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Business Value from Clouds: Learning from Users[1]

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Executive Summary

Cloud computing enables firms not only to mitigate risks in today's hyper-competitive business environment, but also to gain competitive advantages. Based on field interviews with seven early adopter companies, supplemented by some published reports, the authors describe six cloud computing benefit patterns and five business-related strategic risks that can be managed using cloud computing. Dynamically dealing with a mix of legacy systems and cloud solutions is but one of the dimensions of management required today as companies compete as members of ecosystems that include such entities as competitors, complementors, infrastructure providers, development platform providers, and orchestrators.

INTRODUCTION

> *"At Partners, we do not describe our cloud strategy in terms of a relationship with any one cloud vendor; rather, we are focused on delivering services with specific cloud-like capabilities, in response to business drivers."*
>
> Steven Flammini, CTO Partners Healthcare

In the 21st century, companies compete as ecosystems which include entities such as competitors, complementors, infrastructure providers, development platform providers, and orchestrators. Ideas such as modularity, networks, and design rules prevail. Every product or service has an informational component to it. Instead of viewing information technology (IT) simply as a support to the product, IT has become a part of the product.

The underlying informational technologies have also changed. Instead of building from scratch, companies focus on reusing what is available internally and externally to build systems. Instead of negotiating hardware, software, and maintenance issues, companies pick platforms, develop apps, create APIs, and orchestrate the ecosystem. Cloud computing enables enterprises to access such IT resources on–demand, while sharing the provisioning costs and benefits of co-innovating with others. Users can consume basic information processing services like a utility, while leaving the complex issues of managing hardware and software to specialized vendors.

One of the most interesting aspects of cloud computing is not simply how it helps the provisioning and consumption of information services, but how it enables companies to compete effectively. As part of our research on cloud computing, we interviewed stakeholders from seven companies that have been pioneers in deploying cloud computing to create business value. A description of our research methods, a list of the companies interviewed, and the question categories that we utilized for our interviews with IT executives and other key managers can be found in the Appendix.

Using examples from the companies that we interviewed as well as relevant published reports, we first describe the six cloud computing benefit patterns that we found. Then we present five business-related strategic risks that can be managed

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using cloud computing, and the specific cloud capabilities associated with the mitigation of these risks. Based on our research, we then provide a set of recommendations that CIOs should consider as they seek to create business value from deploying cloud computing in their own companies.

BENEFIT PATTERNS

We have identified six patterns of benefits that companies achieved from leveraging cloud computing's capabilities, each of which facilitates achieving competitive advantage in the marketplace.

Increased Business Focus

Although IT is a key determinant for competitive success today, many companies wish for greater support of their business needs from their IT departments. Using cloud computing, companies can keep IT in lock step with their evolving business requirements.

One of the companies we interviewed was Appirio, a consulting company that helps others with their cloud strategy and implementation. Their rapid market growth created a need to open an office in Japan. As Appirio's CEO, Chris Barbin, told us, this was accomplished in a matter of weeks because all the IT support needs for this office were already being met by the cloud. Appiro's cloud strategy permitted its management to focus on people- and business-related issues: IT was truly an enabler rather than a friction point for its growth ambitions.

A similar pattern can be seen when Thomson Financial merged with Reuters in 2008. Faced with different systems for managing sales processes, the merged firm developed a cloud-based strategy, creating a project named TRUST (Thomson Reuters Unified Sales Tool) that used the Salesforce.com cloud to standardize and merge the two sales teams. The merged firm now has one version of the truth related to customer data and leads. In addition, it is able to generate standard reports using the consolidated data from Salesforce.com, allowing it to create a unified approach to new and existing client accounts and to experiment without incurring huge costs.

In the case of the insurance company Aflac Inc, a cloud strategy enabled its sales force to use applications on personal mobile devices[2]. Using mobile applications, sales people can access the customer database, claims or policy information while traveling. Formerly, sales associates had to dial into a call center or were tethered to a computer. Cloud computing helped Aflac reduce the number of calls to call centers, freeing employees to focus on customers and their insurance claims.

In these three examples, routine IT tasks were outsourced to the cloud provider, allowing the companies to focus on the unique value they provide to their customers. Beyond the benefits of traditional outsourcing, these companies contained their IT cost outlay by only paying for the IT services they used.

Reusable Infrastructure

For some companies, the migration to cloud computing technology has served as a catalyst to viewing their IT capabilities as a set of modular services with clear functionality and well defined interfaces. Modularity has several competitive benefits, including the ability to innovate faster by reusing existing assets.

For example, Google invested in building its entire infrastructure as a service available on a cloud. Therefore, when its engineers in Bangalore wanted to create Google Finance, they did not have to build many components: they reused services, such as their discussion boards and news feeds, while adding stock market and portfolio management features.[3] In fact, Google has extended this approach to all new product innovations. With its innovation platform in place, it can simply add new features and test reactions to emerging ideas, and then make the decision to pursue or abandon these product concepts.

Infrastructure reuse, combined again with tapping into knowledge resources from low wage markets, has been a key driver for companies in the pharmaceutical industry to use cloud computing to build sophisticated environments for drug testing. In one global company, researchers in emerging markets requested a new laboratory environment for testing new compounds. Although its standard policy had been for business units to set up their own environments using services provided by the local IT marketplace, in this case, the local market was not sophisticated enough to support them. Fortunately, based on a request from another business unit, the company had already built a cloud-based environment to support drug testing. Using pre-built interfaces to its corporate clouds, the local business unit was able to invoke the necessary

2 Raice, S. and Ante, S.E. "Business Tasks Bring Out Serious Side of Apps," *Wall Street Journal*, 2010.

3 Iyer, B. and Davenport, T. "Reverse Engineering Google's Innovation Engine," *Harvard Business Review* (86:4), 2008, pp. 58-68.

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environment on its cloud and move along the drug discovery process for this emerging market location.

LiveOps, which offers call center services to clients, is another company that has invested in a cloud based, scalable, on-demand technology infrastructure[4]. LiveOps acts as a marketplace that brings together knowledge experts as contractors with companies needing call center services. With over 20,000 freelancers able to handle calls for multiple clients, working from home, LiveOps creates many virtual call centers. New contractors and clients can be added to the network as it expands. Further, when a help desk call comes in, the service operates as a performance-based auction, routing incoming calls to the best-performing worker available (based on how well they served prior customer calls). The platform keeps track of hours worked, billing, call routing, status updates, and reporting tasks. Once again, a company-owned sophisticated infrastructure helped them tap into a lower wage, highly talented labor pool.

Cloud computing technology helped each of these firms develop a unique business model using an infrastructure that can be reused to provide services to internal clients or external customers.

Collective Problem Solving

Most companies have similar requirements for basic systems such as human resource (HR) management, sales force automation or supply chain management needs. Like many large enterprises, Fairchild Semiconductors used a traditional enterprise software vendor to provide it with an ERP package to meet its HR needs. Its IT department bought licenses for the package, purchased new hardware to install it, hired a systems integrator to customize the product, and kept an in-house staff for training, support and updates or changes. Over time, the company became increasingly frustrated with the limitations of the application as well as the high costs and disruption that an upgrade to the newest version of the package would entail.

Since Fairchild's team had good experiences with other cloud-based applications (such as Google Apps, SalesForce.com, and Concur), it was open to a cloud-based HR solution. The CIO recommended a cloud provider of HR services (Workday), and after evaluating this option, the company decided to implement it for all its core HRM needs, including North American payroll. Since multi-tenant cloud-based applications are configurable, but do not accommodate customization, it picked a standard process configuration based on the vendor's demonstration of options from its process library, choosing those that the vendor had already developed for other clients. As a result, they enjoy lower costs by avoiding time-wasting custom building of new processes for a common function, and learning from other customers: the system's current capabilities, as well as ongoing enhancements, are influenced by 150 of the vendor's other customers. As its SVP of HR, Kevin London, declared:

> *"Users are willing to give up on customization when given the choice between that and fast response to changing customer needs. We are not arrogant enough to believe that we have a better succession planning process, for example, than anyone else."*

Cloud technology allows multiple users to share data and processes owned by a vendor. The vendors can choose to allow their partners to modify and enhance this shared asset, while allowing all users to enjoy the benefits of continuous improvement.

Business Model Experimentation

A cloud-based platform enables customers to develop their applications on existing platforms. These applications can reuse many of the functionalities provided by the platform vendor through well defined APIs. As they do so, they can create new business options for themselves.

Apple provides an environment and support tools that facilitate a user company's discovery of new applications to meet their needs. It would be impossible for Apple to develop all 500,000 applications currently existing on its platform. Instead, its distribution platform allows third parties to discover and access these applications. In addition, other members of the ecosystem, such as Appiro and BlueWolf, develop and release utilities that allow applications to work seamlessly with one another.

Among the IT executives that we interviewed, the CIO of Rehabcare, a leading provider of rehabilitation services, decided to tackle the change management and adoption challenges of riding the IT consumerization wave. Once the company's doctors started adopting iPhones and iPads for their personal lives, they demanded that their enterprise applications run on the same devices. In response, Rehabcare's CIO developed a new model for application development and delivery on cloud platforms. One

4 LiveOps. "LiveOps Talent: Social Savvy Agents: The New Consumer-Aware Agent Talent," June 2011, from http://www.liveops.com/why-liveops/independent-contractor.html.

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of its first applications by an in-house developer was a patient pre-screening application for the Force.com platform. The entire development process took only four days, and the application helped shorten the wait time for patient screening from 18 hours to less than 60 minutes. Over time, these types of applications should create a fast response organization and help improve customer satisfaction.

Orchestrating Dependencies

The ability to orchestrate business partners that jointly deliver on a value proposition is pivotal to competing in the era of business networks or ecosystems. When companies choose to use applications on the cloud, they have to consider applications from multiple partners using different vendors. As a result, just as in the case of traditional software, cloud-based development creates an ecosystem of dependencies.

For example, Enterasys Networks, a global provider of hardware, software and services for unified communications, has assembled its applications to run on the Salesforce.com cloud. It uses Salesforce.com as its core system, Jigsaw for data quality and GoodData for business analytics. This allows it to use best-of-breed solutions for its processing needs while focusing its attention on building customer relationships. Enterasys discovered many of these applications on the AppExchange marketplace. The others were suggested to it by sales people and users. In cases where products did not interoperate, it wrote some custom code.

Although Enterasys assembled its own set of interoperating applications, some cloud vendors have realized that they have to be a part of a best-of-breed interoperable solution to compete with big name vendors. To that end, The Small Business Web was founded by a consortium of cloud vendors to create an ecosystem of interlocking, interoperable software. It requires members to have a published open API to access its services, giving customers a set of applications that can interoperate at a small business price point.

In addition to software application based dependencies, customers can create business related dependencies using the cloud. For example, customers can form temporary alliances with partners to share sales force information. Such configurations are easily created on the Salesforce.com cloud.

In these cases, cloud technology through the use of APIs enables partners to interoperate on a particular platform.

Facebook Effect

Facebook has demonstrated how the convergence of mobile devices, real-time data, and social applications with the cloud creates interesting possibilities for companies to design applications with high customer acceptance. Moreover, companies such as Facebook and Zynga have shown how adding social elements to software can increase loyalty to a customer-facing platform. Our analysis, however, shows that loyalty requires more than just adding a social layer. That is, Zynga and Facebook design all their products and features around the user experience; no product or feature is added to the portfolio without extensive user-testing. Both companies are also obsessed with analytics. Every interaction with the user is archived and analyzed for trends, which in turn determine which products get launched and which features are added or modified. As a result, user-driven content-generation and behavioral data-gathering is integral to the business platform.

MANAGING BUSINESS RISKS USING CLOUD COMPUTING

Organizations expect IT to help them deal with certain strategic risks they inevitably face when competing in the marketplace.[5] Some organizations have discovered that both the capabilities of cloud technologies, and the benefits derived from their use, can help mitigate these risks. In Table 1 we relate the six business benefit patterns described in the prior section to five types of business risks.

Below we describe each of the five business risks.

Demand Risk

Fluctuating demand or market collapse may arise from changes in economic conditions, customer taste, or competitive thrusts. Firms must be very flexible in managing such changes to avoid losing market share to competitors.

Since rapid elasticity is a capability offered by the cloud, variation in demand for services can be smoothed out by using cloud based services. In addition, the pay-per-use model prevents users from being locked into fixed commitments. The orchestrating dependencies benefit pattern helps firms change their partners when different resources are needed, as illustrated by LiveOps. When demand

5 Child, J. "Information Technology Organization and the Response to Strategic Challenges," *California Management Review* (30:1), 1987, pp. 33-50.

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Table 1. Benefit Patterns and the Business Risks They Help Mitigate

	Business Risks				
Business Benefits	Demand	Inefficiency	Innovation	Scaling	Control
Increased business focus			√		
Reusable infrastructure	√	√		√	√
Collective problem solving		√		√	√
Business model experimentation	√		√		
Orchestrating dependencies	√	√			
Facebook effect	√				

for a particular type of resource changes (say, from Excel to SQL experts), customers can switch vendors to meet this new requirement. The Facebook effect of designing around the consumer experience and relentlessly collecting data to support doing so, will help identify risks very early in the lifecycle of an idea. Similarly, the ability to create business model experimentation will help appropriate value and assist in managing demand risk. Orchestrating dependencies allows companies to choose the best-of-breed solutions on a pay-as-you-go basis and even shut those solutions down if the business plan does not work. Similarly, reusable infrastructure allows companies to make many incremental improvements to a given product or service.

Inefficiency Risk

Cost structures that are higher than those of competitors put a company at risk of losing market share. Using the economics of scale and scope, cloud vendors help companies drive costs down by allowing them to outsource their infrastructure or even entire processes. Since companies can divide the costs across many users, unit costs for services tend to decrease. Organizations can then choose vendors offering the right balance of quality and cost.

As described earlier, Fairchild Semiconductors switched from an on-premise provider of enterprise software to a cloud service provider, helping it simplify and standardize core human resources (HR) business processes for more than 10,000 employees and managers globally. As Paul Lones of Fairchild Semiconductor stated:

> *"Since Workday opened its platform, we have already successfully built 28 custom integrations to and from Workday, gaining the capability to maintain these or create additional integrations as our ecosystem evolves."*

Lones estimates that the cost to implement and run Workday was about 15% less than buying, installing and maintaining the traditional ERP software. In addition, he estimates that implementing a SaaS solution required about 50% to 70% less time.

According to published reports,[6] the public sector has also saved money by moving to cloud based computing. In 2008, the Washington, D.C., city government shifted many of its 38,000 employee email services across 86 agencies to the cloud, saving 48% on email expenditures. In 2009, the city of Los Angeles moved email service for its 30,000 employees to the cloud. An analysis by City Administrative found that the five-year costs of running the new Google system would be over $17 million—23.6% less than the costs for operating its former system during that same period.

Reusable infrastructure, orchestrating dependencies, and collective problem solving are all benefit patterns that help mitigate this risk. Reusable infrastructure helps by amortizing a vendor's fixed costs over many clients. Since initiatives such as the Small Business Web and marketplaces such as the AppExchange help identify best-of-breed interoperable applications, they reduce both search and operating costs. Finally, sharing business processes helps generate solutions to most problems efficiently.

Innovation Risk

In order to ensure that a company's rate of innovation is at least as fast as competitors, the company must continuously focus on integrating new developments into its business model.

With Salesforce.com as the cornerstone of its customer focus strategy, Enterasys has access to the AppExchange platform, which offers many innovative

6 West, D. *Saving Money Through Cloud Computing*, 2010, Washington, D.C.: The Brookings Institution.

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applications developed by Salesforce.com and third-party developers. Enterasys can discover, access, evaluate, and see reviews by other users on the site. Sometimes individual users discover and test an application before they decide to buy. Regardless of who gets the application, each adopted application is integrated within Salesforce.com.

In many ways, Enterasys has outsourced innovation to third-party developers. Prior to using the Salesforce.com cloud, it either developed innovations in-house or contracted with independent software vendors. Now it can tap into indirect network effects created by the Salesforce.com platform.

Scaling Risk

Businesses typically build excess capacity to ensure their ability to scale fast or efficiently enough to meet market growth. Since these investments must be made in anticipation of revenue growth, they can cast a heavy financial burden. Excessive outlay of funds for future returns is highly risky and may threaten the viability of a firm. When excess capacity is shared across many users, the cost of building this capacity, along with the financial risks, decreases.

Smugmug is a photo-sharing company that saw exponential growth in its usage of storage and processing. It avoided investment in expensive infrastructure that would be used in peaks and valleys by turning to Amazon for its computing needs, using EC2 for photo and video processing and encoding. This service can scale up during high traffic times and, more importantly, be scaled down during low traffic times such as the middle of the night. Cloud computing has been able to match its IT needs as its market has grown, bringing demand for IT services with it.

Control Risk

Businesses need adequate controls to ensure that they can maintain needed service levels. The recent breach of data pertaining to 100 million users of Sony PlayStation network has put the spotlight on controls in particular and cloud computing in general.

Cloud vendors excel in managing this risk, as exemplified by Facebook's Open Computer Project. Facebook committed to publishing technical specifications for its new data center in Oregon, including details of the computers, power supplies, server racks, battery backup systems and building design. Ecosystem partners (Intel Corp., Advanced Micro Devices, Dell Inc. and Hewlett-Packard Co.) have agreed to ship products to other customers based on the standards developed for the Open Computer Project.

Another example of managing control risk is the arrival of the OpenStack cloud operating system. Rackspace, Dell, Equinix, NASA, Intel, AMD, Microsoft and Citrix have committed to supporting this standard. Companies using this standard for provisioning their cloud services will not incur licensing costs and will be able to interoperate across Openstack implementations.

RELATING CLOUD COMPUTING CAPABILITIES TO THE BUSINESS RISKS

In the first phase of our SIM-sponsored research, we identified seven capabilities of cloud computing that can be leveraged to achieve business value.[7] These capabilities are summarized below.

Controlled Interface. This capability creates an infrastructure that is organic and responsive to changing user requirements. As companies develop and deploy application services, each service can be used by other services using an interface called Application Program Interface (API).

Location Independence. This capability controls access to services and information assets from anywhere within an enterprise without needing to know their location.

Sourcing Independence. This capability enables a company to control access to services and to switch service providers easily and inexpensively.

Virtual Business Environment. A virtual business environment (VBE) is a suite of integrated applications (processes) and tools that support specific, major business capabilities or needs. With cloud computing, this capability provides decision makers with integrated and seamless access to all the capabilities needed to analyze and execute business decisions.

Ubiquitous Access. This capability reflects users' ability to access any company service from any platform or device via a web browser.

7 Iyer, B., and Henderson, J. "Preparing for the Future: Understanding the Seven Capabilities of Cloud Computing," *MIS Quarterly Executive* (9:2), 2010, pp. 37-51.

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Table 2. How Cloud Computing Capabilities Can Mitigate Business Risks

	Business Risks				
Cloud Computing Capabilities	Demand	Inefficiency	Innovation	Scaling	Control
Controlled Interface			√		√
Location independence		√			
Sourcing independence		√		√	
Virtual business environment		√	√		
Ubiquitous access	√	√	√		
Addressability and traceability	√		√		√
Rapid elasticity	√			√	

Addressability and Traceability. This capability enables users and the usage of every information service within an organization to be tracked.

Rapid Elasticity. This provides a self-service capability for rapidly scaling up or down service usage transparently and automatically.

In Table 2 we summarize which cloud computing capabilities help mitigate which of the five types of business risks we described in the prior section.

RECOMMENDATIONS FOR CIOs

Based on our research, we recommend that CIOs consider launching the following initiatives as part of their efforts to develop their cloud strategy.

Initiate Strategic, Fast Experiments

In order to deal with innovation risks and bridge the gap between external IT innovations and internal capabilities, we recommend that organizations perform strategic, fast experiments. Merck Research Laboratories, for instance, has created an innovation group just to conduct such fast experiments.[8]

The first step is to identify new technologies worthy of further consideration. Leveraging the wisdom of crowds, employees could be asked to identify and propose emerging technologies to consider, as illustrated by the mystarbucks.com site, which allows people to suggest ideas and then vote on the concepts proposed. The innovation team, in turn, can deliberate upon those with the most votes, identifying promising IT innovations and matching them with internal business needs. Matching innovations with needs prevents wasted time and effort on new technologies that may be interesting but prove inessential to the organization's goals. The team can then orchestrate opportunities to apply promising new technologies to business challenges through short, agile experiments.

These experiments are run using the scientific approach. First, the team identifies a business group to sponsor the experiment. Then they develop a hypothesis, framed as an explanation of a business challenge. What follows is a prediction of the new technology's impact on the business scenario described in the hypothesis. The next step is to design and execute an experiment to test this prediction (which may involve developing a prototype).

Once the project is complete, an objective assessment of the innovative and novel technology is made. Although the sponsoring group can't use the prototype for a "real" application, business units participate to learn and plan their future business strategy on the basis of experimentally verified capabilities of new IT. In addition, by adding the experiment and its results to a corporate knowledge management system, adequate knowledge capture and dissemination can be ensured.

The term "fast experiments" applies because, as a policy, these scenarios are limited to three months at most—achievable because experiments such as these neither follow the typical long lead time procurement process nor are confined by the standard process. Moreover, anything built is not made to last. Since prototypes are decommissioned soon after the experiment, ongoing support and maintenance costs are avoided.

Although the experiments are fast-cycle based, the lessons learned can be long-lasting. First, companies can determine if a real business need exists for that technology. Once they present the results to internal stakeholders, they can see if the technology garners

8 Ray, S. "Enabling Pharmaceutical Research & Development," 2011, Retrieved June 2011 from http://www.pharmafocusasia.com/information_technology/innovative_it_enabling_pharmaceutical_randd.htm.

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interest. If it does, they next assess what investments they need to make in people, process and technology to be able to build it out as a capability.

Establish a Cloud Community Strategy

Since much of the work achieved in the world of clouds occurs with the help of user-driven communities, learning how to navigate and participate in these communities will help minimize demand and inefficiency risk. Take a look at Amazon's web services community. Users pose questions and answer them on Amazon's discussion boards. In some cases, experts from within Amazon respond. Users can also make requests of Amazon to provide a service or explain how something works. Community members can build their expertise and credibility by participating in these conversations. Based on their answers to questions, users can earn points and build status and reputation on these sites. Since these communities are open on Amazon's website, users can familiarize themselves with it before they choose to participate.

Since Amazon does not have a large help desk or call center to respond to user queries, this type of community remains the only source for solutions to many problems with Amazon's services. Similar communities exist for Google, Salesforce.com, and other cloud platform providers. Learning how to participate and navigate within these communities is a critical skill-set to develop.

Employees should also be encouraged first to observe and then participate in these external communities. In addition, companies should create internal communities for people to learn, interact, and share ideas.

Pay Attention to IT Architectural Capability

As companies implement cloud-based capabilities, they typically end up with a mix of traditional and cloud solutions. Moreover, many of the traditional applications continue to have interoperability problems that reduce business efficiency and scalability. In response, organizations should develop an IT architectural capability to access information and products from both within and outside the organization's boundaries, and to integrate them flexibly across disciplines and boundaries within the organization.

The management of APIs is also important. Just as organizations create governance mechanisms to approve applications within organizations, they need a group that decides on APIs to provide and the access rights and privileges of different stakeholders.

Embrace the Role of a Business Architect

Prior to the development of cloud computing, CIOs had to build systems and control change management within their corporate firewalls. Today, CIOs must create an infrastructure that allows employees to be entrepreneurial and innovative using IT. Today's challenges involve juggling the complex set of dependencies that arise between entities in the ecosystem. If not properly managed, this complexity could lead to the enterprise's inability to appropriate value from the ecosystem. We call this new challenge "business architecture."

The business architectural perspective goes beyond merely seeing the process as the focus of design to addressing the emerging competitive reality of using business networks to create new business models. We define business architecture as the set of design rules, policies, and key decisions that position the firm in a business network to maximize its current and future information assets. The role of the business architect is to collaborate with the leaders of the firm to achieve its business network strategy.

Consider the Economics of Networks

Business strategists must understand market pressures and invest in new capabilities. This economic perspective must be incorporated into the development of business architecture.

For example, consider the CIO who is part of a team defining a mobile payment system strategy for a bank. Taking a business architect perspective, she identifies and sketches out the current ecosystems that provide mobile payment services. She identifies operators, payment network providers, technology providers, software vendors, merchants and other complementors who are part of each competing ecosystem.

This analysis unearths the Google Wallet ecosystem championed by Google and ISIS (www.paywithisis.com) championed by AT&T, T-Mobile and Verizon. The CIO then studies these networks to help the bank create a competitive position and notices that the major payment networks like Visa and Discover form the cornerstones for both these ecosystems.

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In addition, merchants may not attach themselves exclusively to any ecosystem. As a result, the CIO advises the bank to simply join the network based on its network effects (how many merchants joined them) and the level of standardization of their APIs.

Value appropriation requires the firm to manage its architectural control points. Increasingly, the architectural control point lies not in the management of physical resources or geographical location, but rather in the command of information assets, standards and intellectual property rights. These complex issues must be translated into business architecture. In essence the business architecture must design the 21st century cash register within the fabric of the business network solution.

Returning to the example of the bank considering a mobile payment system, the CIO realizes that the ultimate goal is to deliver high customer satisfaction and retention, which depends on the ecosystem's performance. As a result, she recommends that the bank interact with every partner in the business network through clearly defined and well-governed APIs. In addition, the bank will also monitor the end-to-end performance of a transaction. If the quality of service delivered by a particular ecosystem to the customer is inadequate, the bank could switch to a different ecosystem. In addition, the bank could set and monitor performance goals for each partner, settling payments accordingly.

CONCLUSION

In conclusion, we argue that CIOs treat cloud computing as a major strategic imperative that requires careful examination prior to major action. Before entering the cloud space, we recommend reviewing carefully the company's strategic goals as well as the set of recommendations that we have provided. However, developing and consuming applications on the cloud is not without IT risks. As the CEO of Appirio has cautioned, "All it takes is one major incident of losing confidential information on the cloud for adoption rates to slow down." Current legislation related to data transfer across geographical boundaries also creates impediments. In the case of the EU, current privacy laws place rigid limits on the free flow of personal information beyond the jurisdiction of users. Similarly, in the financial services industry, audit requirements mandate that companies know where their information resides when it is transmitted, impeding cloud adoption. Ultimately, assessing these opportunities and constraints leads to a final question: As competitors explore and implement cloud and other network strategies to build efficiency and agility, can you afford to wait for every uncertainty to be fully resolved? We doubt it.

APPENDIX: METHODOLOGY

We began our research, sponsored by the APC of SIM, with an ecosystem analysis, which we published earlier as a SIM-sponsored report in this journal (see the June 2010 issue of *MIS Quarterly Executive*). We then interviewed senior executives in the key service companies within the cloud ecosystem to identify a list of companies that were using cloud computing in innovative ways, and were given the contact information for the IT executives in these companies. For this report, in-depth interviews were conducted with the CIOs in the following companies: Rehabcare, Enterasys Networks, Fairchild Semiconductors, Appirio, Partners Healthcare, and a large bank. We also asked to speak with an architect and a business user in these companies. In addition to the extended conversations with the sponsors identified above, we also had conversations with representatives from Thomson Reuters and Salesforce.com.

We developed an interview script with questions for each stakeholder. The questions were divided into seven topics to capture the following type of information.

Context: the role played by the stakeholder, description of the cloud project, project sponsorship information and the criteria used to select them.

Service organization: its evolution, challenges in managing it and the process used for API maintenance.

Design process: methodology and artifacts used for the cloud project.

Value proposition: how the company benefitted from using the cloud.

Approach: methodology and artifacts used for project roll-out and training.

Extended enterprise: how the cloud helped companies connect with their suppliers and other business collaborators.

Lessons learned: key takeaways and critical success factors.

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Each interview lasted for an hour. In many instances, we had to conduct more than one call with each stakeholder. Each interview was recorded with the permission of the interviewer and transcribed. We circulated the written documents back to the interviewees and received their approvals. A presentation based on the approved notes was made to the SIM-APC members during their Atlanta meeting in 2011. Feedback obtained during these interactions helped us identify questions for follow-on conversations with companies.

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