
Chapter 4

Commitment to the Cloud among tech companies

4

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"You don't generate your own electricity; why generate your own computing?"

Jeff Bezos, CEO of Amazon

Cloud computing has all the potential to be one of the powerhouses of innovation in the business field. On the one hand, it facilitates the establishment of new business in nearly all industries, although experts suggest that the areas with most potential for use are health, telecommunications and education (see Illustration 2). At the same time, for technology providers the cloud computing market opens a door to new consumers such as small and medium-sized enterprises and emerging markets which could not previously afford the cost of their products. As was the case during the dot.com boom, when some of the giants we know today first came to the fore, companies competing on tech market cannot limit themselves to following a trend. They have to be able to think ahead and capitalise on an innovative strategy that will allow them to get on the "wave" (in this case the cloud), because there are always more failure stories than success stories.

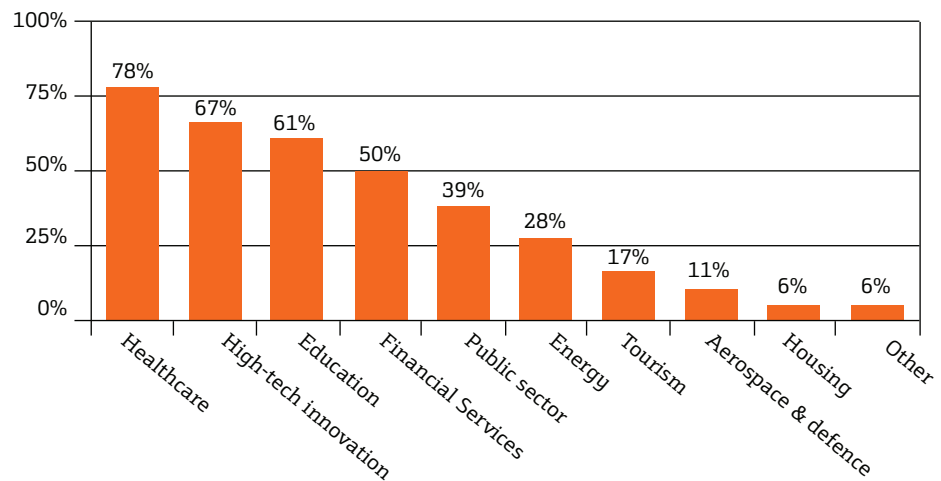


Illustration 2: Sectors in which cloud computing will have greatest impact.
Source: Authors.

Irving Wladawsky-Berger, Chairman Emeritus of the IBM Academy of Technology and one of the experts on the Future Trends Forum, explains his idea of cloud computing and the opportunity it holds out as "a new consumer and development model inspired by Internet services, which solves a problem that has been evident for some time with the extension of computing service"¹⁹. Think for a moment of all the applications that have become an essential part of your

¹⁹ http://blog.irvingwb.com/blog/cloud_computing/.

everyday life: Facebook, Google Maps... even your local neighbourhood citizens' forum. Now think of all the devices that let you keep hooked up 24 hours a day, whether it be your laptop via a WiFi connection or your Blackberry with its real-time upgrades. A level of interaction is being generated which is not sustainable for the current IT model. There has been a need for a model that will allow a high level of scaleability to ensure that people can use all these services and that existing data centres can offer them. And cloud computing, says Wladawsky-Berger, is precisely that model, enabling users to use services and providers to provide them.

Some FTF experts wondered which comes first: do users adapt to the development and launch of a new technology or is it consumer behaviour that drives technological advances? Which came first, the chicken or the egg?

Generation "as a service"

Outside the debate on the origin of the cloud computing market, in this chapter we will be analysing the area of service provision, i.e., all matters related to providers and services in the cloud. New ways of working and interacting personally at a global level require a "however-and-from-whenever" model. The great goal is to provide reliable, flexible and profitable access over the Internet without the need for any physical infrastructure. Providers are very much aware that if they are to compete at a global level, they need to be able to increase the capacity of their resources infinitely without compromising quality and without having to redesign solutions. Ideally, what they should be able to offer users is summed up as "0, 1, ∞", i.e. "zero" own infrastructure and acquisition, adoption and maintenance costs; "one" consistent and flexible environment; and an "infinite" scaleability to respond to changes in business, ensuring interoperability between different products and services and at the same time, a certain degree of personalisation²⁰.

In this regard, a shift is currently occurring from a model of individual supply to a shared platform. Until now, providers provided each company with an IT solution that required its own configuration, monitoring, upgrades and data recovery. With the coming of cloud computing, what is now on offer is a platform in which all the data and the applications from the different companies exist alongside one another in a single logical environment. This means that the provider can manage them faster and more efficiently, since any change can be implemented simultaneously for all clients.

In parallel, the traditional PC is being replaced or complemented by a number of smaller wireless devices, such as smartphones, netbooks and tablets. The rise in these products constitutes the tangible evidence that mobile technology is the order of the day, facilitating access to the information from anywhere at any time. Cloud computing will simply promote the demand for this type of device even further, precisely because it offers ubiquitous access to a wide supply of services. Other areas, however, are seeing a return to the origins of computing. In some ways, cloud computing means revisiting the original client-server model so typical

²⁰ "Allow none of foo, exactly one of foo, or any number of foo", The Jargon File, <http://www.catb.org/jargon/>.

of mainframe architecture. In this model, users accessed the system from a simple terminal and worked remotely on the mainframe server, with all the computing and data storage taking place on the server, not the client. With the coming of the PC, computing and data storage moved to the user's terminal and the client-server model was abandoned.

Cloud computing marks a return to this classic model: the cloud can be compared to a large mainframe which users access remotely from their own terminals.

These developments may change the way the market share is divided up among computer providers. The giant Microsoft looks set to gradually lose some of its supremacy to Google and Apple. The battle in the clouds has begun. "Although Windows still runs 90% of PCs, the fading importance of the PC means that Microsoft is no longer an all-powerful monopolist."²¹ Google and Apple have their own global network of data centres and seek to offer a complete range of cloud services, from tools for collaboration and business applications, to storage services and software for smartphones and other devices²². In addition to these two, there are of course many other firms offering cloud services, all competing for greater market share. We shall discuss these later, but first we need to clarify the concepts related to the way in which providers sell cloud computing.

Just like clouds in the atmosphere, the supply of cloud computing also comes in very different shapes and sizes. Some experts on the Future Trends Forum feel it should not be seen as a new technology, but as an "operational model that is determined by the way in which a business or individual obtains access to information functions". Depending, among other factors, on the speed, use and capital invested, these functions can be broken down into three types: Infrastructure as a Service (IaaS); Platform as a Service (PaaS); and Software as a Service (SaaS).

One of these, SaaS, has already been described. SaaS allows users to have best practices in software available to them without making huge capital investments, paying only for what they use. The classic example is Salesforce.com, a customer relationship management (CRM) Internet service with a pay-per-use system. More recent upgrades of the applications are included in the subscription, which means that clients never have to worry about unforeseen costs. It comes as no surprise, therefore, that their slogan boasts "Success. Not Software". In other words, the company's services focus on contributing to their clients' "success" rather than being limited to the sale of software. While the first wave of SaaS developed in business areas such as CRM (as in the case of Salesforce.com), human capital and financial management, the second wave focused on desktop productivity tools, including text processing, spreadsheets, e-mail and net-conferencing. Some have already dubbed it *Desktop as a Service* (DaaS). The applications work on infrastructure owned by others and are available from anywhere via the usual Internet browsers.

²¹ "Clash of the Clouds", *The Economist* (15/10/2009).

²² "Clash of the Clouds", *The Economist* (15/10/2009).

Secondly, *Infrastructure as a Service* (IaaS) consists of outsourcing the data processing machines. As we mentioned at the beginning of this chapter, there is no longer any need for firms to maintain in-house data centres. Instead, thanks to virtualization, (i.e. the physical separation between the infrastructure and the place where the operations run) companies can pay for the resources as and when they use them. An important example in this field is Amazon Elastic Compute Cloud (EC2), a vast sophisticated data storage centre which customers can access to use servers, storage and networks for a fee, with the possibility of tailoring the service to demand. This is the "elastic" part, since the service "expands" and "contracts" depending on specific processing, bandwidth and storage power needs.

Finally, the *Platform as a Service* (PaaS) function encompasses all activities related to development and implementation of applications from the Internet. To work successfully, it has to facilitate developers' work by providing them with access to any users needing their applications, while maintaining system security and scalability and using standards that will enable their applications to operate in other clouds. Windows Azure Platform offers a flexible environment for developers to create their cloud applications and services -thus reducing time to market- and to adapt the need for resources to meet the changing demands of their business. One of the most significant contributions of PaaS has been to improve the productivity of development teams, since it creates collaborative support from developers in different locations.

Developers have been quick to show their preferences among the offerings of the different cloud providers. Illustration 3 shows the relative position of the main providers in 3D, based on the developers' perception. The first dimension (horizontal axis) shows how developers rate the providers' ability to execute their cloud services strategy. The second dimension (vertical axis) shows how "complete" they felt the solutions offered to be. The third dimension shows how much they had adopted the services: the external circumference in black represents adoption in a period of twelve months, whereas the red sphere shows only current adoption. It is immediately clear that developers see Amazon and Google as having the most complete solutions with the best capacity to implement their initiatives. The extent to which they have adopted the two solutions is very similar at present; however, they expect to use Google more than Amazon over the next year. This perception is not surprising given that the two companies began offering public cloud services before others and have more experience in providing services. In addition, developers are more familiar with their offering because they've been on the market longer.

The next three companies in terms of current pace of adoption were IBM, VMware and Microsoft. The latter, despite being perceived as quite a complete solution with its Azure platform, is outstripped by most of the companies in the survey because it is considered less capable of implementing its cloud services.

To return to the classification of cloud services, Accenture talks about a fourth level, derived out of a combination of Business Process Outsourcing (BPO) and

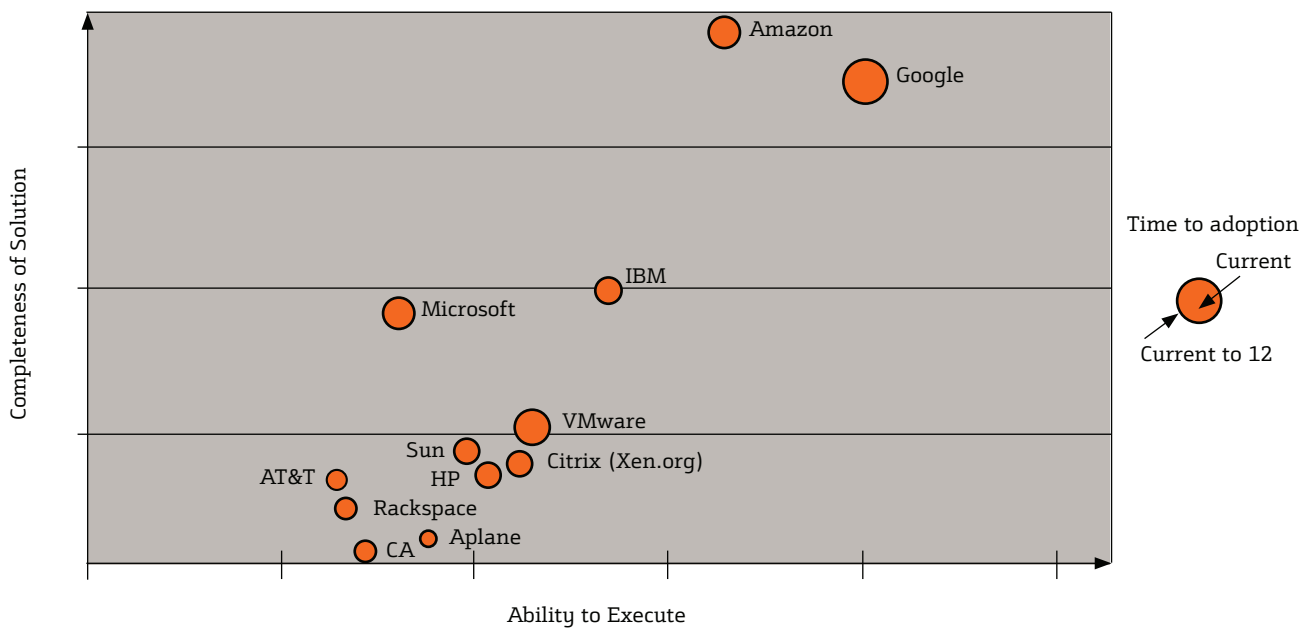


Illustration 3: Developers' perception of cloud computing providers
 Source: <http://www.evansdata.com/reports/viewSample.php>.

Process Oriented Software. *Process as a Service (PaaS)* is based on start-to-finish external, Internet-operated management of a business process, such as complaints, expenses or the supply chain. It therefore involves not only the organisation, but also other stakeholders, such as customers and providers. And the most important feature is that it can be used directly by any employee, without requiring intervention from IT staff. A good example of PaaS supply is ADP Employeease, which offers over 1,500 providers with a combination of process web and outsourcing applications for comprehensive payroll management. New start-ups in this area are not limited to offering software over the Internet but instead take a further step in customer service. ServiceChannel²³, for example, offers facility managers a single platform for procuring, managing and paying for facility maintenance services in real time on their web platform and thus promises to contribute to the business's return on investment. This is another example of a shift in focus between PaaS and SaaS. For company management, PaaS is a way of contributing to the business; the technological advantages that might interest IT managers fade in significance.

As Illustration 4 shows, cloud solutions are available at all IT levels in the company. Until now, each tier was developed independently, with particular importance placed on the "application". However, Accenture notes that "we may see an increasing dependency between upper layers and lower layers of the cloud stack. For example, new application players could turn to infrastructure cloud

²³ <http://www.servicechannel.com/sc/login/index.html>.

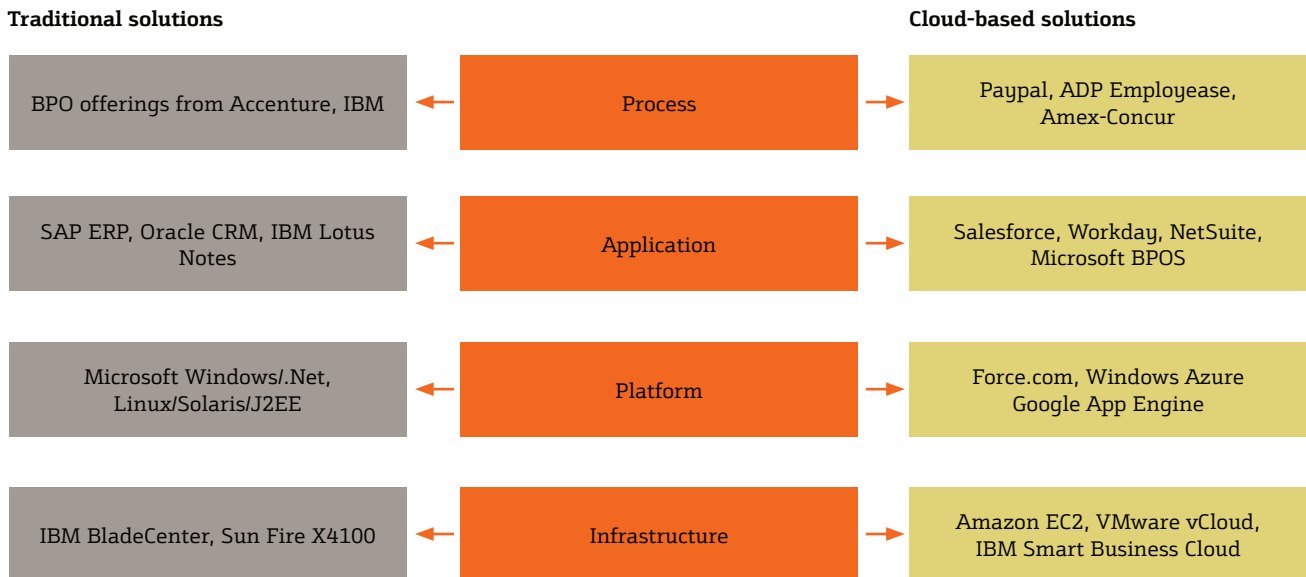


Illustration 4: Traditional solutions versus *cloud-based solutions*
 Source: *What the Enterprise Needs to Know About Cloud computing*, Accenture (October 2009).

providers to achieve a better cost structure, elasticity and faster time to market. Potential process cloud providers may follow a similar path to offer virtual BPO without owning their own hardware and software platforms.²⁴

Business models

According to a study by IDC, a high-tech market research firm, the amount of data generated during 2008 was 3% higher than the company's forecasts and it is estimated that the information generated will continue to grow dramatically. IDC forecasts that in 2012 the amount of data generated worldwide will be approximately five times as much as in 2008²⁵. Efficient data storage, management and access will be key aspects of the new society and the idea of centralising most of the information in the cloud will be an increasingly attractive one. The cloud computing market is led by the large providers who successfully gazed into the crystal ball and found positions on an unfamiliar market, where they have managed to gain a substantial market share. However, there is still room to conquer some of the largest and most traditional companies, now taking the first steps towards the cloud, and there is also a market for smaller providers who know how to meet companies' more exclusive needs, encouraging the creation of successful niches.

The primary business model of the large cloud providers is based on the concept of the long tail, a term coined by Chris Anderson, journalist, writer and lecturer, in

²⁴ *What the Enterprise Needs to Know About Cloud computing*, Accenture (October 2009).

²⁵ *As the Economy Contracts, the Digital Universe Expands*, IDC White Paper (May, 2009).

an article published in October 2004²⁶. In this model (see Illustration 5), by centralising inventories and reducing distribution costs companies can gain a significant benefit by selling small quantities of products that are difficult to find in normal distribution channels (orange area in the illustration) rather than selling large quantities of popular products (red area in the illustration).

El nuevo mercado

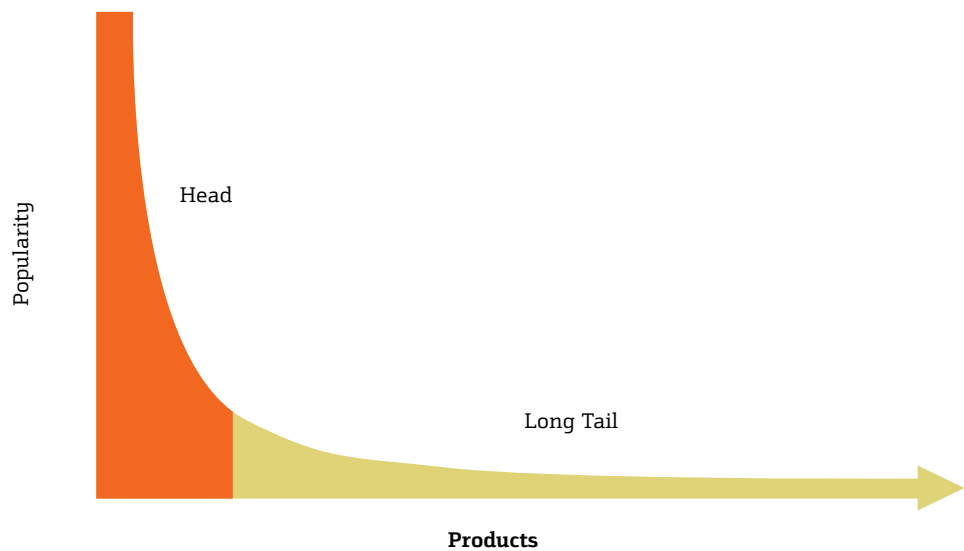


Illustration 5. Long Tail Concept.
Source: <http://www.longtail.com/>

To see how this model works in the case of a cloud provider, let's look at one example: Salesforce's CRM services. The company has large data centres containing all the computing capacity it offers its customers. In the long-tail model, this is equivalent to the centralisation of inventories. Once a data centre has been built, it costs practically nothing to distribute that capacity to clients until demand outstrips the total capacity of the centre and a new one has to be built. Similarly, the maintenance cost of the CRM services is unrelated to the number of clients, since they all use the same service and upgrades are distributed automatically. Thus for Salesforce the benefit of providing service to a client requiring a large capacity is the same as that of offering the same service to thousands of small clients using the same capacity in aggregate. In a certain sense, the providers' business model is almost a mirror-image of their value proposal for their clients, given that they have large fixed costs and practically no variable costs. This obliges providers to acquire a sufficiently large customer base to cover these fixed costs and obtain a profit.

²⁶ <http://www.wired.com/wired/archive/12.10/tail.html>.

Facebook and, to a great extent, Google have a different business model to Salesforce's, though one that is also based on the long-tail concept. These providers offer their services to private users free of charge, and make their income from advertising. However, this advertising does not consist of the classical big-audience TV commercial, but personalised links that vary depending on the user's queries or activities on their social network. By using the large amount of information available in their databases, these providers can target advertising at very specific segments of the population. Given that the advertisements consist of simple links or small images shown on the sidebars of the webpages, it costs practically nothing for the cloud computing providers to add them, which means that they can offer small companies space at affordable prices. These companies benefit not only from the low costs, but also from the fact that their advertisements are targeted much more directly at the market segments in which their potential customers may be found. This model also uses the long-tail concept, but to operate it needs to have a very large base of users of free services, in order to have enough population segments and enough information to attract advertisers.

The long-tail model is valid for large providers of the three main classes of cloud service: IaaS, PaaS and SaaS. In all three cases, the providers make major investments in infrastructures and have very low variable costs. As a result, they are always interested in acquiring new clients, regardless of the capacity this may require. Thus their target extends to both small customers and large companies, though particularly the latter, since their high levels of demand for computing capacity ensure a very significant and more stable source of income than small clients. New emerging providers, attracted by the opportunities of the cloud, are at a disadvantage to large ones. Whereas the latter have an established client base to cover the costs of their infrastructures, the former run the risk of not being able to achieve enough clients. However, the products offered by large providers tend to be standardised, since each service needs to have a minimum client base to be profitable and this offers new companies an opportunity to fill a gap on the market by offering specialist services. In other words, given their inability to compete in cost terms with the large companies, small providers have to distinguish themselves through their service. PaaS is an opportunity to stand out in this respect, by managing an entire business process from the cloud. With specialist services, the client base will be reduced even further, but the revenue per client will be greater the more value offered. In turn, by not concentrating on competing in cost terms, these small cloud providers can minimise their investments by making use of the services offered by the large providers.

The development of the cloud will attract new previously unknown business models. In *Business Strategy for Cloud Providers*²⁷, IBM highlights four models arising out of the splitting-up of traditional cloud computing providers:

- Providers of hardware, software or professional cloud-based services to other cloud providers. They invest in or purchase new technologies and implement the research and mergers needed to develop new capacities. This group is

²⁷ *Business Strategy for Cloud Providers*, IBM Global Business Services Strategy and Change White Paper (2009).

made up of large corporations and the product they offer will be equivalent to a commodity.

- Cloud-based IT outsourcing providers. These are partnerships between outsourcing firms and SaaS providers who offer the infrastructure, applications services and assistance in migrating to the cloud.
- SaaS Aggregators, especially attractive for new and small providers, who meet all the specific or complementary SaaS solutions for a single industry. Their target market segment are companies that are looking for a comprehensive cloud-based solution.
- Managed IaaS providers, providing value-added services to address latency, data security and unique company needs. They invest in costly initial infrastructure, but augment their revenue through these additional services, as well as others such as help desk and asset management, for which they charge a premium fee.

Cloud computing can be seen as a market consisting of a relatively small set of providers of large standardised services with a wide client base, together with a large range of small companies offering differential services. The make-up of these groups will be influenced by large established providers, but also by the strategies adopted by large corporations in adopting cloud services. These companies can act as a springboard for incipient cloud providers; the demand from just one of them might be enough to cover the fixed costs of one or various data centres. Thus a small provider can offer a specialist service and meet the demand of a large corporation and once the service has been optimised, offer it to other potential customers. There is nothing to stop this provider from being a subsidiary or spin-off that starts out meeting the demand of the parent company and gradually extends its customer base to become one of the large cloud providers.

Clash of Titans

Over the last decade, IT technology has consolidated its position as a cornerstone of the economy and markets, over and above any other business sector. Large high-tech companies have become the new giants on the stock market, rivalling once all-powerful index leaders such as banks and pharmaceutical firms. Indeed, the big five in the field –Microsoft, Google, Apple, IBM and Oracle– now boast business figures that come close to those of oil companies such as Exxon, Chevron, PetroChina, RD Shell and Total²⁸. “In 2009 they had their moment of glory on the stock market, with spectacular rises, ranging from Oracle’s 40% to Apple’s 150%, 102% for Google and nearly 60% for Microsoft and IBM”²⁹.

These giants, which had previously concentrated on different areas to each other, are now converging and positioning themselves on the cloud market, which they are approaching with a multi-product and multi-provider focus. Pioneering firms have been building the bases of cloud computing, bringing innovative services to

²⁸ “La era de los gigantes tecnológicos”, www.cotizalia.com (31/12/2009).

²⁹ “La era de los gigantes tecnológicos”, www.cotizalia.com (31/12/2009).

companies and users. However, it will soon no longer be enough just to offer basic cloud services: differentiation will be an imperative. Only those who are fastest in bringing the advances to the market can gain a larger share and higher margins.

Forrester Research see the opportunities as coming mainly for two types of agents: the enablers and the service providers³⁰. The former contribute the infrastructures underlying the model, focusing on technological areas such as virtualization and data centre automation. This is the case of names such as IBM, VMware/EMC, Red Hat, Intel, Sun, Citrix and BladeLogic. The latter are companies that base their businesses in the Internet, and which place their large technological environments at the disposal of clients following the SaaS model. They offer file management and personnel information services, as well as Office and network applications. They are represented by giants such as Microsoft and Google which, in keeping with their business strategy, anticipate technological trends and even plot the route for others. However, other big names have also come on strong, including Amazon, Salesforce.com and Rackspace.

In many cases, it would be difficult to class these providers within a single type of service. The same company may often straddle the boundaries between one tier and another. For example, AWS encompasses a series of services offered by Amazon between IaaS and PaaS, embracing computing capacity to meet specific needs (EC2, Elastic Compute Cloud), mass data storage (S3, Simple Storage Service) and a queue service for storing data travelling between different computers (SQS, Simple Queue Service). Salesforce, the ultimate SaaS company, with its CRM products over the Internet, launched Force.com as an integrated set of application tools and services which software providers and corporate IT departments could use to create and run any type of commercial application. Today, over 80,000 applications run on this PaaS³¹.

The two arch-enemies, Microsoft and Google, have also launched their own PaaS solutions, Azure and Google Apps Engine respectively. These are basically targeted at developers and firms that want to set up their own services on a third-party platform. The benefits are the same in the two cases: cost-savings, less need for know-how and re-use of the components offered by the platform.

Firms such as Amazon are aware that there are benefits to be gained from entering partnerships with other companies. Amazon offers the cloud, the partners provide the applications. The other companies gain from placing their solutions in the cloud without investment in either infrastructure or maintenance. This is the case of IBM which in early 2009 announced that it was offering its products on Amazon's EC2 machines using a pay-per-use system. Amazon, meanwhile, are delighted with the deal because in the eyes of the consumer, it is offering solutions from brands with consolidated leading-edge products on the in-house and cloud market³².

For its part, Google has been a cloud company since it first appeared in 1998, with a global network of data centres using an unknown number of servers (the

³⁰ "Cloud computing, ¿qué es, para qué sirve y cuál es el negocio?", Carlos García, www.materiabiz.com (December, 2009).

³¹ <https://www.salesforce.com/es/platform/what-is-it.jsp>.

³² "IBM, otra grande que se ennovia con Amazon", www.saasmania.com (12/02/2009).

company's best-kept secret). Following a period during which Google was best-known for its famous search engine and for being financed by advertising, it now offers a series of products such as web applications, operating systems for PC and mobiles (Android) and its star product, Chrome. It is also making a name for itself in the sale of business services, with a view to diversifying its revenue sources.

"If Google was born in the sky, Microsoft started on the ground."³³ Yet despite what one might assume, given its aversion to open source software, Microsoft is no stranger to cloud computing. Its Xbox games console has powerful online features; it has built a network of data centres; it is developing a web version of Office and it offers companies software and services on-line.

Another issue that will affect the distribution of power on the hi-tech market is the impact that IT service providers from emerging countries will have. They have already left their mark on the market to a considerable degree in recent years, especially in the US and are likely to continue to do so in cloud computing services³⁴.

All the major firms in the industry are currently doing their level best to stake out territory in the cloud. And of course there's no shortage of nay-sayers. Nokia and Oracle consider the cloud to be a marketing invention with little real impact. They say that cloud computing is just a new name for the server farms, taking us back to the days of the IBM 3270³⁵.

The Right Price

Way back in 1961, John McCarthy, a prominent computer scientist known for his contributions in the field of artificial intelligence said that computer science would become just another public utility, like the telephone service, giving rise to a major new industry³⁶. Unquestionably, one of the most important innovations of cloud computing is the provision of services for which clients are charged by consumption rather than number of users. This means that companies can easily alternate between demand peaks and periods in which the resources are not in use. This alone might appear to be enough to attract clients, yet providers are having to go to great lengths to draw them in; they are currently implementing aggressive pricing strategies, not unlike the sales season for any consumer product. Amazon EC2 cut its prices by 15% in November 2009; a standard Linux instance³⁷ fell from 10 to 8.5 cents per hour, and a yearly premium subscription to Picasa, Google's photo storage application, has dropped from twenty dollars to five.³⁸ The tariffs charged to clients are becoming more complex, too. Amazon, for example, has an on-line calculator that estimates a total cost based on the use of different resources³⁹. Some experts even predict that 2010 will see the advent of a smorgasbord arrangement in the cloud, with clients signing up to a variety of services for a fixed number of hours⁴⁰. Comparisons between the prices of different providers are already frequent in Internet.

Clients aren't the only ones who need persuading; some providers are not prepared to change their predictable income models for a pay-per-use system. As a

³³ "Clash of the Clouds", *The Economist* (15/10/2009).

³⁴ <http://www.enter.ie.edu/enter/mybox/cms/10550.pdf>.

³⁵ <http://newmediaera.blogspot.com/2009/04/vueltas-con-el-cloud-computing.html>.

³⁶ http://en.wikipedia.org/wiki/Utility_computing.

³⁷ An instance, in this context, is the virtual use of an operating system (Linux), i.e., it is not installed on the PC.

³⁸ "10 big cloud trends for 2010", Patrick Thibodeau, www.computerworld.com (28/12/2009).

³⁹ <http://calculator.s3.amazonaws.com/calc5.html>.

⁴⁰ "10 big cloud trends for 2010", Patrick Thibodeau, www.computerworld.com (28/12/2009).

result, they are offering better prices to clients who sign up to their pre-paid services. However, the flip-side of this tactic is the requirement for permanence which may not prove profitable.

For the moment, providers appear to be at liberty to set the type of tariff structure: a survey revealed that 34% majority of users weren't sure how they preferred to pay for cloud services (see Illustration 6.). They need to study the uses and benefits of the cloud because they do not have a clear idea what they can or should demand from the provider. The remainder of those surveyed preferred to pay on a monthly basis without signing up to a yearly contract based on resource requirements.

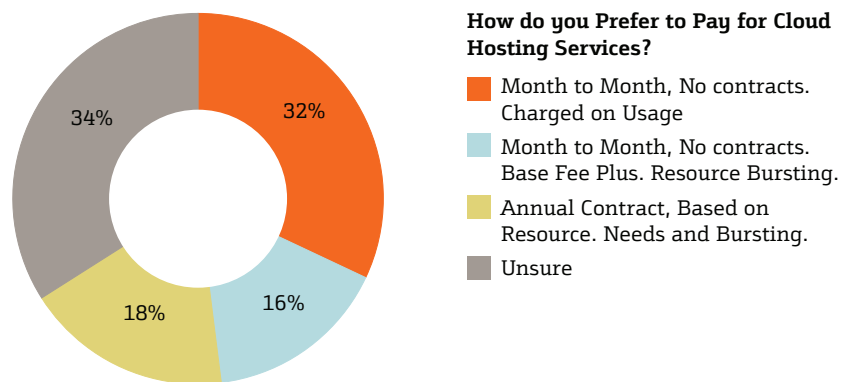


Illustration 6: How Customers Prefer To Pay For Cloud Hosting Services.

Source: <http://www.b10wh.com/2009/02/the-size-of-the-company-does-not-reflect-on-utilization-of-cloud-computing/>.

Spot Instances, the new system for auctioning excess storage capacity set up by Amazon in December 2009, may be the forerunner of a computing pricing system similar to that for energy⁴¹. Under this system, clients make bids for excess capacity and get the requested capacity as long as the supply is above a minimum price set by the on-line giant. Even if the supply exceeds this amount, the customer only pays the minimum established price, which is determined on the basis of the balance between supply and demand, so that it varies throughout the day just like oil or coal. This system is suitable for applications that do not need to be run at any particular time; however, it is not viable for applications that have to be available at all times, since Amazon will cut the capacity when the minimum price exceeds the tendered price and that could happen at any time. This pricing model has the potential to reduce IT costs for many firms, but the most important thing is that it has opened the way for IT to evolve in the same way as commodities.

⁴¹ http://www.economist.com/business-finance/displaystory.cfm?story_id=15663898.

Another way in which providers could differentiate their offer is by providing better service level agreements (SLAs), consisting of contracts between the

provider of the service and its client agreeing on the quality of the service. They include specifications on service definition, performance measurement, problem management, client's duties, guarantees and conditions for termination of the agreement. To verify compliance with the contract, variables are often used such as supply cuts (see Illustration 7.) and Return to Operation (RTO) time. Serious questions are now being asked about the providers' capacity to ensure certain levels of SLA, given that the performance of the systems depends on the Internet and it is practically impossible to commit to offering specific figures. Many experts suggest that efficiency in attending to business requirements by means of an SLA, together with the degree to which services can be customised, is what is really going to determine whether cloud computing takes off or not.

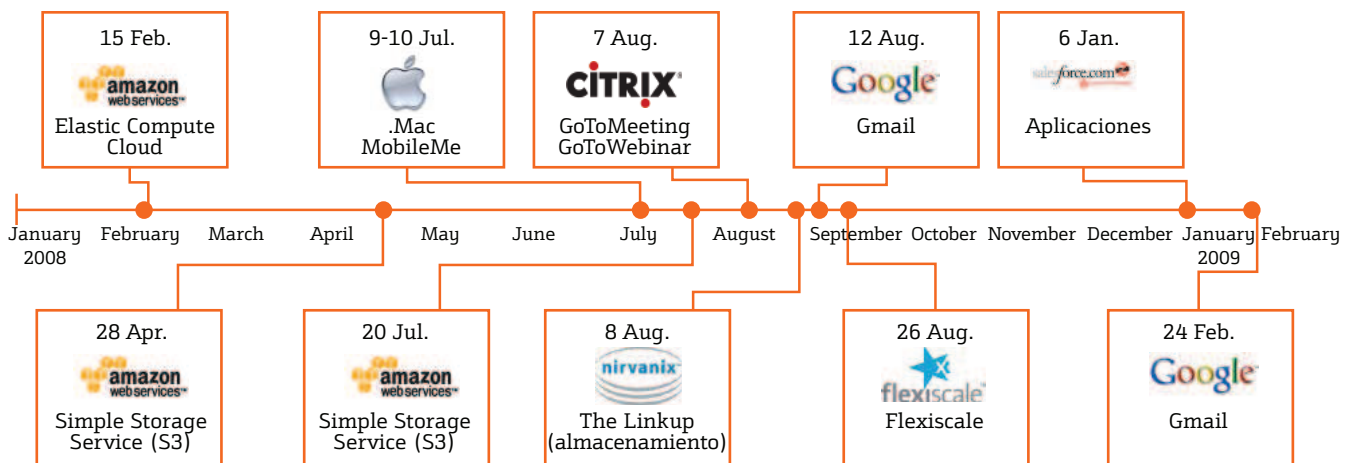


Illustration 7: Major recent supply cuts.
 Source: *Envisioning the Cloud: The Next Computing Paradigm*, Marketspace (20/03/2009).

The latest price-related challenge faced by the cloud computing community is that of licences. "The traditional licensing model of today's corporate software does not adapt well to the world of the cloud, where the logic is that an application is run on a large number of servers"⁴². It is tremendously costly for the providers of these licences to monitor their use in an environment characterised by virtualization, elasticity and scalability of the services. A new model of licences is therefore an indispensable requirement for cloud computing to take off. Among other issues, it will be necessary to address the portability of the licences to the cloud and the implementation of indicators that set a price for the use made of the software, including the costs of upgrades and technical support.

Some experts argue that free software is practically the only type of software that can be used in the cloud because "licence charges do not go up as the number of

⁴² "Cloud computing, ¿qué es, para qué sirve y cuál es el negocio?", Carlos García, www.materiabiz.com (December, 2009).

users increases⁴³. Otherwise, offering cloud computing services would not be economically viable. The term *free software* is often used interchangeably with *open source software* but it is important to note that the two are not exactly the same. *Open source* is a development methodology, whereas *free software* is a social movement⁴⁴. In other words, one consists of making the source code of a program visible for everyone as a more collaborative method for developing applications, whereas the other works to defend the user's freedom. It is also important to get the definition straight: free software is not "zero-charge" software (i.e. *freeware*) but free in the sense of "unrestricted" because it may be used, copied, modified and redistributed without the limitations of a licence.

In conclusion, cloud computing offers providers a market full of possibilities although there is still room for greater price competition, an improvement in the SLAs on offer and a tailor-made licence model. Moreover, all the signs are that cloud computing will simply blur the boundaries between proprietary software and free and open software.

Can you trust cloud computing?

Inevitably, one of the most common themes in any discussion of cloud computing is the challenge of security and the loss of control over data and systems. Say you are the IT manager of a company that is considering migrating to the cloud. What concerns would you have? One of the primary worries tends to be that one of the firm's most prized assets, information, will no longer depend on the company. All the company's information is sent from in-house servers and stored on external ones. This loss of control considerably augments the feeling of insecurity among in-house IT departments.

Avanade believes that there are three important things to remember about cloud security⁴⁵. First, cloud security is almost exactly like your internal security. The security tools you use every day are the same tools that will be used to protect your data in the cloud. The one difference is that you share the service with other clients. Second, security issues involving the cloud can all be addressed using your current security tools. Security needs should be carefully considered. But they shouldn't be viewed as a hindrance if you are considering a move to the cloud. The important thing is that if firms have not been strict enough with their security up to now, they shouldn't begin to be strict because of the cloud but because it's important for their business. Third, if you select a quality cloud services provider, your security in the cloud will be as good as, or better, than with in-house security. At the end of the day, an IT firm is more likely to offer greater security than one from a different area. To know whether a provider is good in this aspect, one good indicator tends to be its success on the market and the way in which it resolves its own safety challenges.

What should a provider take into account to meet cloud security expectations? First of all, it is essential that security is guaranteed by means of processes and checks throughout the entire chain of supply, from the cloud computing providers through to the service users, by way of the organisation itself. The security management

⁴³ http://www.jtech.ua.es/jornadas/charlas/modelos_negocio.pdf.

⁴⁴ <http://www.gnu.org/philosophy/free-software-for-freedom.html>.

⁴⁵ *A Practical Guide to Cloud Computing Security*, Avanade (27/08/2009).

processes must, on the one hand, identify and evaluate the existing assets and, on the other, identify and classify possible risks by impact, frequency and probability. All of this should lead to a plan that includes certain contingency steps, for which it is essential for the provider's commitment to be in line with the organisation's needs, ensuring aspects such as making sure that the data is in the right physical location; that the data from the different organisations using the cloud does not get mixed up; that thorough audits are performed; that the permanence of the data is assured; and that plans are provided for running effective security backup copies.

Providers must also have recovery plans in the event of catastrophes such as natural disasters or terrorist attacks. Before September 2001, it was almost impossible to convince an organisation of the need to invest in a plan of this type. September 11 marked a turning point in this aspect, and these days most firms don't think twice about making sure their business can survive an incident of this kind. It was estimated that replacing the technology at affected securities firms, including hardware (workstations, PCs, servers, printers, storage devices, wiring, communication hubs to routers and switches, etc.) and software (networks, operating systems, applications infrastructures, etc.) would cost around \$3.2 billion⁴⁶. It would be no bad idea for organisations to ask their cloud providers whether their data centres are geographically scattered and whether their facilities have suitable security measures in place to diversify the risks of data loss.

There are groups of providers such as Cloud Security Alliance⁴⁷ -made up of members such as Dell, Cisco and AT&T- and the Enterprise Cloud Buyers Council -whose members include Microsoft, Cisco and IBM⁴⁸- which are trying to break down some of the barriers to the adoption of cloud computing by ensuring security, reliability and transparent access to information in the cloud. Clearly, security is a problem that affects all providers, simply by dint of the fact that the way in which the cloud is organised means that the risk is shared by all. For example, if an SaaS provider needs an infrastructure, it won't build one, but will request one from an IaaS provider. It therefore becomes a shared objective that all agents have to deal with together⁴⁹.

Data privacy is closely related to the issue of cloud security. There has recently been a spate of cases of people de-activating their Facebook or Twitter accounts because they felt they had lost part of their privacy. Remember that with cloud computing any information stored locally can be in the cloud, including e-mails, files, photos, financial information, calendar notes, address books and many others. Information stored in the cloud is everywhere and nowhere at the same time. For this reason it is often legally presumed to be located in the country of a provider's physical servers. This location can have a significant impact on the way in which the information can or cannot be protected. For example, personal information that ends up being held by a cloud provider in a European Union member state could be permanently subject to EU privacy laws⁵⁰. As for the issue of anticipating points of conflict, the information could be transferred from one jurisdiction to another without the user's knowledge, making it difficult to know what regulation protects it at any time. Criminals will be able to make themselves

⁴⁶ "Sept. 11 teaches real lessons in disaster recovery and business continuity planning", articles. techrepublic.com (17/05/2002).

⁴⁷ <http://www.cloudsecurityalliance.org/>.

⁴⁸ http://www.computerworld.com/s/article/9141998/Microsoft_Cisco_IBM_and_others_form_cloud_computing_group.

⁴⁹ *A Practical Guide to Cloud Computing Security*, Avande (27/08/2009).

⁵⁰ *Privacy in the Clouds: Risks to Privacy and Confidentiality from Cloud computing*, World Privacy Forum (23/02/2009).

at home on line, hopping from one jurisdiction to another, while public authorities from different countries will have to learn to co-operate more⁵¹.

A future of walled gardens

The increasing complexity and quantity of systems and data has engendered chaos in information technology. The uncontrolled extension of processes and applications means that it is ever less easy and efficient to access the services used. Think of all the different user names and passwords you have: one for your business e-mail account, another for your personal mail, another for a social network, one for your firm's Intranet, not to mention the access codes for on-line banking, etc. You might think it's safer to do things that way – and you might be right. Nonetheless, some experts argue that the underlying intentionality is very similar to that seen in the face of technological advances in the past. It is what is known as a technological lock-in⁵², because it attacks the interoperability of systems and applications. In some cases, the result is simply to oblige you to fill in a form with private data every time you want to join, for example, a social network. Each network is a walled garden where the benefits are artificially restricted, thus making it impossible, for example, to associate a Facebook friend with one on MySpace⁵³.

The impact is even greater when it comes to the risk of rival companies' marketing their own formats that are incompatible with all the rest. With the increasing complexity of systems and processes, it will not be possible to connect and interrelate them unless a certain degree of standardisation is encouraged. If not, it will hamper the creation of efficient services, safe and easy to access and use. Companies must take into account the criterion of interoperability in order to undertake cloud-based projects if they want to avoid technological lock-ins and ensure that switching between one service and another on the cloud is less problematic. Providers, for their part, have to agree on certain standards that will facilitate the movement of data in the cloud. Only in this way can we avoid the mistakes of the past (which violated the rules of free competition) and increase the appeal and ease of "moving to the clouds".

The "father" of the Internet calls for a standard

For the services we are talking about to be interoperable, there naturally has to be some agreement on how things should operate. It is the same old story in IT: when a technological development reaches the phase of mass adoption, the need arises to create certain shared standards accepted by all parties involved.

In early 2010, Vint Cerf, considered to be one of the "fathers" of the Internet, pointed to the need to create standards on data portability in cloud computing⁵⁴. He explained that there are now several clouds created by firms such as Microsoft, Amazon, IBM and Google, but that they lack mutual interoperability. In other words, there are no standards that would allow the different clouds to communicate with each other. Without common specifications for interfaces and protocols, the risk of a "technological lock-in" in a given cloud increases. From an

⁵¹ *Privacy in the Clouds: Risks to Privacy and Confidentiality from Cloud computing*, World Privacy Forum (23/02/2009).

⁵² "Clash of the Clouds", *The Economist* (15/10/2009).

⁵³ "Pull down the walled gardens", news.bbc.co.uk (15/08/2007).

⁵⁴ "Cerf urges standards for cloud computing", www.infoworld.com (8/01/2010).

architectural standpoint, a single logical cloud that masks the complexity of different cloud-based offerings is highly desirable in order to minimize application design complexity. This requires developing and adopting foundation cloud computing standards for identity, authentication, federation, and encryption."⁵⁵

According to the National Institute of Standards and Technology⁵⁶, it is necessary to "provide guidance to industry and government for the creation and management of relevant cloud computing standards allowing all parties to gain the maximum value from cloud computing"⁵⁷. Under this premise, cloud computing is a fungible, i.e., a cloud may easily be replaced by another and the information transferred from one place to another. For this purpose it is proposed to make data and applications portable, to establish a federated security service and to foster common models of interfaces, semantics and programming. The Open Cloud Manifesto, of which Accenture is a member, is further proof that providers are trying to achieve certain common standards and greater transparency. The manifesto is a declaration of principles defending the opening up of the cloud. In the next chapter, where we shall look at the demand for cloud computing, we will analyse in greater detail the different forms a cloud can take: public, private or hybrid. For now, we shall set out the principles on which this manifesto is based⁵⁸:

1. Cloud providers must work together to ensure that the challenges to cloud adoption are addressed through open collaboration and the appropriate use of standards.
2. They must not use their market position to lock customers into their particular platforms and limit their choice of providers.
3. They must adopt existing standards and avoid reinventing or duplicating them.
4. When it becomes necessary to adjust existing standards, they must be pragmatic to avoid creating more standards than necessary and ensure that they promote innovation and do not inhibit it.
5. They must carry out initiatives on the basis of customer needs, not merely the technical needs of cloud providers.
6. All those involved must work together to ensure that their initiatives do not conflict or overlap.

If these groups do not achieve their aims in time, governments may intervene to regulate the cloud by force. Given the short history of cloud computing to date, there is a risk that more restrictive standards might compromise innovation.

A cloud of specialisation and innovation

The Future Trends Forum experts agree that the true future of cloud computing depends on specialisation in the supply of services and on allowing users to

⁵⁵ "Developing an Enterprise Cloud Computing Strategy", White Paper Intel Information Technology (January 2009).

⁵⁶ US agency whose mission to promote industrial innovation and competitiveness in the country through progress in standards and technologies that improve economic security and quality of life.

⁵⁷ Effectively and Securely Using the Cloud Computing Paradigm, Peter Mell, Tim Grance (NIST, Information Technology Laboratory, 2009).

⁵⁸ Adapted from www.opencloudmanifesto.org.

personalise them. While the great majority of providers offer a broad range of integrated cloud services, it still remains to be seen what others specialising more in specific areas will do, as is the case of Salesforce and NetSuite. Software developers have a chance to create applications with a high degree of specialisation faster and more efficiently by using cloud platforms which have to a great extent simplified programming tasks: rather than "writing" code, it is now more a case of "clicking and dragging" software modules. In this regard, cloud computing allows users to develop and manage applications that can easily increase their capacity (scaleability), function at speed (performance) and seldom fail (reliability), without worrying about the underlying infrastructure⁵⁹. A good example is Facebook, which provides an excellent platform for users to create their own social networking applications⁶⁰. With the time and energy not consumed by administering programming environments, the cloud enables companies to make better use of developer talent and expands the pool of potential workers who could master the tools to come up with innovative ideas.

In *The Future of Internet and How to Stop It*, Jonathan Zittrain⁶¹ offers a very different view. He says that moving to the cloud may even act as a disincentive to innovation. The reason is the user response to the viruses, spam and cyber-attacks that have contaminated the PC and led to the adoption of devices such as the iPhone and the Xbox, which only allow innovation initiatives to be developed with the manufacturer's approval. This creates a sterile environment, which is not open to new ideas. As a counter-argument, firms such as Apple have always been very open to collaboration in a common environment where developers can share knowledge and gather talent, thus increasing the chance of new specialities appearing in applications. And the cloud offers precisely such an environment.

In effect, cloud computing reduces innovation costs and breaks down the barriers to user participation. It frees companies from worrying about IT-related issues and allows them to centre more on their business, since they have computer resources that match their needs without having to make a large economic and human investment in implementation. In this way, the companies' products and services get better faster and fall in price. In turn, new businesses are created with more flexible structures. The most immediate consequence is an intensification of competition, in turn stimulating innovation, setting in motion a virtuous circle. Obviously, this marks a turning point for emerging markets, since they can make use of cloud infrastructure and applications to start out on even footing with their international competitors.

Innovation will also be promoted under the umbrella of the Open Source movement, which enables application source code to be freely altered so that it can be improved by developers. The possibility of re-using existing code will enable new applications to be created faster and more easily, acting as a leg-up for innovative software initiatives. Richard Stallman is recognised as the creator of the free software concept. The story goes that in the laboratory where he worked, he decided to fix a printer that was not generating any network message to warn of paper jams, with the result that there was an immense backlog in the system.

⁵⁹ *Envisioning the Cloud: The Next Computing Paradigm*, Marketspace (20/03/2009).

⁶⁰ *Envisioning the Cloud: The Next Computing Paradigm*, Marketspace (20/03/2009).

⁶¹ *The Future of Internet and How to Stop It*, Jonathan Zittrain, Yale University Press (April 2008).

Without asking for anything in return, Stallman requested access to the source code of the printer drivers, so that he could implement a network message warning about jams. When the company refused, Stallman realised how restrictive it was to use privative operating systems that prevented a user or programmer from solving an error found in the application. As a result, in 1985, he founded the [Free Software Foundation](#) (FSF) and introduced the definition of free software and the concept of [copyleft](#), which he developed to give users more freedom and limit the possibilities of the [software being appropriated by individuals or firms](#).

Today numerous firms offer product hosting and provide developers with the necessary tools to create open code initiatives: Amongst the most important are Red Hat, WordPress, OpenBravo, JasperSoft, SugarCRM and MySQL.

It is hardly surprising, then, that cloud computing has been referred to in many forums as the new driver of innovation. As we have seen throughout this study, on the supply side it has materialised into a new business model in the form of services of business processes, software, platforms and infrastructure. Remember that its calling card is access from anywhere (virtualization), the possibility of increasing capacity predictably (scaleability), availability of resources that can be extended or reduced to meet requirements at any time (elasticity), pay-per-use charging for resources and the offering of products and services to more than one company or user at the same time. We are constantly being bombarded with innovations and improvements in the world of cloud computing. Time will tell whether those who see it as a whole new field of opportunities were right... or whether it all turns out to be a passing fad.

The crowd in the cloud

The cloud computing supply model means that organisations using services are going to share the resources in a common environment. Obviously, this will encourage people to be more predisposed to collaborating. "The PC and its applications were conceived to increase individual productivity, while cloud-based applications and services –by dint of their residing on a shared platform– favour teamwork and collaboration. In that sense, as content and communication converge in the cloud, every application becomes a social application"⁶².

Within a globalised framework, businesses are becoming increasingly widely dispersed. Cloud computing is seen as a way of bringing them closer to one another and facilitating collaboration, especially in the case of SMEs, which tend to form ad hoc and virtual work teams. Company CEOs have seen the value of these collaboration agreements. Sometimes it is simply a matter of reorganising or motivating the staff in the company; on other occasions it is necessary to look beyond organisational borders. If the search is limited to in-house, ideas are often passed over that might offer an alternative perspective. This is why top management are focusing on promoting an environment that is increasingly open to innovation among employees, users and members, instead of maintaining the traditional model of innovation.

⁶² *Envisioning the Cloud: The Next Computing Paradigm*, Marketspace (20/03/2009).

In the area of collaborative innovation, open innovation –also known as *crowdsourcing*– consists of seeing innovation as an open system in which agents inside and outside the organisation all participate. The reasons why this phenomenon has arisen are as follows: the process of globalisation; democratisation and the accelerated rate of development in technologies; ever-more demanding clients; and the thin line separating professionals from amateurs⁶³. The ultimate example is Wikipedia, a free encyclopaedia created by internavts from around the world with varying degrees of expertise on the subjects dealt with. The most creative functions in Google are often contributed by the users themselves. There are even social networks –such as NineSigma, YourEncore and yet2.com– which bring together participants and experts from different specialities, with no restrictions on time or space, to offer solutions to the problems posed by organisations.

One aspect we have touched on in this publication, and which very closely relates cloud computing to collaboration is the open code movement. Many providers have considered the idea of their software being distributed and developed freely by third parties. By placing the code of its two most recent creations, Android and Chrome OS at the users' disposal, Google has managed to increase demand for its products and the scope of its advertising.

It also makes life even more difficult for its rivals, who are still charging for their products. Surprising though it might seem, even Microsoft, famous for keeping its source code like a state secret, is participating in initiatives that defend freedom of action in this area⁶⁴.

Apple, on the other hand, is prepared to swim against the tide. On the one hand, the company is very interested in cloud computing and has built a data centre worth billions of dollars. However, its interests have always centred more on users than on organisations. According to a study, in 2009 iTunes sold 25% of all music in physical format in the US. The figure for the digital market in the same country is much more surprising: 69% of total sales during the first half of 2009 were downloaded from iTunes⁶⁵. Despite this preference among average users, open source is not precisely part of Apple's strategy. On the contrary, they do their utmost to block dissemination of their operating system to any other device that is not part of their brand and to limit iPhone-compatible applications. Nor do they openly share their innovation plans and they keep the recipe of their success jealously guarded.

In short, cloud computing consists of a wide variety of computer solutions that contribute operational efficiency to firms, without a physical link to the resources and without maintenance costs for the infrastructure. This is a decisive step in the industrialisation of information technology and the possibilities for cloud providers to create emerging and innovative business models are infinite. The sky is most certainly the limit.

⁶³ <http://www.slideshare.net/abediaga/innovacin-abierta-ms-allde-la-innovacin-tradicional>.

⁶⁴ <http://www.microsoft.com/opensource/>.

⁶⁵ http://www.npd.com/press/releases/press_090818.html.