Executive Summary

We are currently witnessing the dawn of the new paradigm of "cloud computing", grounded on the idea that anything that can be done on a computer can be transferred to the cloud — in other words, to the Internet. In this model, computer resources are used in just the same way as any other service utility, such as electricity or the telephone. These resources are offered by cloud providers, which manage them in large remote data centres, providing a service to large numbers of customers who can access them over any Internet-connected device. By 2012 it is estimated that the cloud computing market will have a turnover of 42 billion dollars, and will extend to large and established providers such as Google, Microsoft, Salesforce, IBM and Amazon.

Cloud supply

Services offered from the cloud can be classified as follows: infrastructures (Infrastructure as a Service), development platforms (Platform as a Service), applications (Software as a Service) and even business processes (Process as a Service). Virtualization has been the key advance in the development of the clouds. It consists of sharing the use of servers among different applications.

The profitability of the large providers is based on economies of scale; they make large investments but have insignificant distribution costs. This means that they can make profits by aggregating small consumers. The customers, on the other hand, save the large investment they would otherwise have to make in infrastructures and receive a variable-cost service, with pay-per-use tariffing.

Not all providers offer this type of charge system. Indeed, the majority are still based on more predictable pre-paid models. However, companies such as Amazon have already set an unstoppable trend towards turning computing into an undifferentiated product.

Companies tend to be reluctant to hand over the management of their most important asset, information; as a result, privacy is the most critical aspect in the cloud. Providers and others seeking solutions to this problem have come up with initiatives such as Cloud Security Alliance and the Enterprise Cloud Buyers Council. Business is also wary of the lack of standards, a factor that restricts the appeal and ease of "moving to the clouds". The National Institute of Standards and Technology and the Open Cloud Manifesto use different alternatives to respond to this issue.

The cloud allows firms to focus more on their business and speed up improvements in their products and services, thus encouraging innovation. However, they are also encouraging user participation and with it what is known as crowdsourcing, a system of open innovation in which anyone can contribute.

Cloud demand

Among business and government, the recession has led to interest in the cloud as a means of cutting costs. However, this is not its sole appeal: it also offers a broad range of possibilities, as users are gradually coming to realise.

The cloud is particularly attractive for SMEs and start-ups. Firstly, because these firms do not currently have easy access to capital, the reduction in initial investment the cloud offers is one way of remaining competitive. Secondly, the cloud cuts time-to-market; new services can be ready in a question of hours, at limited risk. Thirdly, it gives them access to economies of scale through the providers. Fourthly, they can access much more sophisticated security systems. And finally, they benefit from highly specialist user support.

Although few firms were using cloud services in 2009, a very large percentage had plans to move to the cloud. The main reason they gave was the reduction in costs involved, but it is predicted that the reasons will change once the financial crisis has blown over. What the cloud really offers SMEs is the possibility of playing in a bigger league.

Cloud services are more widely used in big companies. For them, the main advantage is they can turn fixed costs into variable ones. This gives them a better idea of the real costs of each application while at the same time minimising the risks involved in launching new products and services. The cloud holds out great future opportunities, one of the most important of which will be the use of social networks. Nonetheless, only 1% said they have fully implemented cloud computing. The main barriers appear to be security and privacy, although confusion over the term and difficulty in managing service level agreements also pose major obstacles.

Cloud computing is not limited to business, however. The great size, complexity and large physical area government technology services need to cover make them ideal candidates in this race to the clouds. The main obstacle in this process will be the sensitivity of government-handled information. Governments throughout the world are starting initiatives to promote the technology. Among the most

important examples are Britain and Japan, which have decided to create private "government" clouds.

Government will play a fundamental role in developing cloud computing, in its twin roles as a regulator, setting the market game rules and an early adopter with a higher level of hi-tech expenditure than any private company. However, when it comes to exercising their position, governments should not only consider the impact the new model will have on their markets, but also the effect it will have on more needy countries, which could be the great beneficiaries of the new technology.

Businesses and governments need to lay down a suitable strategy for moving to the cloud. For business, the first step will be to identify the most suitable applications and users. They will then have to evolve their internal systems towards the cloud. In the case of governments, the order of the move will depend on the sensitivity of the information. The first data to be migrated will be public information, while non-public data, particularly information on citizens, will be handled with much greater caution.

The new "cloud" model of accessing information is transforming society. People are beginning to share information and collaborate for no apparent economic gain. There is a tendency to highlight the benefits for business, but cloud computing also has humanitarian and social potential.

The origins of the cloud lie in the private sector, but the academic community needs to position itself as an independent advisor and shape its technical curricula to the new needs of the cloud, which are more concerned with management than development. At the same time, the cloud will promote telepresence, distance research and distance learning, key factors for fostering equal education for different parts of the world.

Nonetheless, the cloud still has to demonstrate its "green" credentials; cloud computing makes more efficient use of energy by increasing the utilisation of systems, but much of the energy is lost in transmission and cooling, and big companies are already developing innovative systems to improve efficiency rates.

And what is happening in Spain?

Innovative companies are springing up in Spain to offer cloud services, but the real appeal lies on the consumer side. Spain is a market founded on services,

particularly tourism, and a business world in which 99% of all businesses are SMEs. It also has a high rate of Internet and mobile phone penetration and this means that the majority of these firms are potential cloud users. At the same time, strong pressure to cut government spending has aroused interest in the potential of cloud computing. In short, the country's future looks "cloudy", in the very best sense of the word.