Reaching for the “cloud”: How SMEs can manage

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Abstract

Cloud computing is an emerging new computing paradigm for delivering computing services. The approach relies on a number of existing technologies e.g., the Internet, virtualization and grid computing. However, the provision of this service in a pay-as-you-go way through the popular medium of the Internet renders this computing service approach unique compared with currently available computing service modalities. This article highlights some aspects of this uniqueness and also explores some of the concerns that might be preventing some companies from adopting it. Notwithstanding these concerns, it is argued in this article that cloud computing is likely to prove commercially viable for many small and medium enterprises (SMEs) due to its flexibility and pay-as-you-go cost structure, particularly in the current climate of economic difficulties. A case study of a cloud experience by a British SME is also presented in this study in order to further highlight the perceived values of cloud computing in terms of cost and efficiency for real small enterprises.

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1. Introduction

Not long ago, SOAP (Simple Object Access Protocol) Web services emerged to represent a model of software delivery based on the notion that pieces of software applications can be developed and then published to a registry where they can be dynamically discovered and consumed by other client applications over a number of transport protocols (e.g., HTTP, TCP/IP, etc.) irrespective of the language used to develop those applications or the platforms (e.g., operating systems, Internet servers) on which they were implemented.

However, for the last two years cloud computing was receiving all the publicity and adulation from almost every corner of the computing landscape that were once the reserve of Web services. Admittedly, there seems to be real justification for this excitement, as will be explained in this study.

Interestingly, Web services (as a concept involving the consumption of software over the medium of the Web) are now one of the building blocks that underpin this new computing paradigm (namely cloud computing) that promises to deliver not only software remotely (as Web services once did) but also other computing-related functionality (thanks also to other relatively new technologies namely “virtualization” and grid computing).

Virtualization is a technology that masks the physical characteristics of computing resources (e.g., a PC, a Server) in order to simplify the way in which other systems, applications, or end users interact with them. For example, a PC running Windows can use virtualization to enable another operating system (e.g., Linux) to run besides Windows. Furthermore, the technology also enables single physical resources (e.g., a server, an operating system, an application, or storage device) to appear as multiple logical resources.

Grid computing involves the use of software to combine the computational power of many computers, connected in a grid, in order to solve a single problem (often one that requires a great deal of computer processing power). Furthermore, grid computing also uses software that can divide and farm out pieces of a program to as many as several thousand computers. Grid technology, therefore, can be thought of as the technology that enables the establishment of network-distributed parallel processing and distributed and large-scale cluster computing.

Both virtualization and grid computing have become two fundamental technologies underpinning cloud computing (see Carr, 2009).

2. Methodology

In order to demonstrate the economic viability and efficiency of cloud computing for SMEs and its other likely benefits, this study will look into the type of services offered by this new computing paradigm and explain how those services differed from anything experienced so far by those businesses in terms of flexibility, availability and cost structure. Furthermore, the study will also examine the findings of some surveys which not only reveal the preparedness of many SMEs to use cloud computing but also show that many of those businesses are already using some of the cloud services on offer. A case study of a British SME will also be presented in order
to further demonstrate the economic and efficiency merits of cloud computing.

3. Cloud computing: definition

No common standard or definition for cloud computing seems to exist (Grossman, 2009; Voas & Zhang, 2009). However, the definition that describes it as clusters of distributed computers (largely vast data centers and server farms) which provide on-demand resources and services over a networked medium (usually the Internet) seems to be commonly accepted. The word “cloud”, a metaphor for the Internet, was likely to have been inspired by IT textbook illustrations which often depicted remote environments (especially the Internet) as cloud images.

The services that can be offered by cloud computing can be listed in the following three main areas (see Miller & Veiga, 2009; Salesforce.com; Sultan, 2010):

- Infrastructure as a Service (IaaS): Products offered via this mode include the remote delivery (through the Internet) of a full computer infrastructure (e.g., virtual computers, servers, storage devices, etc.). The most notable vendors under this category are Amazon’s EC2, GoGrid’s Cloud Servers, and Joyent;
- Platform as a Service (PaaS): services provided by the traditional computing model which involved teams of network, database, and system management experts to keep everything up and running (e.g., operating systems, databases, middleware, Web servers and other software) are now provided remotely by cloud providers under this layer. Among the early market leaders in this area are Google’s App Engine, Microsoft’s Azure, Amazon Web services, and Force.com (by Salesforce.com);
- Software as a Service (SaaS): Under this layer applications are delivered through the medium of the Internet as a service. Instead of installing and maintaining software, one can simply access it via the Internet; thus freeing oneself from complex software and hardware management. This type of cloud service offers a complete application functionality that ranges from productivity applications (e.g., word processing, spreadsheets, etc.) to programs such as those for Customer Relationship Management (CRM) or Enterprise-Resource Management (ERM). For example, products under this category include Yahoo mail, Google Apps, Salesforce.com, WebEx and Microsoft Office Live.

Fig. 1 gives a simplified pictorial impression of how cloud computing works. A cloud provider maintains a number of data centers (possibly scattered in different parts of the world and interconnected) stocked with servers that provide the three types of cloud services listed above. Cloud users access and interact with those services through the cloud (i.e., the Internet). Typically, users do not have to worry about the location of their data. In some cases, however, they could be presented with an option to choose the preferred locations of data centers. This would be useful for organizations that are legally required to maintain their clients’ personal data in certain geographical locations.

Some analysts question the appropriateness of using the term “new paradigm” to cloud computing arguing that this approach is largely dependent on existing technologies and approaches such as utility computing, software as a service (SaaS), distributed computing and centralized data centers. Cloud computing’s only innovation, according to this view, is that it combines and integrates these approaches (Weinhardt, Anandasivam, Blau, & Stößer, 2009). Other authors equate the service of cloud computing with the practice of “timesharing” that existed in the 1970s when small companies relied on other companies (that had access to mainframe computers) for processing some of their data (e.g., payrolls) for a fee

4. The rationale

It is argued that the main drivers of this computing approach are economics and simplification of software delivery and operation (Erdogmus, 2009). Some see huge potential of the technology in reducing the cost of IT to organizations and freeing them from the expense and hassle of having to install and maintain applications locally (Leavitt, 2009). Providing IT services in the cloud shifts much of this expense to a pay-as-you-go model and consequently offers significant cost advantages according to one view (Lin, Fu, Zhu, & Dasmalchi, 2009). However, there are serious doubts and concerns surrounding this new computing approach. In some cases, there is an outright rejection of this model. Richard Stallman, creator of the GNU operating system and founder of the Free Software Foundation, described cloud computing as a “trap” aimed at forcing people to...
buy into locked, proprietary systems that are likely to prove expensive in the future. He went further to describe it as “a marketing hype campaign”. This view was also echoed by Larry Ellison, the founder of Oracle, who once criticized the rash of cloud computing as “fashion-driven” and “complete gibberish” and commented that it would be hard to make money in this technology which he sees as “lacking a clear business model” (Hasson, 2008; Johnson, 2008).

5. Commercial implementations of the cloud

Cloud computing is being implemented successfully on a commercial basis by a number of providers. For example, Amazon’s Elastic Compute Cloud (EC2) offers a variety of services and it represents a virtual computing environment that allows users to use Web service interfaces in order to launch instances with a variety of operating systems, load them with customers’ custom application environments and manage customers’ access permissions to networks. Amazon’s other cloud, known as S3 (Simple Storage Service), provides a simple Web services interface that can be used to store and retrieve any amount of data, at any time, from anywhere on the Web. It provides developers with access to “the same highly scalable, reliable, fast, inexpensive data storage infrastructure that Amazon uses to run its own global network of Web sites”, according to Amazon’s description of this service. Furthermore, Amazon has two other cloud-based services: Amazon Simple Queue Service (SQS) and Amazon Flexible Payment Service (FPS). Amazon SQS offers a hosted queue for storing messages as they travel between computers. Developers can use this service to move data between distributed components of their applications that perform different tasks, without requiring each component to be always available. It also integrates well with Amazon’s other platforms, e.g., EC2 and the Amazon Web Services (AWS) infrastructure. Amazon FPS is a set of web services that allow companies to bill users (similar to PayPal or Google Checkout) and also provides senders and receivers of funds with the ability to decide how they can structure payment instructions, including standing instructions that can remain in place for multiple transactions. One of the objectives of FPS is to make micropayments efficient and financially cost effective by allowing companies to charge very small amounts of money and then group those purchases together in order to lower transaction costs (see Amazon; Cumbrowski; Reese, 2009).

Google has a number of clouds serving different needs. One popular one is Google Apps. Google Apps (not to be confused with “Google App Engine” which is a Web development environment) is a collection of Web-based applications and file storage that run in a Web browser. The applications include communication tools (e.g., Gmail, Google Talk, and Google Calendar) and productivity tools (e.g., Google Docs: text files, spreadsheets, and presentations). Google Apps makes content-sharing simple and facilitates collaboration and collective generation of knowledge.

IBM also has a number of cloud products under its Smart Business portfolio. They include Smart Market, Smart Cube and Smart Desk. Smart Market is a portal service to compare and manage different business applications that run in IBM’s cloud environment. Smart Cube is an all-in-one appliance that has networking, storage, and office software built in. Smart Desk is a dashboard software package designed to enable users to manage applications and services from the Market and Cube clouds. One of the main concerns and challenges of IT staff was often finding enough available resources to perform tests before moving new applications into production. IBM was successful in addressing this issue by introducing its “Smart Business Test Cloud”. This product is designed, according to IBM, to reduce costs to organizations substantially by enabling clients to test cloud applications before sending them to production in their enterprises (IBM, 2009; Treadway, 2009).

Like other major vendors, Microsoft is also investing heavily in this new computing service delivery model and has introduced “Azure”, as its cloud platform offering. Azure has three components: Windows Azure, SQL Azure and Azure AppFabric (formerly known as .Net Services). Windows Azure is designed to provide developers with on-demand compute and storage to host, scale, and manage Internet or cloud applications. SQL Azure is developed to extend the capabilities of SQL Server, Microsoft’s database managing system (DBMS), into the cloud as a Web-based distributed relational database. AppFabric is a set of integrated technologies designed to help developers connect applications and services between Windows Azure and on-premises deployments (Bailey, 2009; Foley, 2009).

The aforementioned examples are intended to provide an impression of the type of cloud services on offer by some of the major players in this field. There is no space here to list the many other cloud services on offer. However, a simple Web search can yield lists of web sites and blogs (e.g., see CloudTweaks; JohnWWillis; Maguire, Vance, & Harvey, 2009) that maintain long tables of those cloud providers and the services they offer. This, undoubtedly, is a manifestation of the growing number of cloud providers and vendors.

6. Interest in cloud computing

The high rate at which IT technology changes will continue to place a great deal of pressure on organizations’ budgets. Continuous upgrades of software and hardware have become important items on many of those organizations’ resource meetings. This situation is likely to be made worse in the current difficult economic conditions following the near collapse of the world’s financial systems.

However, cloud computing services could provide many of those companies with the opportunity to continue to take advantage of new developments in IT technologies at affordable costs. Cloud computing is likely to be an attractive proposition to startup and small to medium enterprises [defined by the European Commission (European Commission, 2005) as companies with fewer than 250 employees and annual turnovers not exceeding 50 million euro and/or an annual balance sheet total not exceeding 43 million euro]. The UK’s National Computing Center (NCC) estimates that SMEs can reduce the total cost of ownership of technology using hosted solutions (Microsoft, 2009a).

Another research conducted by EasyNet Connect has shown that UK SMEs are increasingly eager to adopt cloud computing, with 47% planning to do so within the next 5 years. Of those companies which indicated their preparedness to move to cloud computing, 35% of them cited cost savings as the key driver (Stening, 2009).

Similar results were obtained by the European Network and Information Security (ENISA), an EU agency. The ENISA survey found that 68% of the SME responses it received indicated that avoiding capital expenditure in hardware, software, IT support and information security is behind their possible engagement in cloud computing while almost 64% of the responses also indicated that flexibility and scalability of IT sources was the reason (ENISA, 2009).

7. Concerns and challenges

Cloud computing, as indicated earlier, is an emerging computing service paradigm. And, like other services of this scale, complexity and novelty, there are fears, uncertainties and concerns about the technology’s maturity. However, the most important can be listed as those relating to: control, vendor lock-in, performance, latency, security, privacy and reliability.

IT departments and organizations are likely to be wary of surrendering control of their resources to outside providers who can...
change the underlying technology without customers’ consent. The ENISA survey showed that 29 out of 62 SME responses saw “loss of control of services and/or data” as being “very important” (ENISA, 2009). Issues relating to performance and latency (evidenced by the temporary run-outs of capacity by some providers) are also problematic.

Furthermore, there are also valid security and privacy concerns. A recent survey of chief information officers and IT executives by IDC (International Data Corporation) rated security as their main cloud-computing concern and almost 75% of respondents said they were worried about security. Recently, the Electronic Privacy Information Center (a not-for-profit organization), has filed a complaint with the US Federal Trade Commission (FTC) about the security standards of Google’s cloud computing infrastructure, arguing that Google does not encrypt information held on its servers (Marshall, 2009). Moreover, various governments, such as those in the European Union, have privacy regulations that prohibit the transmission of some types of personal data outside the EU which has prompted companies such as Amazon and Microsoft to develop offerings using data centers located in the EU and to provide users with the option to choose the geographical locations of their data centers.

Another concern is vendor lock-in and failures. Currently many cloud providers offer their services through proprietary interfaces as there are no cloud-computing standards for elements and processes such as APIs (application programming interfaces), the storage of server images for disaster recovery, and data import and export. Portability is likely to be increasingly important as the number of cloud providers increases. Furthermore, failure of a cloud provider which owns data centers can have serious repercussions for end users who trusted their data with such a provider. However, there are currently some efforts to address issues relating to the portability and security of cloud computing by some bodies such as the Cloud Computing Interoperability Forum (www.cloudforum.org) whose purpose is to promote the creation of a common cloud computing interface and the Cloud Security Alliance (www.cloudsecurityalliance.org) which was created to promote security best practices in a cloud computing environment. Moreover, there are currently efforts to base vendors’ APIs on open source message standards such as SOAP or REST (Representational State Transfer) to overcome this interoperability problem. Companies such as Amazon and Microsoft are moving into this direction. For example, Amazon is making its S3 storage cloud available through both SOAP and REST and Microsoft ensured that its Windows Azure cloud also supports those standards.

Lastly, reliability can also be a serious problem for cloud users. Salesforce.com, for example, left customers without service for 6 h in February 2008 while Amazon’s S3 and EC2 suffered a 3-h outage in the same month a few days later. In the same year in July an 8-h outage was caused by Amazon’s S3 (Leavitt, 2009). In early 2009 Google’s Gmail (its Webmail service) went down for 3 h, thus preventing its 113 million users from accessing their emails or the documents which they store online as “Google Docs” (Naughton, 2009). Vendors often provide service credits for outages. However, those credits, according to a director of a US market research firm, are “cold comfort for sales opportunities missed and executives cut off from business information” (Leavitt, 2009).

Notwithstanding these concerns, using cloud computing has many operational benefits. One such benefit is efficiency. It is an efficient service that matches computing supply to demand thus providing instant scalability. Furthermore, the virtualization technology that cloud computing relies on can help reduce redundancy. For example, companies requiring access to hardware (e.g., servers) can rent, rather than buy, these (virtualized) resources from cloud providers. Even where cloud computing is thought to be giving rise to concerns about security and reliability there are some analysts and cloud users who think that cloud computing can still provide better security and greater reliability than those provided in-house (see Ashford, 2009; Financial Times, 2009; Linthicum, 2009). According to Eran Feigenbaum, Google’s enterprise security director, most businesses do not have the security intelligence gathering capabilities and resources that are available to his company. The following is a collection of quotes by Feigenbaum on a visit to London that reflects his views on this issue:

“Cloud computing can be as secure, if not more secure, than what most organisations do today in the traditional environment. Data is typically lost when laptops and USB memory sticks are lost or stolen, but local storage is no longer necessary if a company uses cloud-based apps. . .Statistics show that 66% of USB sticks are lost and around 60% of those lost contain commercial data” (Ashford, 2009).

On the issue of security patching, a common problem with many organizations, and cyber attacks, Feigenbaum explains how this issue is handled by his company:

“Research shows most organisations take between 25 and 60 days to deploy security patches, but CIOs admit it can take up to six months. . .Google is able to patch systems rapidly and efficiently as it has a homogenous IT environment across the organisation, unlike most other businesses. . .Google is able to gather security intelligence from billions of transactions a day and apply that intelligence in real time throughout the organisation” (Ashford, 2009).

Reflecting on the security concerns expressed by companies contemplating moving to the cloud, Green, from Trustmarque Solutions (a UK software solutions provider based in York), asks:

“. . .how many of those companies can truly say they have an internal data policy that is more rigorous than that of a third party? And is duly enforced. How many of those companies strictly govern their staff’s training to ensure they understand security policies and their importance and the consequences when they fail?” (Green, 2010).

The aforementioned views on cloud versus in-house security are shared by Field, director of Parsec Systems (a London-based IT solutions provider), who says:

“There is a tendency to assume data is safer in-house because we have control. However, large cloud providers can generally fund more significant security measures. They do that because they hold a goldmine of digital information and will be attacked regularly and assiduously by well funded cyber-criminals. This has to be factored into the cost/benefit analysis. Unemotional thinking will be necessary when comparing in-house security to that of an external provider” (Field, 2010).

Despite some highly publicized system “glitches” (as those mentioned above) by a small number of the big cloud players, some analysts also argue that cloud computing has, thus far, a good up-time record. Linthicum (2009), a technology consultant, asserts that cloud computing providers understand the sensitivity of their customers towards downtime and that most of them have built distributed failsafe features into their offerings. This, according to him, means that when a cloud provider’s primary data center goes down another data center is ready and waiting to pick up the load, typically invisible to the cloud computing consumer, and when there is a catastrophic failure, most cloud providers often have procedures in place to resume a service very quickly.

8. Case study

The objective of this case study is to demonstrate the economic viability (and flexibility) of using cloud computing by a UK-based
SME. The company is known by the name of “Dot Net Solutions”. It is based in central Windsor (Berkshire) with a workforce of 20 people. It describes itself as an “agile” systems integration company specializing in building bespoke solutions using Microsoft products and technologies. The case study is based on information and comments provided by Dan Scarfe (the Chief Executive Officer of Dot Net Solutions) through an interview and email communications and literature published by Microsoft (see Microsoft, 2009b). Even though it highlights the experience of a UK SME with Microsoft’s Azure cloud platform, the case study does not attempt to compare this platform with other cloud platforms which might have provided similar or better service than that provided by Microsoft’s Azure.

When implementing its projects, the company used the “Scrum” approach which involved placing sticky papers on its walls to represent milestones in those projects.1 This system proved problematic, especially when there was a need to share project progress with clients. The company was resorting to some time-consuming efforts such as emailing pictures of the project wall to clients and through teleconferencing. To overcome this limitation, the company developed software (called ScrumWall) to manage its projects. The software uses Silverlight (Microsoft’s animation technology) and is based on the same “project wall” principle. The software attracted customer interests which then encouraged the company to consider using Windows Azure in order to offer it as a hosted service.

The decision to use Windows Azure to host the company’s ScrumWall software made economic sense to the company which would have, otherwise, needed to invest heavily in hardware and support staff. There was also the risk of not getting it right (after all) which could potentially have implications for customer satisfaction.

The ScrumWall software relies on the Service Bus feature of Windows Azure to connect users over the Internet. This allows the company to send messages to its clients to alert them of developments in managing a certain project (e.g., moving a sticky note). To access that information, all a client needs is a Web browser, the Silverlight plug-in (which is free), and access to Windows Live (a free messaging software) as an extra communication method. Fig. 2 shows how information is communicated between Dot Net Solutions and its clients through its ScrumWall software which is hosted by Microsoft’s Azure platform.

The company found Windows Azure to integrate well with Microsoft’s development environment, namely Visual Studio .Net and had no problems migrating its software code to Windows Azure; thanks to the familiarity of its staff with using Microsoft’s products. Using Windows Azure, the company was able to bring a new product to market without a risky capital investment, allowing it to safely foray into new territory that may hold high revenue potential. The launch required minimal effort due to the easy migration of code to the new environment.

The company, according to Dan Scarfe, does not pay Microsoft anything at the moment as the Azure platform is still CTP (Community Technology Preview) and it only uses currently one Azure server. However, he indicated that his company will eventually be on a pay-as-you-go model (depending on how much server capacity it will consume) in early 2010.

When asked by this author on his 18 months experience with Azure in terms reliability, efficiency, risk management and future growth, Dan summarized his views thus:

“Reliability has been fantastic. Efficiency is good, although deployment to the cloud is necessarily a bit slower than to local servers. Risk management is always tough with the cloud, although Microsoft’s ability to geo-target data relieves some of these problems. There is always an attitude that the cloud is less secure than on-premises, but this stigma should soon pass. Future growth is the main advantage of the cloud so no problems there”.

Dan is very excited about the potential of cloud computing to reduce costs for companies. He said, when questioned about this issue:

“I think there’s huge potential in cloud computing to bring down the costs for IT, particularly for start-ups (start-ups inside a corporate, or outside) and give the small guy access to the same levels of redundancy and scale-out that traditionally have been the reserve of the big boys.”

Dan is upbeat about the future of cloud computing. He is of the view that large IT services will be provided through public cloud infrastructures. However, he also sees huge challenges for cloud computing at the moment with relation to “perception” vis-à-vis issues such as security (for which it, unnecessarily, seems to have a bad name) and also, more importantly, vis-à-vis legislative requirements, particularly those concerning where data can be stored and processed. On the security issue, Dan, in an interview with the Financial Times (2009) voiced his satisfaction with the security of data in the cloud by arguing that data in the cloud can be more secure than that which is kept on premises due to the tight security measures and sophisticated technology used by cloud providers to secure their clients’ data.

Dan was finally asked by this author to comment on a recent study by GFI Software2 which claimed that 44% of UK SMEs cited ‘too expensive’ as a reason for not adopting cloud computing. He said:

“Cloud is expensive if you have already paid for on-premises equipment. In general though, the reduction in management costs will be significant and this will drive adoption. The main challenge is that companies will see their IT departments resisting the move to the cloud and turkeys don’t vote for Christmas. This will slow adoption more than anything else. For Azure, the costs to our company are a fraction (say 20%) of traditional hosting so it’s not really an issue there”.

9. Who should use the cloud?

Concerns about the reliability of cloud services are valid. Similar glitches that befell the cloud services of Amazon and Google are likely to surface again as the number of cloud providers (and users) increases. For large companies, however, loss of service as a result of cloud glitches would be a major concern, particularly if it impacts their customers and results in substantial loss of sale opportunities and customer dissatisfaction. For SMEs, however, it is a question of tradeoff. The rare loss of service for a few hours for many SMEs and educational establishments may not be catastrophic.

Indeed, an increasing number of SMEs, as demonstrated by some of the surveys that were mentioned in this article are thinking

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1 For more information (with illustrations) on the Scrum approach see: http://www.dotnetsolutions.co.uk/agile/how-does-it-work/.

2 This study (see GFI, 2010) is based on a survey of 250 UK SMEs. The study seems to have produced confusing results. For example, while 44% of the respondents indicated high cost as the main reason for not electing to deploy cloud computing, only 12% of the respondents cited security as a main reason for not actually pursuing this model.
of migrating some aspects of their operations to the cloud. This is evidently a manifestation of the perceived advantages and the emerging popularity of this computing utility.

10. Conclusion

Cloud computing is an emerging computing paradigm which promises to provide opportunities for delivering computing services in a way that has not been experienced before. Cloud computing, as suggested in this article, is likely to be an attractive option for many SMEs, particularly in the current global economic crisis, due to its flexible cost structure and scalability. Cloud computing, as argued here, is unlikely to be suitable for some organizations. However, for those who aspire to be at the cutting edge of technology (at a cost they can afford) in order to retain and attract clients, this computing approach could be the way forward. Like many new technologies and approaches, cloud computing has teething problems. However, from the emergence of powerful players behind this technology in a massive way, and as the technology matures, some of those concerns are likely to be mitigated.

This study concentrated mainly on the merit of “public” cloud services (where services are provided by “remote” suppliers who take responsibility for delivering those services to their clients). “Private” and “hybrid” cloud offerings are now emerging with the intention of providing clients with a level of “control” over their resources. This issue would be a suitable area to explore in any future follow-up study to this one in order to examine the pros and cons of this new cloud approach and whether or not it can add any more benefits to organizations and to SMEs in particular.

Furthermore, the case study that was presented in this article is small in its scope. A more exhaustive study is required (preferably based on a number of cloud platforms from different vendors) to critically examine the true benefits and costs of cloud computing to SMEs.

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References


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