Cloud Adoption in Capital Markets: A Perspective

Moving to the cloud is not a one-size-fits-all proposition. Given the array of options, the decision to adopt cloud computing requires a thoughtful and flexible roadmap to guide applications and processes, set priorities, address security considerations and establish return-on-investment objectives that are above and beyond non-core services.

Executive Summary

As the financial services industry continues its slow recovery from the 2007-2008 global economic crisis, business sponsors and key decision makers the world over are continuously looking to generate alpha performance for their business while trying to recover lost profitability. A key metric is keeping IT infrastructure costs and operational risks under control.

Given this context, cloud services have emerged as a viable business imperative. The cloud enables financial services companies to focus more on core competencies – growing assets, servicing customers, gaining faster time to market for key offerings, reducing capital expenses via pay-per-use models, and enabling services to quickly flex with market demands.

This white paper offers our point of view on how cloud adoption can deliver significant and unique business benefits to capital markets firms based on:

- Analysis of current cloud adoption trends within the industry.
- Advantages and challenges surrounding cloud adoption by industry firms.
- Drivers of cloud-based solutions for capital markets.

From our assessment, we will:

- Propose a risk-management framework for overcoming persistent security concerns.
- Classify business processes around cloud services, and offer a time horizon for adopting cloud computing.
- Recommend a return on investment (ROI) assessment model for cloud computing.

Cloud Adoption in Capital Markets

The forever-changing business environment and greater regulatory supervision have helped accelerate the pace of cloud adoption in the financial services industry. In 2012, research estimated that global spending on cloud computing in capital markets would grow to US$2.8 Billion in 2013.[1] A recent ECI survey shows that as of September, 2013, 87% of investment management firms were using some form of cloud computing services.[2]

Cognizant

Many financial services firms already use the cloud to power CRM, HR applications, employee benefits and basic non-mission-critical technology functions. Though public cloud computing has been a major talking point for financial institutions, firms prefer to deploy private clouds for core applications within their own data centers – citing security and compliance as chief concerns. As early as 2011, 60% of the world's financial services companies had funded private cloud initiatives.[3] Hybrid clouds have found applications in multiple areas, and sometimes in specific communities, such as the NYSE Capital Markets Community platform.[4]

Software as a Service (SaaS) and infrastructure as a Service (IaaS) are widely used in capital markets, serving as the foundation for various third-party products. Recent trends in the adoption of Private Platform as a Service (PaaS) have shown to significantly improve infrastructure efficiency and reduce infrastructure costs.[5]

Cloud-based solutions are used by numerous buy-side firms in the areas of analytics, portfolio management, decision support and investment administration. For sell-side firms, these solutions support corporate action, regulatory compliance and reporting.[6]

As the cloud market unfolds, we expect capital market firms to develop a comfort level in leveraging back-end applications on the public cloud platform, with pure financial applications to follow. Since data security remains a major concern for market participants, we believe they should begin their cloud journey with non-critical applications centered on non-confidential/non-critical data, with services provided by partners with demonstrated and documented security mechanisms. Once fears over data security are allayed, and as cloud service providers evolve with higher security standards and widely accepted industry protocols, market players should consider partners that have the necessary security mechanisms in place to accommodate pure financial applications that involve confidential customer data.

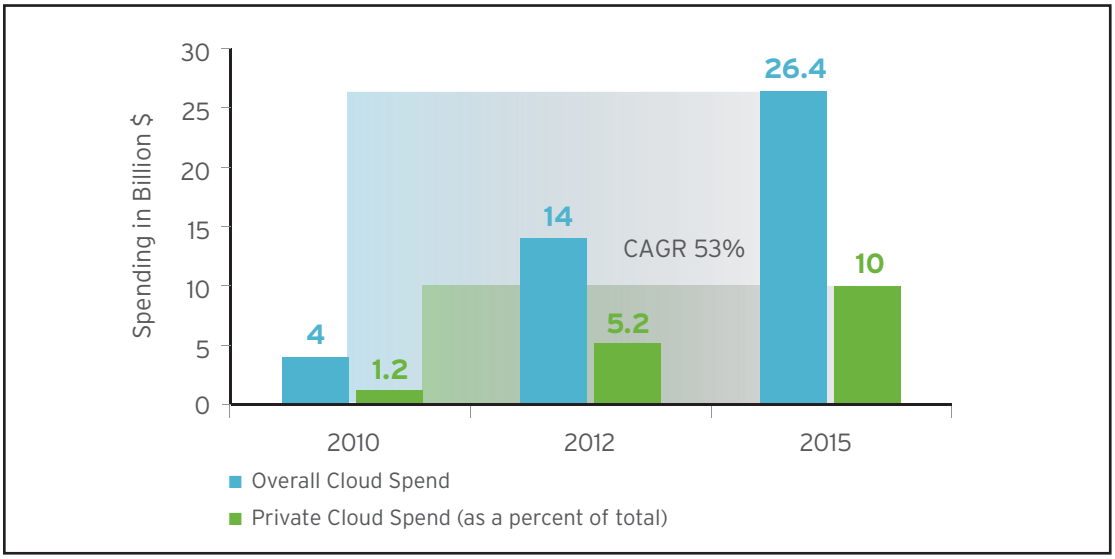
Business Cases for – and Against – Cloud Adoption

Given that cloud technology is in its very early stage of adoption by the capital markets industry, various challenges – some real, others colored by perception – must be overcome by market participants. Also, there are cases for and against adopting cloud computing. As such, a rigorous assessment of whether the cloud's benefits outweigh its disadvantages, as well as strategies for mitigating challenges, must be undertaken.

Major Drivers for the Cloud in Capital Markets

In addition to the cloud's main advantages – cost optimization and revenue transformation (Cap-Ex to Op-Ex conversion) – we see regulatory

Private Cloud and Public Cloud in the Financial Services Industry



Source: Tower Group. Destination 2015 - Spending on Cloud Computing in FS. It is anticipated that cloud spending in global financial services will grow from US$4 Billion in 2010 to more than US$27 billion by the end of 2015.
Figure 1

Factors Favoring and Challenging Cloud Adoption

Factors Favoring Cloud Adoption	Factors Challenging Cloud Adoption
Capital Optimization • Cloud adoption gives the ability to convert Fixed Infrastructure Costs (CAPEX) into Variable Costs (OPEX). • Cloud enables transition to pay-per-use model and is profitable when benefit from cloud transition > Fixed Infrastructure Costs.	**Security and Availability** • Cloud service providers are reluctant to take full responsibility for security in the cloud since security is a shared responsibility. • Even the most reliable cloud providers have faced outages and immense business impact. • Cloud service providers' maturity is a definitive question and the industry is just out of its infancy. However, secure access to publicly available client information can be provided by cloud service providers. For example, client research reports, research and insights.
Increased Revenue Potential • Cloud computing frees up organizations from routine IT activities and allows employees to focus on more strategic, innovative and revenue-generating work. • Study predicts businesses' increased revenues from cloud enablement could reach US$1.1 trillion a year by 2015.	**Cross-Border Rules for Data Access** Concerns continue to linger around cross-border data movement across the EU and the U.S. as, as governments around the world emphasize information privacy, (e.g., European Data Protection Directive). Recently many cloud providers, including AWS and Microsoft Azure, have started participating in the safe harbor programs.
Infrastructure Scalability and Agility • Minimal/no requirement of hardware, software license and implementation service. Small and medium enterprises (SMEs) adopt early, since cloud enables infrastructure scalability when needed. • Large firms can achieve infrastructure agility through proper change management and integration of cloud.	**Vendor Dependency/High Switching Cost** In SaaS, cloud service providers give access to resources via Web interfaces, proprietary APIs or command line tools. Switching costs will be high, and finding a provider offering a similar range of features might be difficult.
Resource Utilization a. Removes the issue of over-provisioning a network with spare capacity or under-provisioning with demand exceeding availability. b. Drives focus on core competency as cloud frees up time, efforts and budget.	**Limited Liability of Cloud Service Providers** Cloud service providers do not share complete liability (loss of revenue or penalties) in case of violations of Service Level Agreements (SLAs).
Minimum Data Readiness Requirements a. Data readiness requirements for cloud transition are very minimal, so less time is needed to adopt cloud services. b. Any data stored in databases can be moved to the cloud. For the data in the file format, converters are readily available for transition.	

Figure 2

compliance and emerging technologies as the two major reasons capital markets firms will increasingly embrace cloud solutions.

Regulatory Compliance

The U.S. Dodd-Frank Act and the EU's European Market Infrastructure Regulation (EMIR) have given rise to new regulatory requirements in the areas of storage, compliance and reporting. New solutions for Dodd-Frank adherence were launched by cloud service providers and targeted primarily at small and medium firms in banking, asset management, hedge funds and insurance brokerage. These companies prefer not to make heavy capital investments in infrastructure/licensing to meet impending regulatory compliance deadlines.[7]

Regulatory Compliance

Business Lines Impacted	Areas Where Cloud Can Be Used
Investment Banking	Regulatory Reporting.
Wealth Management & Investment Advisory	Regulatory reporting requirements on financial advisors for disclosing details such as assets under management (AUM), leverage including off-balance sheet items, counterparty exposure, valuation, trading policies and side arrangement.
Hedge Funds & Private Equity (PE) Funds	Recordkeeping requirements and reporting of Assets Under Management (AUM), counterparty credit risk exposure, valuation methodologies and practices, types of assets held and trading practices.
Securities Trading	Real-time and pre-decided, period-based reporting for public, regulators, and market supervision while following the guidelines for data dissemination.

Figure 3

Emerging Technologies: The Cloud as an Enabler

We believe that newer technologies such as big data, analytics, mobility and social media make it possible to realize more value from cloud. Cloud computing has significant potential to make emerging technologies easier and more efficient to use by shifting data management from an important competency to a critical competitive differentiator.

Big Data

In response to the challenge of managing the ever-increasing volume and velocity of data, and the need to analyze it in real time, capital market firms are setting aside a bigger slice of their IT spend on big data technologies – a market that is expected to grow to US$16.9 billion in 2015 (from US$3.2 billion in 2010).[8] Considering the massive computing power and storage required to support big data, plus the flexibility that the cloud provides, the use of cloud-based solutions is a logical fit. Two major areas in which big data and the cloud can be used together are:

- Financial and reference data management.
- Trading and risk analytics for calculating metrics used in pre-trade analysis, portfolio analysis, performance attribution, simulation and scenario analysis.

Analytics, Mobility and Social Media

The global cloud analytics market is expected to grow – from US$5.25 billion in 2013 to US$16.5 billion in 2018 (CAGR of 25.8%).[9] Cloud analytics services give rise to new opportunities in areas of capital markets that require analytical insights for decision making, e.g., pre-trade and post-trade analytics.[10] In fact, according to Juniper Research, the cloud-based mobile market will likely generate annual revenue of US$9.5 billion in 2014.[11]

Cloud computing has the potential to be highly synergistic with analytics, mobility and social media. The value proposition that this combination offers will enable fund managers to use a mobile platform to perform analytical calculations on the cloud using social media data input.

A Management Framework for Mitigating Risk in the Cloud

Addressing deep-seated security concerns around cloud computing is a big issue, due to the sensitivity of the systems and data that are critical to capital markets firms' operations. The key to overcoming these trepidations is to offer security provisions that are tailored to these companies. It is thus incumbent upon service providers and industry players to understand the types of data they are working with and the processes behind data generation, location, access and protection. Adherence to compliance regulations must also be top of mind.

Our risk-management framework provides four levels of security. In our view, it is the only proposed solution for customizing cloud security. As such, it should be thoroughly assessed and understood before adopting a cloud solution. It covers the following security levels:

- **Level 1 (policy security):** Controls and processes that define, report and enforce the security of the operating environment, applications and data that must be defined at the policy-security level. The end consumer's security

Cloud Security – Risk Management Framework

Figure 4

responsibilities greatly differ among cloud service models – a consideration that should be factored in.

- **Level 2 (environment and infrastructure security):** Addresses recoverability and protection of system-level assets and infrastructure. Recording of infrastructure configuration and policy changes, along with security for the logging, auditing and reporting environment, are covered here. Comprehensive disaster recovery, availability and a redundancy plan lay the groundwork for robust cloud security.
- **Level 3 (systems and platform security):** Insulates cloud networks with a secure connection to guard against data leakage and eavesdropping. This process involves intrusion detection, hardening applications, and database and network servers to ensure confidentiality, integrity and availability of data at rest, in transit and in use.
- **Level 4 (data security):** The first three levels guarantee the final level of data security. This level classifies the identities of stakeholders (admin, end users, operations, etc.); assigns resource and access privileges based on roles; validates identities on the basis of cloud credentials (authentication), and grants access to protected cloud infrastructure resources (authorization).

Business Process Classification for Cloud Adaptability

Based on our analysis, we have classified capital markets business processes into three categories, with a view toward providing a cloud adoptability time horizon (see Figures 5 and 6).

- **Phase 1 includes non-core/non-critical/non-proprietary applications that involve low collaboration, data from third party vendors, accounting and reporting applications.** These applications have relatively low risks, and can be moved to a private cloud or replaced with existing public cloud applications relatively easily.
- **Phase 2 includes mission-critical applications that deal with transactional data, account-related data and analytical applications with short peak load duration.** Due to the criticality of these applications, the assessment phase should carefully consider the potential impact of downtime and have sufficient risk-mitigation measures in place.

Phase-Wise Classification Metrics

Basis for Classification	Phase 1	Phase 2	Phase 3
Investment Banking	Non-Core/Non-Critical/ Non-Proprietary Applications	Mission-Critical Applications	Customer-Oriented Applications
Type of Data	Third-Party Data, Transactional Data	Transactional Data, Account Data	Customer Data
Collaboration Between Applications	Low	High	High
Computational Needs	Medium	High	Medium
Risks Involved In Downtime/Criticality	Medium	High	High

Figure 5

- **Phase 3 focuses on business processes powered by applications that pivot around critical customer data.** As cloud computing matures and capital market firms develop a level of comfort for managing risks around this technology, data security measures such as masking, encryption, tokenization, etc. can be used to safeguard customer data before placing it in the cloud. Moreover, cloud adoption for individual business processes can be done on a case-by-case basis.

We envision a future ideal state that will include all Phase 1 applications in the public cloud, Phase 2 applications in public/private hybrid cloud, and Phase 3 in a private-on-premises cloud.

Business Process Classification in the Capital Markets Industry With a View on Cloud Adoptability in Three Phases

Capital Market-Specific Business Process

Business Area	Categorization							
Trading & Order Management (Front Office)	Trade Strategy & Order Management	Order Routing & Management	Pre/Post-Trade Analytics	Pre/Post-Trade Compliance	Execution Strategies	Pricing & Structuring	Quoting/Market Making	Research Algorithmic Trading
	Deal Capture & Position Management	Trade Capture & Enrichment	Matching & Netting	Confirmation & Affirmation	Position Keeping			
	Client Management	Customer Acquisition	Onboarding	Customer Service				
Middle Office	Recordkeeping Services	Deal Confirmation	Portfolio Recordkeeping	Reference Data Management	Performance & Attribution	IT Trade Support		
	Risk Compliance & Control	Risk Analysis	Post-Trade Compliance					
Clearing & Settlement (Back Office)	Clearing & Custodial Services	Position Management	Payment Processing	Regulatory Reporting	Trade Settlement Custodial Servicing	Corporate Action Processing	Depository & Investor Services	Transfer Agency Services
	Collateral Management	Margin Management	Securities Lending	Collateral Management	Income & Dividend Processing	Investment/Fund Accounting		
Portfolio Management	Portfolio Strategy	Portfolio Strategy & Models	Decision Support Engines	Pre-Trade Analytics & Compliance	Research & Analysis	Asset Allocation Strategy		
	Fund Administration	Investor-Customized Reporting	Fund Analytics	Fund Legal & Compliance	Regulatory Reporting			

Common Business Process

Business Area	Categorization						
Data Management Services		Securities Reference Data	Client Reference Data	Market Data	Pricing Data	Trade Data	
Governance, Risk & Compliance	Legal & Compliance	Regulatory Reporting	KYC Processing	Trade Surveillance	Legal		
	Risk Management	AML	SOX	Market Risk	Credit Risk/ Counterparty Risk	Enterprise/ Operational Risk	Risk Monitoring & Reporting
Client Management		Client Onboarding	Client enquiries	CRM	Reporting		
Communication Services	Channels & Infrastructure	Client/Partner/Trading Portals	Telephony/ Fax/E-mail/FIX				
	Interfaces	Client Connectivity	Exchange/ECN Connectivity	Vendor/Partner Connectivity			
Accounting Controlling & Reporting	Treasury	Cash Management & Forecasting	Funds Transfer Cost Attribution				
	Product Control	P&L Analysis	Ledger Control & Reporting	Reconciliation (Nostro/ Depot/GL)			
	Finance	Accounts Payable/ Receivables	Financial Accounting & Reporting	General Ledger Postings	Billing & Invoicing		

Movable to Cloud Phase 1 | Movable to Cloud in Phase 2 | Movable to Cloud in Phase 3

Figure 6

Cloud Return on Investment Assessment Model

A return on investment assessment model is essential for evaluating if the envisioned cloud transition will provide benefits greater than the current application and the cost incurred along the way (see Figure 7). Estimating the potential ROI involves:

- Undertaking a thorough assessment of internal applications and identifying the business processes/applications that are suitable for cloud transition.
- Quantifying the key metrics from identified applications in their current state.
- Quantifying the metrics of these applications in the transitioned state (envisioned system).
- Substituting quantified metrics in the ROI assessment model for objective decision making.

Depending on the business/IT strategy, an objective judgment for cloud adoption can be made by capital market firms based on the factors listed in Figure 8.

Return On Investment

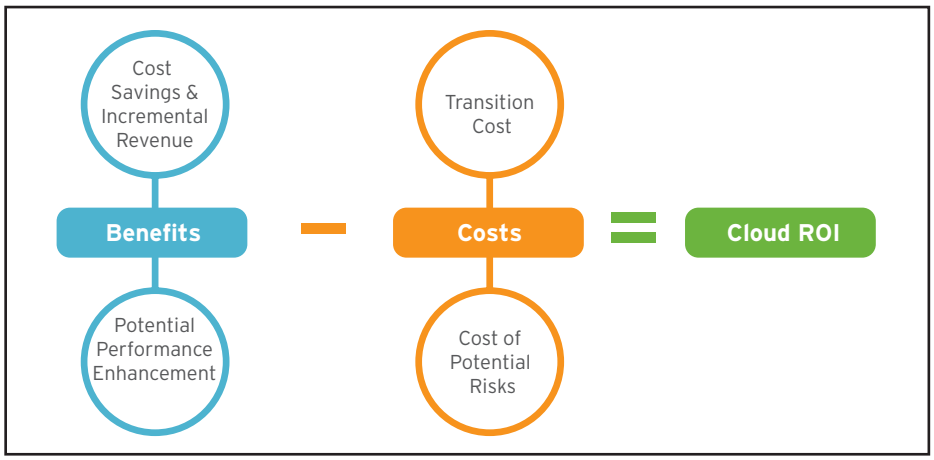


Figure 7

Return On Investment

Quantifying Benefits Derived from Cloud	Quantifying Costs Incurred in Adoption
Cost Savings & Incremental Revenue • Measure workforce, software, hardware and hosting cost; Capex to Opex potential. • Estimate additional revenue generated through transition to cloud. • Estimate savings from transition to cloud reinvested for revenue-generating opportunities. **Potential Performance Enhancement** • Evaluate the potential for performance enhancement in quality, timeliness and productivity. • Measure the effort saved, improvement in utilization, automation, quality of user experience.	**Transition Cost** • Estimate the cost incurred to integrate the cloud platform with existing system. Costs to address change management and integration challenges. • Measure the recurring cost component, which includes cloud platform subscription fee, transaction fee, coordination and security cost. **Costs Associated with Potential Risks** • The costs of risk vary depending on the criticality of the applications. Measure costs of risk involved in cloud adoption (e.g., impact of service outage) by assigning risk weightage to applications based on criticality. • Understand up front what the exit strategy will be, and build those costs into ROI analysis.

Figure 8

Key Performance Indicators

Terms	Definitions
Quality	
Usability	Level of ease of use and improvement in user experience.
Error Rate	Default rates, mean time between failures.
Green Benefits	Service /Hardware Utilization and KwH savings.
Performance	
Utilization	Ability to maximize workloads.
Capacity	Size of the workload compared to available infrastructure.
Time	
Timeliness	Degree of service responsiveness, mean time to recover.
Volume	Volume of transactions processed per unit of time.
Time to provision	Time required to provision network and storage resources.
Profitability	
Margin Growth	Ability to generate revenue and margin increase per unit of revenue.
Revenue Growth	Rate of revenue growth, rate of new market acquisition, ability to increase profits/customers.
Value Generated	Business value generated per effort hour / Business value generated per watt consumed.
Cost	
CAPEX costs	CAPEX cost on-premise ownership versus cloud CAPEX Cost.
OPEX costs	OPEX cost on-premise ownership versus cloud OPEX Cost.
Total Cost of Ownership (TCO)	On-premise physical asset TCO versus cloud TCO.
Support Cost	Headcount support personnel / Support time.

Figure 9

Key performance indicators (KPIs)[12] can be used to evaluate the effectiveness of cloud adoption. KPIs can be broadly classified under metrics such as quality, performance, time, profitability and cost. Figure 9 documents indicative KPIs.

Cloud Solutions for Phase 1

There are cloud service offerings for capital markets business processes identified for the Phase 1 transition. Figure 10 lists the available cloud business solutions.

Looking Ahead

Despite engrained negative perceptions about security and privacy, cloud technology can be easily adapted for capital markets firms. However, effective adoption will require vendors and firms to work together to overcome the challenges. Moving non-core business processes to the public cloud is a suggested first step because capital markets firms are risk-adverse and may expect a tangible ROI before fully embracing the cloud. But, since cloud service offerings are in the initial

Available Cloud-Based Solutions in the Market

Business Process		Cloud Solutions
Corporate Action	Enterprise-grade cloud solutions for end-to-end corporate actions	Xsprisa
Portfolio management, investment administration, reporting, decision support.	Cloud-based outsourcing solution for hedge funds, asset managers, fund of funds and buy-side firms consolidating applications across trading middle/back-office operations	InvestCloud mbOffice, InvestCloud CustomPort (for more customized and complex deployments).
Reporting	Risk and Attribution Reporting, Trade Data, Regulatory Compliance	InvestCloud, Thunderhead One, Kloudtrack
CRM	Campaign Management, Sales Automation Applications, CRM, Social Media Monitoring for Market Participants	Tier1ACE, Salesforce.com, Navatar Capital Markets Cloud
Market Data	Cloud-Based Market Data Platform	SuperDerivatives DGX, XigniteonDemand
Analytics	Pre-Trade Analysis, Portfolio Analysis, Performance attribution, Simulation, Scenario Analysis	CloudMetrx, StatPro Revolution, Ipreo,

Figure 10

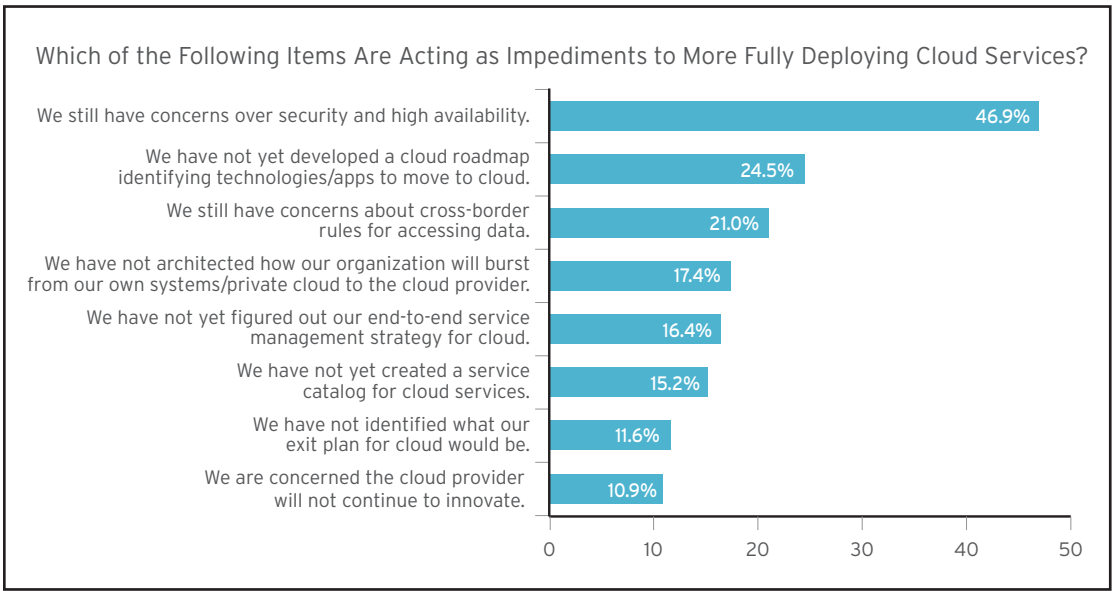
stages of development, a break-even on the investment in cloud may take time. Migrating core business processes to the public cloud should be de-prioritized until a clear business case is made and returns from earlier non-core initiatives can be quantified.

Cloud-based services will also lead to newer operating models, such as co-sourcing of services in the areas of accounting, data management functions and rebalancing. This will enable operational resources to be leveraged on a need basis. As a consequence, service providers will emerge as providers of skilled resources during times of increased demand, such as tax-reporting season and new fund launches.

As mentioned earlier, most investment management firms are satisfied with the cloud's ability to reduce IT costs. In fact, according to the report by ECI, 93% said their chosen cloud deployment method either meets or exceeds expectations; 91% percent of surveyed firms stated that they believe the cloud is simplifying management of their IT systems. Given these high satisfaction levels, the survey points out that financial services firms will continue to leverage the cloud, and that the rate of adoption is expected to grow at a rapid pace over the years.

Capital markets companies that are thinking about cloud adoption should consider using our roadmap to identify prospective business process areas and applications that can be migrated to the cloud. Firms can also use our proposed security and return on investment framework as a checklist to assess the feasibility of cloud adoption.

Appendix A



Source: 2012 Vertical IT & Communications Survey, IDC, May 2012 N=229 Multiple Responses Allowed – Will not equal 100%

Appendix B

Glossary of Terms

1 **Cloud Deployment Models:**

- 1.1 **Public Cloud:** An arrangement in which multiple cloud computing clients use a single vendor-run, off-site server simultaneously.
- 1.2 **Private Cloud:** An off-site server or servers used and maintained by client exclusively. It can be accessed only through a private network.
- 1.3 **Hybrid Cloud:** A cloud which is a composition of two or more interoperable clouds (e.g., private + public), enabling data and application portability.
- 1.4 **Community Cloud:** A cloud that is shared by several organizations with common concerns, managed by the organizations or by a service provider. Costs are spread over fewer users than a public cloud.

2 **Service models:**

- 2.1 **SaaS (Software as a Service):** The most common form of cloud computing, in which a vendor sells access to its software via the Web. The software runs on the vendor's servers and the user is charged on a pay-as-you-go basis. Gradually evolving to BpaaS - Business Process as a Service
- 2.2 **IaaS (Infrastructure as a Service):** A vendor sells access to data storage, networking and other services online to software developers.
- 2.3 **PaaS (Platform as a Service):** A cloud computing service that provides a computing platform and a solution stack as a service. In this model, the consumer creates the software using tools and/or libraries from the provider.
- 2.4 **BpaaS (Business Process as a Service):** BPaaS is any type of horizontal or vertical business process that is delivered based on the cloud services model.

3 **Collocation:** The use of servers or sometimes just physical space for servers-maintained and rented to clients by vendors.

4 **Elasticity:** The ability of a cloud to handle greater or lesser computing loads on demand.

5 **Scalability:** The ability of a system, network or process to handle a growing amount of work in a capable manner or enlarge to accommodate that growth.

6 **Agility:** Rapid provisioning of computer resources. Cloud environments can usually provide new resources or storage in minutes.

7 **Outsourcing:** Contracting with an outside specialist vendor for IT services, as is common in HR or other areas.

8 **On Demand:** A contract with an IT vendor that allows the user to easily access computing resources whenever they are needed.

9 **Server:** A central computer to which others are connected via a network.

10 **Commercial Processing:** Services ii (CPS ii). A service that provides risk management, compliance reporting, verification and reconciliation services to address Dodd-Frank compliance requirements. (http://www.cpsii.com/)

11 **Autonomy:** Dodd-Frank recordkeeping solution. (www.autonomy.com/dodd-frank)

12 **Nastel's Autopilot:** Nastel's Autopilot solution for banks and brokerage firms for Dodd-Frank compliance monitoring. (http://www.nastel.com/tech/cloud-computing.html)

13 **Safe Harbor program:** A regulation that reduces or eliminates a party's liability under the law, on the condition that the party performed its actions in good faith or in compliance with defined standards. (http://en.wikipedia.org/wiki/Safe_harbor_(law)

Footnotes

[1] Sankar, Sreekrishna, and Bill Fearnley, Jr., "Celent Study on Cloud Computing in Capital Markets." September 27, 2012. www.celent.com/reports/cloud-computing-capital-markets.

[2] Eze Castle Integration (ECI) Survey: Examining Cloud Usage Within the Investment Management Industry. September 24, 2013. http://www.eci.com/knowledge-center/2013-cloud-usage-survey-results.html.

[3] Waters Cloud Report. November, 2011. http://www.waterstechnology.com/waters/special/2122278/cloud-computing-special-report.

[4] Case study on VMWare in NYSE, April, 2012. http://www.vmware.com/in/company/customers/nyse-case-study.html.

[5] Scott Bils, "Five Takeaways from the JPMorgan Chase Paas Announcement," LeverHawk, March 8, 2013. http://leverhawk.com/five-takeaways-from-the-jpmorgan-chase-paas-announcement-20130308211.

[6] XSPrisa, CPSII are existing cloud solutions available for Corporate Actions, Regulatory Compliance and Reporting. http://www.iss-mag.com/news/cantor-fitzgerald-switches-to-cloud-platform-fo, http://www.cpsii.com/.

[7] Dodd-Frank Compliance Solution from Nastel and CPS II Targeting Small and Medium Enterprises. http://www.waterstechnology.com/sell-side-technology/news/2249870/nastel-unveils-dodd-frank-compliance-offering, http://www.cpsii.com/.

[8] "Big Data Market Size in 2015." IDC and IIA research estimates. http://cloudvane.com/2012/11/16/idc-big-data-market-growing-by-40-annually-reaching-16-9b-by-2015/, http://www.forbes.com/sites/gilpress/2013/12/12/16-1-billion-big-data-market-2014-predictions-from-idc-and-iia/.

[9] Cloud-Based Business Analytics Market: Global Forecast and Analysis. http://www.companiesandmarkets.com/Market/Information-Technology/Market-Research/Cloud-Based-Business-Analytics-Market-Global-Forecast-and-Analysis-2013-2018/RPT1146121.

[10] Cloudmetrx – A cloud-based analytic tool that revalues open positions across asset classes and OTC derivatives. www.cloudmetrx.com/.

[11] Juniper Research on Mobility. The Juniper Research Blog, Juniper Research. http://www.juniperresearch.com/analyst-xpress-blog/2010/01/26/mobile-cloud-application-revenues-to-hit-95-billion-by-2014-driven-by-converged-mobile-services/.

[12] Building Return on Investment from Cloud Computing: Cloud Computing Key Performance Indicators and Metrics. The Open Group. http://www.opengroup.org/cloud/whitepapers/ccroi/kpis.htm.

About the Authors

Rajagopal Sethuraman is a Senior Manager within Cognizant Business Consulting's Banking and Financial Services Practice. With over thirteen years of business consulting experience in the capital markets industry and information technology service companies, he specializes in providing IT/consulting solutions in the areas of trading, clearing and settlement functions across all asset classes. He holds a management degree with specialization in finance/systems. He can be reached at Rajagopal.S@cognizant.com.

Harish Rahim is a Consultant within Cognizant Business Consulting's Banking and Financial Services Practice. With over five years of technology and consulting work experience in the banking and capital markets industry, Harish has worked on leading buy-side front-office applications and has experience in analytics and investment management practices. He is a management graduate from Indian Institute of Foreign Trade – Delhi, with specialization in finance and marketing. Additionally, Harish is a FRM-certified risk management professional. He can be reached at Harish.Rahim@cognizant.com.

Vasanth Kumar Bhaskar is a Consultant within Cognizant Business Consulting's Banking and Financial Services Practice. With over four years of technology and consulting work experience in the banking and capital markets industry, Vasanth specializes in post-trade processing of OTC (over the counter) derivatives in the Dodd-Frank era. He is a management graduate from Loyola Institute of Business Administration, with specialization in finance and marketing. He can be reached at VasanthKumar.Bhaskar@cognizant.com.

Acknowledgments

The team would like to acknowledge the contributions/advice of the following subject matter experts in the development of this white paper: Vignesh Thiagarajan, Senior Consultant, Cognizant Business Consulting, Banking and Financial Services Practice; Dilshad Kunnumal, Senior Manager, Business Development, Cognizant Cloud CoE; and Balaji Varadarajan, Principal Architect, Technology, Cognizant Banking and Financial Services Practice.

About Cognizant

Cognizant (NASDAQ: CTSH) is a leading provider of information technology, consulting, and business process outsourcing services, dedicated to helping the world's leading companies build stronger businesses. Headquartered in Teaneck, New Jersey (U.S.), Cognizant combines a passion for client satisfaction, technology innovation, deep industry and business process expertise, and a global, collaborative workforce that embodies the future of work. With over 50 delivery centers worldwide and approximately 171,400 employees as of December 31, 2013, Cognizant is a member of the NASDAQ-100, the S&P 500, the Forbes Global 2000, and the Fortune 500 and is ranked among the top performing and fastest growing companies in the world. Visit us online at www.cognizant.com or follow us on Twitter: Cognizant.

World Headquarters
500 Frank W. Burr Blvd.
Teaneck, NJ 07666 USA
Phone: +1 201 801 0233
Fax: +1 201 801 0243
Toll Free: +1 888 937 3277
Email: inquiry@cognizant.com

European Headquarters
1 Kingdom Street
Paddington Central
London W2 6BD
Phone: +44 (0) 20 7297 7600
Fax: +44 (0) 20 7121 0102
Email: infouk@cognizant.com

India Operations Headquarters
#5/535, Old Mahabalipuram Road
Okkiyam Pettai, Thoraipakkam
Chennai, 600 096 India
Phone: +91 (0) 44 4209 6000
Fax: +91 (0) 44 4209 6060
Email: inquiryindia@cognizant.com