceived security, and real drivers; agility, expanded toolsets and capabilities, ease of Big Data, scalability, and machine learning and model development."

Added another, "The continuous collection of data on application usage will provide advantages in observed customer behaviours, allowing for continuous improvement to deliver better customer outcomes, taking advantage of Big Data and Machine Learning tools in cloud."

In the long run, practitioners believe issues around latency, performance and uncertainty of value will be overcome. "Over time, cloud providers will offer a full array of services in relevant data centres, replicating on-prem," said one survey respondent. "Then there will be little difference and the advantages will outweigh the disadvantages."

Along similar lines, another suggested that "If the connectivity between firms is via

a private network or Internet (in either case, WAN-driven), I would see no material difference between on-prem or cloud-based capabilities, and all the benefits of cloud computing would drive towards its use where feasible, assuming firms' ability to build and manage cloud applications is mature."

As one respondent succinctly put it: "It is inevitable that we will move to the cloud."

8. How Rapid Addition Can Help

How Rapid Addition Can Help

Rapid Addition's low-code asset class and message protocol-agnostic platform technology enable organisations to design and implement their own unique trading workflow solutions. The open-API architecture ensures the platform is highly interoperable with a firm's current or future trading ecosystem and underlying infrastructure, whether on-premises or in-cloud.

Rapid Addition has successfully deployed the RA Platform within multiple customer cloud environments, both as dedicated or hybrid implementations, The same solution that is deployed on-premises can be migrated to cloud in-line with customers' technology plans, future-proofing investment and creating a glide path to cloud transition over time.

High-performance components, including Rapid Addition's proprietary FPGA solution, can be implemented on-premises while offering seamless interoperability with cloud-hosted instances of the RA Platform. This extends to advanced high availability and disaster recovery capabilities.

Importantly, Rapid Addition's technology is not restricted to working with a specific cloud provider – customers have the freedom to deploy the RA Platform in their preferred cloud solution.

9. About Rapid Addition

Rapid Addition
Electronic Trading Innovators

Rapid Addition was an early pioneer in the development of advanced electronic trading technology and is recognised as a market leader in financial messaging protocols and scalable middleware. Our asset class and message protocol-agnostic platform provides a foundational building block that enables organisations to build electronic trading capabilities that meet their unique requirements.

Architected to accelerate the deployment of customers' IP and custom business logic, The RA Platform gives firms the freedom to design and implement a broad spectrum of optimized electronic trading workflows through our low-code development framework.

Proven scalability protects against unforeseen volatility, while the combination of hardware acceleration and software delivers an unrivalled blend of speed, flexibility, and control that helps our customers succeed in today's competitive world of electronic trading.

Whether deployed on-prem, in the cloud, or via hybrid infrastructure, Rapid Addition's open platform approach is fully interoperable with the customer's current technology ecosystems and will support their future business strategy in whichever direction it takes.

To find out more visit our website at www.rapidaddition.com or contact us at enquiries@rapidaddition.com

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