Capturing the Value of Cloud Computing

*How Enterprises Can Chart Their Course to the Next Level*

David Dean and Tamim Saleh

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How Enterprises Can Chart Their Course to the Next Level

Some of the biggest and most powerful IT players—Microsoft, Google, IBM, SAP, and Wipro Technologies—are jostling for positions in the emerging cloud-computing market. Countless start-ups, many telecommunications companies, and several other unexpected players—Amazon.com, in particular—have joined the party, too.

Analysts estimate that in 2012, the size of the enterprise cloud-computing business may reach $60 billion to $80 billion—or about 10 percent of the global IT-services and enterprise-software market. Although its double-digit growth rate is welcome relief for vendors in this downturn, the cloud-computing market is still early in its life cycle.

So is cloud computing overblown hype or a real opportunity to transform how IT is consumed and deployed within an enterprise? The truth is more subtle than some analysts and service providers might suggest. As with other technologies, it is easy to overestimate the short-term effect of cloud computing while underestimating its longer-term consequences.

Similar to Web 2.0’s disruption of traditional business models in the entertainment, media, and telecommunications industries, cloud computing presents a new paradigm. It extends the Web 2.0 concepts of common architecture, abundant bandwidth, and community to computing resources, and could help spark the creation of new business models built around collaboration, networks, and information in nearly all industries.

The Potential of Cloud Computing

To explain the potential of cloud computing, it is useful to start with a definition. Cloud computing is commonly defined as the deployment of IT resources as a service over the Web and other networks. Those resources—such as processing power, storage, computing platforms, and applications—are remote from the user, or “in the clouds,” and are paid for only as they are used. (For a fuller definition, see the sidebar “Defining Cloud Computing.”)

The nature of computing changes when IT resources become more abundant and can be instantly and affordably deployed, flexibly managed, and universally accessed from a broad range of devices, including PCs and mobile handsets. This “variabilization” of both the costs and scope of IT resources is central to the promise of cloud computing and helps explain the gathering interest in it. In the enterprise environment, cloud computing has the following advantages, not only for the CIO but also for all IT users:

- Accelerated deployment of new applications without consuming the computing resources of the enterprise
- Reduced capital requirements for up-front investments in IT since the enterprise is able to utilize the infrastructure, applications, and platforms in the cloud
- The flexibility to meet sudden changes in demand and peaks and troughs
- The capability to provide applications or services that meet demand precisely and can match future demand
- Significant cost savings in selected situations, notably when the scale of an enterprise’s computing resources is relatively small compared with that of cloud providers
Capturing the Value of Cloud Computing

Cloud computing has sparked several competing definitions. One commonly accepted definition explains cloud computing as a pay-per-use model for enabling convenient, on-demand access to a shared pool of configurable computing resources—such as networks, servers, storage, applications, and services—that can be rapidly and easily deployed and released. This definition focuses on public clouds, but private clouds—those dedicated to an organization or group of organizations—will likely spur large enterprises to adopt cloud computing. Private-cloud offerings will lead to hybrid models that combine public- and private-cloud infrastructures.

The cloud-computing model offers four general types of services:

- **Software as a service** is the provision of applications, such as customer-relationship-management software, which is offered over a network and does not require users to install and run the application on their own computers. Of the four cloud services, software as a service currently has the largest market by a wide margin.

- **Infrastructure as a service** is the availability of storage, processing, and network capacity that is billed by consumption.

- **Platform as a service** refers to a development environment and associated tools and services that are offered to customers for building their own applications.

- **Process as a service** is the logical extension of software as a service—the full provisioning of a process, such as accounts-receivable collection, in the cloud.

Data sharing and collaboration capabilities for processes that involve many parties; cloud solutions are often more economical and faster to deploy than their alternatives.

The ability to efficiently deploy greenfield business processes; cloud computing frequently enables enterprises to launch new initiatives without relying on legacy systems and architecture.

Although the enterprise cloud-computing market is developing rapidly, it will take time for enterprises to realize these advantages. Challenges involving data security, privacy, and regulation will slow implementation in some cases. To date, cloud technology has been deployed in those areas with low perceived risk, such as e-mail, backup and recovery, batch processing, testing, and quality assurance. Other emerging cloud applications include customer relationship management, workflow, unified communications, and simple enterprise-resource planning. Applications that are more sophisticated will be deployed as the market matures. For example, research and development in the pharmaceutical, automotive, and other industries is increasingly moving to the cloud.

The Levels of Clouds

In our work with clients, we see three distinct levels of value in cloud computing. Each level builds on the previous one and requires a shift in current business processes. But each level also enables value creation up to an order of magnitude larger than the prior level. (See Exhibit 1.)

- **Utility Level.** Enterprises can benefit from lower costs and higher service levels through the availability of elastic computing resources and pay-per-use models.

- **Process Transformation Level.** Enterprises can introduce new and improved business processes by leveraging the common and scalable assets and collaborative potential of cloud computing.

- **Business-Model-Innovation Level.** New business models can be created by linking, sharing, and combining resources using cloud computing in an entire business ecosystem.

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1. This definition draws heavily on one used by the National Institute of Standards and Technology, an agency of the U.S. Department of Commerce.
Although utility-level cloud services can produce bottom-line results quickly, the benefits of the process transformation and business-model-innovation levels will take longer to realize because they represent fundamental shifts in the way that work gets done within enterprises and among business partners. Many companies have begun to benefit from the utility level; however, far fewer have explored the process transformation and business-model-innovation levels. To do so, CIOs will need to work closely with executives to develop a strong understanding of the strategic and operational requirements of their businesses. But, as companies are discovering, the benefits of each level are considerable. (See Exhibit 2.)

**The Utility Level: Lower Costs and Higher Service Levels**

Although small and midsize enterprises and start-ups may have been early adopters of cloud computing, larger companies are now beginning to selectively pick applications that take advantage of the greater efficiency, scale, and focus of cloud service providers to improve their companies’ deployment of labor, hardware, software, and power. Genentech, the biotechnology company acquired earlier this year by F. Hoffman-La Roche, is an example of a company that has turned to Google Apps for its e-mail and calendar programs and a host of other applications for its 11,000 employees. At the time of its migration to the cloud-computing model a year ago, Genentech had 36 terabytes of e-mail and 2 million scheduled meetings stored in its systems. It was contemplating spending tens of millions of dollars on a new data center. Genentech avoided that capital expense and reduced its anticipated cost of ownership by several million dollars over the next five years by using cloud service providers and virtualization technologies.

Even the public sector is using cloud computing. Carlsbad, a city in southern California, is relying on Microsoft’s cloud offering for e-mail and collaboration services, such as meeting scheduling and instant messaging. The city is saving more than 30 percent annually. On a potentially much larger scale, the U.S. government has launched Apps.Gov, a portal that helps government agencies migrate their computing resources to the cloud-computing model. This is part of President Barack Obama’s initiative to modernize and reduce the cost of IT infrastructure in government agencies.

**Labor.** Most CIOs recognize that their departments spend too much time “keeping the business running.” These responsibilities decline significantly in a cloud environment. Rather than fixing the plumbing, IT staff can be improving the functionality and features of IT systems while CIOs work on transforming the business. IT organizations can become more strategic or smaller.

**Hardware.** Companies can benefit from the presumed higher efficiency of cloud service providers. A typical corporate data center needs to carefully balance many competing demands—in particular, optimizing utilization while managing large spikes in volume and delivering high levels of service. Cloud
service providers aim to achieve a better balance across these demands by leveraging scale and standardization along with smarter technologies, such as server virtualization. Consequently, they can potentially operate at a lower cost than a typical enterprise-IT data center. To be sure, traditional outsourcing arrangements also convey many of these labor and hardware benefits, but they generally lock customers into longer-term contracts with less flexibility.

**Software.** Enterprise consumption of software is driven by demand. With cloud computing, companies can more easily deploy new applications and adjust usage up or down than with a conventional setup. Traditional maintenance and support are performed by the cloud service provider, significantly reducing the operating costs of enterprises.

**Power.** Enterprises can take advantage of the advanced power-management capabilities of cloud service providers. They can also make use of their renewable energy supplies and other green initiatives that reduce the carbon footprint of computers and servers.

### The Process Transformation Level: Improved Business Processes

Although the value of utility-level cloud services may appeal mostly to CIOs, the benefits of process transformation should accrue throughout an enterprise—allowing the finance staff to conduct transactions more efficiently, researchers to set up and modify their computer models more swiftly, and sales professionals to serve their customers more effectively.

Enterprises frequently have a difficult time improving business processes and systems, despite the best efforts of both business and IT executives. The business processes are often inadequately supported by the underlying technologies—an array of different systems and incompatible data structures. The cloud-computing model of standardized applications, data formats, and development tools helps enable the implementation of processes that depend on access to shared data, collaboration, and mobile or remote access.

One company aims to undercut its competitors by 30 to 50 percent in offering digital document management and storage by moving to the cloud-computing model. The vendor is building a delivery model involving document scanning and offshore processing. The model relies on workflow, business-process-management applications, a common database, and storage available through cloud computing.
Another example of a company using cloud computing is Bechtel, a large engineering and construction company, which is on a journey to standardize construction management. The company has created a large private cloud, based on a common and shared set of processes and applications, that allows employees, contractors, and partners to work together.

Retailers may also eventually be beneficiaries of process transformations enabled by the cloud-computing model. These companies require vast computing resources to analyze the mushrooming data—which are doubling every nine months—about customers and products. Cloud computing can provide the resources needed to perform real-time analysis of customer behavior, such as heavy-spending patterns, and economic incentives, such as how product placement affects sales of merchandise.

The Business-Model-Innovation Level: New Business Models

All companies rely to a greater or lesser extent on partnerships and cooperation with other companies and organizations. Some of these so-called business ecosystems are well known, highly developed, and very successful, such as Procter & Gamble’s Connect + Develop program and Toyota Motor’s network of suppliers.

Cloud computing can help power the next generation of business ecosystems by enabling the deconstruction of value chains and the emergence of new, innovative business models. The value chain of the health care industry, for example, consists of pharmaceutical companies, insurers, physicians, hospitals, and patients. Under the current crazy-quilt system seen in many markets, bits and pieces of a patient’s health record are stored in several locations, but the complete record is rarely in one place. Slowly, patient data and health histories are being made available through cloud providers. Quest Diagnostics, for example, makes lab results available to patients through Google Health and Microsoft HealthVault, both cloud services. Although this is a small step, it could eventually lead to more readily available information that can help deliver medical care more efficiently and effectively.

Pharmaceutical companies are also exploring ways to fundamentally reshape their processes for discovering new drugs by using cloud computing to simplify collaboration on basic, nonproprietary, but expensive research. Through the creation of a common set of data standards, tools, and processes, these companies can dramatically increase their ability to work with outside researchers and partners, and save up to 30 percent of the cost of discovery—which could amount to several hundred million dollars per drug.

Cloud computing could also reshape the business models of other industries. The media industry, for example, is in the process of digitizing content while facing substantial business challenges, including piracy, declining audiences, and new forms of entertainment, such as user-created videos. Competitors, such as television networks or cable channels, could conceivably agree to operate common content production, distribution, and storage platforms in order to create a radically lower cost basis.

Cloud computing is not a panacea—and certainly not the only way that companies can achieve greater collaboration. Toyota began collaborating with its partners long before the birth of cloud computing. But cloud computing does provide a common platform that eases the way. Companies will still need to rewire the way they operate, for example, by putting their data and content in a standard form. They will also need to make fundamental choices about where they possess competitive advantage and derive value, and where they can cooperate without jeopardy.

The View of the Cloud from the Inside

CIOs are still figuring out if and how they want to take advantage of cloud computing. The Boston Consulting Group recently surveyed about 30 CIOs in several industries and countries, and found that most of them were thinking through the performance, availability, and security concerns of cloud computing—but also considering its operational and strategic implications. About one-third of the CIOs were experimenting with or deploying cloud services for activities such as e-mail and data storage. Another third had developed clear plans and strategies to fit cloud computing into their overall IT strategy. And a final third did not have clear plans but said that they will be investigating or developing strategies that address the
role of cloud computing. We found that the CIOs in the pharmaceutical, health care, media, and logistics industries were particularly advanced in their thinking.

Many of the interviewees in these industries had moved beyond viewing cloud computing simply as a way to save money and manage resources. They were considering ways that cloud computing could improve the technical environment and their business processes, and enable new business models.

Although recognizing cloud computing’s potential, many of the CIOs were still concerned about its performance, availability, ability to integrate with existing IT systems, and security. Most of the CIOs recognized that cloud computing poses risks and rewards that must be carefully assessed. Some of the hurdles will disappear with technological advances. Others depend on an amenable regulatory environment, both national and global. But some of the most important hurdles are internal—the cultural, organizational, and legacy barriers of moving applications to the cloud. (See Exhibit 3.)

The Path Forward

Given that cloud computing is in its infancy, enterprises need to chart their course carefully. They need to understand both the immediate needs of their businesses and their longer-term aspirations. Some companies may be content with lower costs and higher service levels. Others will have greater ambitions or want to tackle strategic business challenges. Enterprises also need to fully understand the risks and rewards of cloud computing and the competitive landscape. All cloud-service providers are not created equal. Their market ambition and service and support levels vary considerably. Some provide integration with other IT systems, while others are selling basic, standalone services. Furthermore, companies should understand how their outsourcing partners view cloud computing and what role they play in fulfilling the enterprise’s IT needs. Are outsourcing partners embracing cloud computing themselves? Does it make sense to migrate outsourced applications to the cloud?

Finally, enterprises need to be willing to change how they operate. Within the IT department, work may become more strategic and less operational. The ability to enforce and maintain common architectural standards will be a prerequisite for success. Many cloud services require a cultural shift to greater collaboration, sharing, and trust within the enterprise. Although many employees will embrace this

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**Exhibit 3. Despite Its Promise, Several Hurdles Still Hinder Wider Adoption of Cloud Computing**

| Performance, availability, scalability, and adaptability | ◦ Concerns about latency of data networks and service interruptions  
| Security and regulation | ◦ Anxiety about data security, especially of critical customer information  
| | ◦ Strict regulation of data privacy and protection in some regions  
| | ◦ Underdeveloped rules on cross-border data exchange  
| Vendor landscape | ◦ Road maps of some vendors lack clarity about functionality, performance, and cost  
| | ◦ Concerns about long-term viability of some vendors  
| | ◦ Undeveloped cloud-computing standards, making migration between vendors difficult  
| Organizational inertia | ◦ Cultural resistance to sharing data and changing traditional ways of working  
| | ◦ Lack of clarity on IT processes  
| | ◦ Large investments in traditional applications, infrastructure, and other resources  

Sources: BCG interviews and analysis.
change, others will find it unsettling. (See Exhibit 4 for an outline of key issues that enterprises need to address.)

CIOs should take the lead and help prepare their organizations by making both short- and long-term plans to diagnose current operations, identify opportunities, and act.

In the short term, CIOs should consider the following steps:

- Explore cost savings opportunities of the more mature and relatively stable cloud offerings, such as backup, storage, and e-mail
- Initiate controlled pilots in areas such as application development, batch processing, and “burst” capacity needs
- Develop a road map for integrating cloud computing into the IT agenda by identifying potential areas in which the cloud model could create value
- Evaluate specific cloud applications in light of the ease of implementation and the readiness of the organization
- Set up a governance structure to manage and deliver cloud applications

For the long term, CIOs should work with senior executives on a more ambitious set of initiatives. As a group, they should first develop a common understanding of the potential of cloud computing and its consequences for business process transformation and business model innovation. They should put cloud computing on the business agenda.

Second, the team should create an overall plan that enables fundamental business transformation through cloud computing. The plan should quantify the business case and track it through clear milestones in order to ensure that cloud investments are justified.

Third, the group should define the role of cloud computing in the overall IT strategy, taking into account

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**Exhibit 4. Enterprises Should Plot a Course to Cloud Computing**

<table>
<thead>
<tr>
<th>Risks and rewards</th>
<th>Competitive landscape</th>
<th>Role of outsourcing</th>
<th>Change management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which applications are most suited to cloud computing?</td>
<td>How clearly defined, stable, and suitable are vendors’ current offerings and future road maps?</td>
<td>How do current outsourcing partners view cloud computing? Are they embracing it in their own offerings?</td>
<td>How significant are the change management challenges of cloud computing and how can they be addressed? For example:</td>
</tr>
<tr>
<td>Are the economics as beneficial as some vendors claim?</td>
<td>What are vendors’ market ambitions and service and support levels?</td>
<td>How competitive is outsourcing versus alternative cloud offerings?</td>
<td>◦ Workforce deployment as tasks become more strategic</td>
</tr>
<tr>
<td>Is a private cloud more appropriate than the public cloud?</td>
<td>What is the longer-term viability of vendors, especially those providing critical applications?</td>
<td>What role does outsourcing play in current and potential future applications when compared with cloud computing?</td>
<td>◦ Ability to enforce and maintain common architectural standards</td>
</tr>
<tr>
<td>Are risks related to data security, privacy, performance, and regulation in proportion to the benefits?</td>
<td></td>
<td>What is the potential to migrate outsourced applications to the cloud-computing model?</td>
<td>◦ Cultural shift to greater sharing, collaboration, and trust within the enterprise</td>
</tr>
<tr>
<td>What value does cloud computing offer beyond the utility level? Are fundamental process-transformation and business-model innovations achievable?</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Source: BCG analysis.
the following areas:

- **Architecture.** What standards can be adopted that benefit from cloud technology and provide the foundation for further development?

- **Infrastructure.** What is the role of cloud computing in managing data centers and delivering infrastructure services? How will traditional and cloud infrastructures be managed?

- **Applications.** Which traditional applications can or should be replaced by cloud applications? What is the role of cloud computing in the application road map?

- **Data Protection, Privacy, and Jurisdiction.** What data can be moved to the cloud? How can security and privacy concerns be rigorously managed? What are the regulations across jurisdictions?

- **IT Processes and Governance.** How will IT processes change, and what capabilities are needed to manage them?

- **Outsourcing and Partnerships.** How will outsourcing models leverage the cloud-computing model? How will strategic alliances and partnership models change?

By following a systematic and measured approach, enterprises can explore the benefits of cloud computing, manage the risk of adoption, and achieve advantages in cost, speed, efficiency, and competitive positioning. For some, it will be sufficient to focus on realizing the benefits of the utility level; for others, the true value of cloud computing will lie in a fundamental reappraisal of business processes or the development of entirely new business models.
About the Authors

David Dean is a senior partner and managing director in the Munich office of The Boston Consulting Group. You may contact him by e-mail at dean.david@bcg.com.

Tamim Saleh is a partner and managing director in the firm’s London office. You may contact him by e-mail at saleh.tamim@bcg.com.

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