SURVIVAL OF THE FITTEST
How Europe can assume a leading role in the cloud
"It is not the strongest of the species that survives, nor the most intelligent. It is the one that is the most adaptable to change."

Charles Darwin (1809-1882)

Roland Berger Strategy Consultants, founded in 1967, is one of the world's leading strategy consultancies – the only one of the "top five" to boast European roots. The company has amassed decades of experience in international ICT projects. Helping clients to achieve strategic realignment in dynamic and converging business contexts is one of its specialties.

Founded in 1972, SAP is a leading provider of enterprise software. The company helps corporate customers of every size and in every industry to improve their efficiency. SAP enables people and organizations to collaborate more efficiently and make more effective use of business information in every area, from administration to top management, from the warehouse to the point of sale, on desktop systems and mobile devices alike.
Executive summary

The market for information and communication technology (ICT) is experiencing a far-reaching transition. On the demand side, cloud services present a tremendous opportunity to reduce fixed costs and add flexibility that sharpens the user's competitive edge. On the supply side, they open up new potential for growth. To realize this potential and exploit these opportunities, however, incumbent ICT companies are going to have to alter their business models. This study examines the most important drivers and characteristic attributes of the emerging cloud economy. It shows how structural transition harbors opportunities for Europe in particular – provided that industry and governments recognize the potential and take decisive action.

We outline four success factors that can help European ICT providers to attain a leading position in the cloud economy. We encourage them to see the big market picture (understanding the cloud as an ecosystem). We also map out strategic trajectories for large corporations (benefiting from networks as "centers of gravity") and both small and medium-sized enterprises (SMEs) in the cloud economy (leveraging the potential of "biodiversity"). Lastly, our requirements profile for an innovative industry policy spells out what governments and the corporate sector must do to create a premium environment for the cloud economy.

We recommend creating a common EU legal framework for cloud services, supporting a European gold standard for cloud computing, promoting cloud research, supporting the uptake of cloud computing by SMEs, to position the public sector as a pioneering user and maintaining the momentum of progress.

OBJECTIVES AND METHODOLOGY

This study is intended as a contribution to the debate surrounding market development in the cloud economy. Our concern is to highlight promising strategies and areas of potential that ICT companies in Europe can tap in the future. Our insights and hypotheses are based on interviews with experts on the subject of economic effects and industry trends, and on analysis of numerous recent publications. SAP’s experience of the market for cloud-based services was also channeled into the study, as were insights gained by Roland Berger Strategy Consultants in the course of consulting projects in the ICT industry.
The cloud economy – What potential does it offer to Europe?

Cloud computing is regarded as one of the most important ICT trends in recent years. In the B2C market, there are already signs that the disruptive nature of innovative cloud offerings will have a massive impact on the entire industry landscape. One need only think of the success of Facebook, or of niche services such as Flickr and Picasa. Similar developments are possible in the B2B market too, although many challenges remain to be overcome. Cloud computing is much more than merely repackaging existing software and services and delivering them on virtualized computing infrastructures with a subscription pricing model. It represents a veritable paradigm shift in the way applications and services are developed, sold, deployed, maintained and consumed. This sea change is disruptive to the current enterprise computing paradigm in much the same way that client/server computing disrupted mainframe computing years ago. Cloud computing fundamentally changes the way companies buy and consume IT resources. It also ushers in a paradigm shift across the entire IT solution value chain, including software and hardware providers, by changing the way in which the latter develop, sell, deploy and continuously innovate IT solutions. For customers, cloud computing alters how they buy, deploy and maintain these resources.

Companies are shifting their preferences toward cloud computing because of compelling benefits such as:

> A significantly lower total cost of ownership, including low or – better still – no up-front costs
> Ease of consumption
> Fast and easy deployment, delivering a short time to value
> Flexibility to follow changing business needs in a globalized economy
> Fast adoption of business and technology innovation.

Cloud computing represents a paradigm shift in the way applications are developed, sold, deployed, maintained and consumed.

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Figure 1: Structure of cloud environments

<table>
<thead>
<tr>
<th>Applications and content</th>
<th>Virtual Private Cloud</th>
<th>Corporate Private Cloud</th>
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<tbody>
<tr>
<td>Development platform</td>
<td></td>
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<tr>
<td>Infrastructure, software and hardware</td>
<td>Run by cloud provider</td>
<td>Run by customer for select group of users</td>
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<td></td>
<td>&gt; Shared, multi-tenant offerings</td>
<td>&gt; No sharing with other customers</td>
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<td></td>
<td>&gt; Standard solutions</td>
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<td>Public Cloud</td>
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<td>Software as a service</td>
<td>Software as a service</td>
<td>Corporate services</td>
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<td>Platform as a service</td>
<td>Platform as a service</td>
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<tr>
<td>Infrastructure as a service</td>
<td>Infrastructure as a service</td>
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Source: SAP
There are three categories of cloud services (see Figure 1): Software as a service (SaaS) gives customers access to applications that run on the provider’s infrastructure. Sellers are responsible for managing these applications and the underlying infrastructure, while customers set up the specific configuration that they require. Platform as a service (PaaS) makes available platforms on which customers and their partners can build and run their applications. Infrastructure as a service (IaaS) involves providing virtual, standardized computing, network and storage capacity.

Cloud environments can take on a variety of forms. Public clouds are open to a very broad user community. Virtual private clouds are based on an outsourced or internal infrastructure and serve a clearly defined group of users. Lastly, corporate private clouds are sealed off from the outside world. They run on a company’s internal infrastructure and are used exclusively by internal stakeholders. At present, hybrid cloud deployments – a mix of all three categories – are the most prevalent form. For their part, customers associate cloud offerings with local (“on-premises”) software.

As public cloud services in particular improve, small and medium-sized companies will increasingly gain access to top-class IT solutions whose prohibitive cost has hitherto made them the exclusive preserve of large corporations. The cloud economy could thus give SMEs a keener competitive edge and serve as a catalyst to business model innovation in this segment.

Definition of the "cloud economy"

The cloud economy refers to all value that is created in virtual environments – for ICT companies, but also for companies in other industries. Players in the cloud economy form business relationships, the exchange of information between partners and collaboration between both people and organizations in virtual environments. They use web-based resources to generate individual revenue streams. The cloud economy is based on cloud computing, cloud data and cloud services, i.e. the provisioning of freely scalable IT solutions. Retail (private) and corporate customers pay on a flexible basis for whatever they actually use. Data is processed by third parties. Customers can access data and services over the Internet in either open or closed architectures.

The cloud economy will change industry structures and spawn a wealth of completely new products and services.

The cloud economy will change industry structures and spawn a wealth of completely new products and services. A number of recent studies indicate just how substantial the macroeconomic potential of this emerging phenomenon really is. Spending on cloud computing will jump from USD 21.5 billion in 2010 to USD 72.9 billion in 2015,1 making this the fastest-growing segment of the ICT industry over the next few years.

The economic benefits of cloud computing are much greater still. In Europe, cloud computing alone is expected to account for about 0.1% to 0.2% of GDP growth.2 In the five largest European economies (Germany, France, the UK, Spain and Italy),

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2) Federico Etro (2011): The Economics of Cloud Computing
the cumulative economic effect could rise as high as EUR 763 billion between 2010 and 2015. The relevant studies factor in productivity gains as well as savings on both capital investment and fixed costs. They also include revenues that will be generated by new business models birthed by both newcomers and incumbents. Estimates about how much money companies will be able to save range from 20% to 50% of their total ICT costs. The cloud economy is expected to deliver significant stimulus to Europe’s labor market across the entire spectrum of industries. Conservative estimates put the number of new jobs per year at 70,000; optimistic ones go as far as 800,000.

Economic value added in the information and communication technology industry already triggers a multiplier effect in other industries. From 2009 through 2013, the ICT market was behind the emergence of more than 75,000 new companies worldwide. In the wider orbit around an IT colossus of the caliber of Microsoft, say, more than 6.1 million people generate revenues of over USD 537 billion. For every unit of sales that Microsoft generates (in whatever currency), someone else generates nearly 8.7 units with software and services. On this side of the Atlantic, however, productivity gains driven by the investments of European ICT providers lag behind those of US companies. All in all, cumulative ICT investments rose from around 9% of the USA’s GDP up to 1991 to 30% up to 2010. Europe’s ICT capital climbed from between 6% and 9% up to 1991 to just 20% of GDP up to 2010.

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### Table 1: Examples of EU-based players in the cloud industry

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<tr>
<th>COMPANY</th>
<th>COUNTRY</th>
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<td>Germany</td>
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<td>Alcatel Lucent</td>
<td>France</td>
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<td>Amplitdata</td>
<td>Belgium</td>
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<td>Atos (&amp; Siemens IT-Solutions)</td>
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<td>BT Global</td>
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<td>Capgemini</td>
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<td>CommanIT</td>
<td>France</td>
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<td>Computacenter</td>
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<td>Host Europe</td>
<td>Germany</td>
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<td>Logica</td>
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<td>Orange Business Services</td>
<td>France</td>
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<td>Pironet NDH AG</td>
<td>Germany</td>
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<td>SAP</td>
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<td>Strato</td>
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<td>T-Systems</td>
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<td>Tieto</td>
<td>Finland</td>
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<td>Zimory</td>
<td>Germany</td>
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</tbody>
</table>

Source: Roland Berger Strategy Consultants

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3) Centre for economics and business research: The cloud dividend report
4) Federico Etro: The Economics of Cloud Computing, 2011
5) IDC White Paper (2009): Aid to recovery: The economic impact of IT, software and the Microsoft ecosystem on the global economy
6) Oxford Economics (2011): Capturing the ICT dividend: Using technology to drive productivity and growth in the EU
7) SIS became a wholly owned subsidiary of Atos on July 1, 2011
There are plenty of indications that the evolution of the cloud economy will pose a stiff challenge to incumbent ICT players in particular. At the end of the day, there will be winners and losers. Right now, it looks very much as though global IT providers of US American origin have a firm grip on the market. There are two reasons for this impression. One is that most of the well-known cloud applications in the consumer segment come from the USA. The other is that US firms also dominate the infrastructure segment.

It is true that infrastructure as a service (IaaS) offerings are pivotal to cloud computing. In the medium to long term, however, infrastructure will become a commodity that yields only comparatively low margins. By contrast, the markets for platform as a service (PaaS) and software as a service (SaaS) are projected to add considerably more value. And since the die has not yet been cast on who will dominate this nascent market, this is precisely where opportunities abound for the European ICT industry. Europe’s firms must develop innovative, market-oriented services for the premium segment – services whose security features and compliance with data protection requirements stand out from the crowd.

A radical paradigm shift is needed if the potential afforded by the cloud is to be fully exploited. The question is whether, how and to what extent European companies will effect this shift. Nor are we talking only about companies that are headquartered within the EU. Rather, our gaze is focused on technical and intellectual capabilities in Europe that can also attract value from other regions. European providers are traditionally strong in the B2B segment. If they build on their existing skills, they can thus very definitely establish themselves as a vital facilitator in the development of the cloud economy.

Let us examine the strengths of Europe’s ICT industry:

> **Positive starting position:** Major European ICT providers such as Atos, CapGemini, Orange Business Services, SAP and T-Systems already rank among the world leaders in the market for service, consulting and software (see Table 1). They focus on providing support for complex business processes for which solutions must be developed in close alignment with specific customer requirements – unlike pure-play infrastructure business and standard application support, both of which are commoditized markets. These companies' experience will therefore be invaluable if Europe’s ICT providers want to position themselves as platform and/or application providers in the cloud.

> **Agility:** The SMEs that form the backbone of the European ICT industry have brought forth a multiplicity of business models that are of relevance to the cloud economy. European providers are strong on security technology and in the way they support business processes, but also on the special-purpose software that is fitted in products and systems. In all these areas, the cloud could unleash tremendous innovative potential. Many of the concepts used in embedded software, for example, could be used more widely in future in the cloud. Developments in this direction are gaining
Study

added momentum from the new Internet Protocol IPv6. This protocol makes it possible to assign a unique and dedicated IP address to every device. Thus, physical products and their embedded software can form an "Internet of Things".

> **Credibility edge:** In our experience, European providers are widely associated with values such as trust, reliability, security and data protection. That is important, because – in light of data protection scandals, hacker attacks and cyber espionage – companies are expected to and normally do handle data circumspectly and well. This credibility edge could turn out to be a critical competitive advantage for European cloud providers.

> **Collaborative capabilities:** The European industry is used to thinking in terms of flexible partnerships. Having positioned itself as a "system head", the German engineered products sector accounts for a large proportion of the value created in this industry worldwide. In many areas, collaboration between research organizations such as the Fraunhofer Institute, the Max Planck Society, etc. and industry is also much more widespread in Europe, a fact that is conducive to rapid and effective innovation. Europe’s ICT industry could therefore assume a pioneering role in exploiting potential networking effects in the cloud.

It is to be expected that the cloud economy will break with a number of what have so far been effective success factors, and that the structures and centers of power will change as a result. As long as the key positions remain unoccupied, every player still has the chance to shape the market and play an active part in its development. That is why it is important to reinforce the provider landscape in Europe while the market is still experiencing dynamic growth. Industry must contribute its innovative strengths; yet political support too is equally imperative.

We have identified four factors that will be vital to the success of a European cloud economy:

1. Understanding the cloud as an ecosystem
2. Benefiting from the network as "centers of gravity"
3. Leveraging the potential of "biodiversity"
4. Creating a premium environment for the cloud economy

This study therefore analyzes the potential of European providers on the basis of these criteria.

As long as the key positions in the cloud market remain unoccupied, every player has the chance to shape the market.

Success factors

1. Understanding the cloud as an ecosystem

IBM visionary Irving Wladawsky-Berger compared the cloud economy to the Cambrian explosion. The Cambrian explosion is regarded as a major milestone in evolution, having ushered in a hitherto unprecedented diversity of species around 543 million years ago. Within a short space of time, the basic blueprints for all multicellular organisms thus came into being.

In all probability, there will not be an "explosion" in the cloud economy. Even so, the analogy of evolutionary processes provides a useful illustration of how the cloud economy works. The cloud can be understood as an ICT ecosystem in which the development of services, their areas of application, customer groups and competitive structures evolve constantly and irreversibly. Like its counterpart in the natural world, the cloud ecosystem will spawn many different kinds of new players who are better adapted to the new environment than their established rivals.

Characteristic attributes of the cloud ecosystem

The cloud ecosystem is populated by the players (providers, intermediaries and customers), technologies and functions that constitute a virtual value-added network. As in the biological realm, this system reflects four essential characteristic attributes: openness, dynamic development, co-creation and diversity.

Openness

Cloud ecosystems have no fixed boundaries and low barriers to entry. This leaves them open to a wide variety of providers, customers and technologies, who/which are more or less loosely associated with each other within the ecosystem. The more participants come together in an ecosystem, the greater the network effects that can be realized.

Dynamic development

Cloud ecosystems can change at tremendous speed, with advances taking place asymmetrically and in sporadic bursts. For example, a given technology can take a huge leap forward in a short period while the range of participants in the ecosystem remains relatively stable.

Co-creation

The creation of services is a constant process of give and take between the supply and demand sides. Adding value thus becomes a reciprocal process, allowing the ecosystem to respond quickly and flexibly and to new customer needs.

Diversity

Within a cloud ecosystem, different "biotopes" each plot their own development trajectory. At present, the most common models are software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS). It is nevertheless expected that additional types of offering will take shape in the future.

What does all this mean for ICT providers? Linear modes of thought no longer work in an ecosystem. In the past, ICT companies typically engaged in one-to-one relationships with their business customers, with intermediaries joining the equation in some cases. Similarly, products and services too tended to be developed in a straight line. Existing services were given a new label, smartened up with ever more features or simply had their performance improved. By contrast, a cloud ecosystem no longer assumes the traditional one-dimensional supplier-customer relationship in which the supplier generates services and the demander consumes them. Instead, value is added by cooperating with other network players. Each partner makes its own contribution to value creation. In this way, the ecosystem presents a broad, innovative and flexible portfolio that has much more to offer customers than any one provider could ever do.

A series of trends are fueling this paradigm shift. Customers’ needs are naturally a key driver. But so too are major leaps in technological development, new user habits and the structure of the ICT market, all of which favors the evolution of the cloud.

> **Customer needs:** Market volatility makes companies less and less willing to accept heavy up-front investments in ICT and protracted payback periods. Lower fixed costs reduce risk. Concentrating on core business and core competencies engenders focus. At the same time, companies want to respond more swiftly to the changing needs of their customers, to the actions of competitors and to shifts in their own objectives, all of which requires them to adapt their ICT solutions ever more rapidly. Cloud services help them to achieve all these apparently conflicting goals. Companies only pay for those cloud services that they actually use, so they no longer have to shoulder heavy up-front investments. Also, cloud solutions can be introduced much faster, at less cost and with less effort than a traditional on-premises solution.

> **Technology:** Thanks to virtualization and multicore processor architectures, the cloud opens up hitherto unheard-of potential for economies of scale. Bundling the computing needs of a large number of customers allows data centers that would be far too large for any single company to be operated very efficiently. Aside from the traditional issue of economies of scale, factors such as energy consumption and the degree of data center efficiency will likewise grow in importance in future. Another technological driver is constant growth in the mobile infrastructure, which now supports Internet connectivity at ever faster data speeds. Tremendous leaps in the development of mobile devices are likewise accelerating the evolutionary process.

> **Users:** These days, it has become second nature for people to use ICT technologies both privately and professionally. The Internet, smart phones and tablet PCs have become a regular feature of everyday life, not just the preserve of "digital natives". The consequences at the place of work are many and varied. Employees of all ages have become proficient in the use of these technologies, and they expect their company's internal ICT landscape to keep pace with the outside world (a trend known as the "consumerization of enterprise ICT"). Solutions must be intuitive to use and ready to run immediately. Mobile devices are thus increasingly substituting for traditional desktop PCs. In business applications too, it is now standard practice to embrace users' social network links. Cloud applications meet all these design criteria.
ICT providers: As in other industries, value-added networks are becoming increasingly fragmented in ICT too, which is helping small and medium-sized ICT providers to gain in significance. SMEs can unfold their full innovative potential, slotting smoothly into the ecosystem even if they are highly specialized. Startups can likewise establish a global footprint and market their wares without incurring vast expenses.

The extent to which this ecosystem mindset changes whole industries can already be seen elsewhere in Europe. Up to the end of the 20th century, the German auto industry devoted itself to developing ever more high-performance premium vehicles for its customers. Today, the individual vehicle occupies a different place in their strategic thinking. While companies’ core business remains intact, tantalizing questions are now being asked about what premium solutions for personal mobility might look like and what part car-makers might play. The traditional automotive supply chain was pyramid-shaped, with original equipment manufacturers (OEMs) perched on the apex. In the new ecosystem, however, OEMs too must cultivate a far more networked mindset than in the past, as they are now required to weave together all kinds of different skills and competencies to form coherent offerings. When you start offering mobility (instead of cars), you need completely new value chain partners. Examples include airports, local and long-distance transport service providers (railway companies and local passenger transport utilities), telecoms companies, providers of geodata, and so on. All these different players have to be brought together on a single platform.

Like the automotive industry, ICT providers will, to a certain extent, have to reinvent themselves. Only if ICT providers understand the cloud economy as an ecosystem, accept new business models and are prepared to link both direct and indirect distribution models is it possible for them to survive on the markets of the future. By building on new technologies and leveraging extensive value chain networks, solution providers will be expected to deliver the speed, flexibility and agility that tomorrow’s customers will take for granted.

2. Benefiting from networks as "centers of gravity"

Who will carve out a dominant market position for themselves in the cloud? The capabilities that give a company a competitive advantage are changing all the time. The briefest excursion into the history of the ICT industry proves the point. When the IT revolution began to roll in the 1970s, a knowledge of hardware was the ace everyone wanted up their sleeve. Back then, it was a mastery of complex and expensive mainframe technologies that secured leading positions for companies such as IBM and DEC. The spread of personal computers (PCs) repainted the picture. Software skills came to the fore and helped Microsoft, for example, to dominate the market. The rise of the Internet then sparked off a new round of development in which providers of search engines, e-commerce and social media platforms (respectively epitomized by Google, Amazon and Facebook) asserted themselves. Now, entire business processes are being modeled by applications "in the cloud" – often combining a variety of cloud services with traditional on-premises applications. Yet again, it seems that the business models operated by the major ICT players are about to be challenged.
So what must ICT providers do to exploit the new potential afforded by these cloud ecosystems? In future, customers will go where those software engineers, industry experts and content providers that best meet their needs work together. Innovative platforms will thus exert a powerful attraction, emerging as what we call "centers of gravity". These centers of gravity will become the strategic hubs of cloud ecosystems. The organizations that operate these centers will have the opportunity to build a very wide-ranging business model and to think beyond the boundaries of relationships with their own customers and partners. They will act as network nodes, knitting together application services (e.g. web-based CRM systems), content services (e.g. market data), B2B integration services and the operation of components. Those that do so successfully will be the enablers of the cloud economy – and will control a sizeable chunk of the value chain. Their core capability must be to add value for their target customers. To do so, they must achieve excellence in understanding both the new needs of customers and the potential of partners to fulfill these needs. Another critical skill will be orchestrating individual services in a way that allows customers to leverage cloud services for their own business smoothly and without difficulty.

Platform as a service (PaaS) providers will assume a pivotal role in the cloud ecosystem. Their aim must be to establish themselves as centers of gravity. In other words, they must become the key shapers and enablers of the newly emerging competitive structures. They are the ones who must take care of the technical standards, architectures and integration mechanisms that all players will have to adopt in order to use the platform. Maintaining the analogy of the cloud as an ecosystem, they will offer the fertile ground on which innovative providers can cultivate applications, content and services. If these offerings flourish and grow, network effects will foster ongoing development and expansion across the entire ecosystem.

Two different platform strategies will be applied depending on the levels on which they are implemented (see Figure 2). There are overlaps between these strategies, and the two can also be combined with each other. Both will be complemented by a distribution strategy.

Figure 2: Two fundamental platform strategies

1. **Generic development platform as a service**
   - Examples:
     - Microsoft Azure
     - Google App Engine

2. **Application-based platform as a service**
   - Examples:
     - Salesforce.com
     - SAP Business ByDesign

Platform providers will offer the fertile ground on which innovative providers, applications, content and services will be cultivated.

Source: SAP
1. **Generic development platforms**
   In this model, an operator provides a standard, multipurpose development and operating environment that allows independent applications to be developed quickly and operated safely. Time and cost to market are crucial factors of competition here, as is the availability of trained engineers who can work in the development language used by the platform. The platform users will be companies who need applications tailored to their specific needs and independent software vendors that also want to market the applications they build on the platform. As a rule, PaaS offerings will therefore also include a distribution platform such as SAP Store.

2. **Application-based platforms**
   Application-based platforms provide more than just a generic development environment. They also facilitate access to the data and process models for a core application (e.g. SAP Business ByDesign). This will create a very efficient way to build new applications that can, for example, access the processes and business objects of the core application. As a result, it will be possible to integrate add-ons in the core application relatively easily. Once the core application and the associated services are comprehensive and mature enough to serve as the basis for an exhaustive business solution, a highly dynamic network effect will be triggered. The attractive core application will give rise to a customer base that makes it worthwhile for solution providers to offer add-on applications on the same platform. The resultant multiplicity of applications will in turn make the core offering more attractive, causing the target market to increase continuously. For the platform provider, it will therefore be important to safeguard the quality of the overall offering. Since not many market players will be able to build and manage this kind of platform service, oligopolistic structures will emerge.

Both development-based and application-based platforms can be combined with a **distribution platform**. Distribution platforms will work like electronic marketplaces where different companies can sell their solutions and services. The operator will enforce certain minimum quality standards and oversee distribution handling. It will also provide standard, scalable distribution processes (catalogs, online purchases, payment, billing, etc.). Distribution platforms will lower the barriers to entry for customers and software users, give solution providers greater reach and keep selling costs down in the long run.

European companies have a good chance of positioning themselves as centers of gravity. Their strengths come to the fore especially in situations that require good customer relationships, in-depth industry expertise and the ability to manage well in multicultural and diverse legal environments. Those that succeed in gathering together innovative providers will have a significant influence on how revenue streams are divided up. Why? Because the cloud economy is a “multisided market”. In other words, one platform can facilitate interaction between a variety of users. This constellation gives operators the opportunity to concurrently generate direct and indirect revenue streams across a broad spectrum of independent customer groups. Since each customer group benefits from the presence of the others, potential multiplies and grows with the ecosystem. There is another reason why it is important to establish a foothold as a platform provider: Quite apart from the economic value of the actual services rendered, market power too will play an increasingly important role in determining the breakdown of revenues – as Apple currently proves, primarily in the context of B2C business.
Although the market for cloud-based enterprise software is still in its early stages, individual platforms – such as Force.com, a development platform for customer-specific solutions – have already experienced rapid development. Ultimately, however, the platform market as a whole remains undecided. As long as providers and customers remain skeptical about data protection and data security, especially in public cloud offerings, the network effects described above will be unable to realize their full potential.

Role models that show how such ecosystems can work already exist in the shape of established clusters in the real economy. A cluster can forge a unique selling proposition for itself as a distinct entity. At the same time, however, the individual players that make up that cluster remain independent enough to respond flexibly to market trends. Examples include the small fashion companies that populate Italy’s design clusters, biotech clusters made up of research spin-offs and industrial companies in South Germany, automotive clusters in and around Stuttgart and clean-tech clusters in Switzerland.

3. Leveraging the potential of "biodiversity"

The centers of gravity described above can only experience truly dynamic growth if as many solution and service providers as possible contribute their specific knowledge and strengths to their platforms. Operating as small, flexible units, they represent the full, rich spectrum of biodiversity in the cloud ecosystem. In principle, cloud services can cover any and all enterprise solutions, such as analytics and business intelligence, ERP/enterprise apps, customer relationship management, human resources, corporate performance management, procurement and supply chain management. Over time, the portfolio of cloud-based services will grow. We therefore expect to see fresh innovation and new business models, especially in the areas of mobility, big data and collaboration.

Small and medium-sized companies will be instrumental in shaping these markets, for two reasons. First, the cloud significantly lowers the barriers to entry for these firms. Small companies will reap disproportionately large benefits from the capital that their (larger) partners have invested in infrastructure, provisioning and marketing. Functions that are not part of their own core portfolio (such as geolocation services and payment services) can be sourced more cost-effectively with other cloud players. In addition, platform-driven network effects will enable them to reach their targeted customer groups more quickly. Ultimately, the faster a company gets to market, the more quickly it can cash in on successful solutions and break even, which in turn reduces their business risk. Second, this kind of cost-effectiveness gives SMEs greater flexibility to develop new functionality and, hence, to realize their full potential in terms of industry expertise and process knowledge. Small and medium-sized companies in particular will thus become a powerful catalyst to cloud development, driving innovative capabilities throughout the entire ecosystem.

The players that make up a cloud ecosystem will essentially fulfill one of four key roles (see Figure 3):
Case studies: European platform providers

**SAP – Business ByDesign**

**SAP’s key activities:** SAP Business ByDesign is an integrated enterprise software solution that covers all the relevant business management functions needed by SMEs. Software vendors and partners can use SAP Business ByDesign Studio to add industry-specific or customized modules onto the core application and then market their offerings via the associated electronic marketplace SAP Store (store.sap.com).

**Customers:** Small and medium-sized companies across all industries

**Solution providers:** SAP develops SAP Business ByDesign as the core application. Partners develop industry-specific add-on modules, integrated web services or business services, say, to complement and/or expand the core application. SAP Business ByDesign platform partners include Abayoo, Accenture, Crossgate, Syskoplan and Xing, etc.

**SAP’s value proposition:**
- Customers can access all relevant business management functions, thereby reaping the known benefits of the SaaS model
- Customers can test the technical compatibility of the desired solution at the SAP Store before buying
- Solution providers can reuse the extensive array of business management functionality already contained in SAP Business ByDesign, which helps them develop add-ons much more quickly and efficiently
- The SAP Store gives solution providers an efficient distribution channel via which solutions can be sold, distributed and installed fully electronically
- The SAP Store gives all solution providers the chance to position themselves on the global market, thereby extending their reach
- Sales partners and networks with a local and/or industry-specific focus are called in as professional consultants to provide customer care

**Cloud Control**

**Cloud Control’s key activities:** Cloud Control is a classical development platform. The provider automatically takes care of all infrastructure administration (covering both software and hardware). The platform delivers all the traditional benefits of the cloud, including scalability, high availability and accurate, use-based accounting.

**Customers:** Small and medium-sized firms that do not need their own platform capacity but that still want the flexibility (e.g. the ability to quickly run up new servers) and computing power of a large server landscape. In addition, many customers have neither the specialist skills nor the knowledge to manage technical issues such as load balancing.

**SaaS:** Providers of add-on services are called in to handle highly specialized tasks, such as when videos need to be converted to different formats, when monitoring applications are needed or when databases are used. Add-ons can automatically be integrated in the customer’s development process via a special programming interface on the Cloud Control website.

**Cloud Control’s value proposition:**
- European servers only – for reasons of data security
- No minimum contractual term, so that customers do not get the impression of lock-in effects
- Enables the use of different Open Source components to give developers sufficient freedoms
- Pay-per-use and automatic capacity scaling to cut the cost to the end customer

Source: SAP, www.cloudcontrol.de
Independent software vendors and solution providers will be the application developers. They will build new solutions or complement existing ones by adding industry-specific details, for example.

Service providers are experts when it comes to onboarding customers to cloud services. They also fine-tune solutions to the customer's precise business processes, migrate customer data and provide training to users.

In respect of the customer, resellers or distribution partners serve as trusted advisors or as brokers. By negotiating the relationships between providers and customers, they ensure that the costs and benefits of different offerings remain transparent, thereby reducing the complexity of purchase decisions.

Providers of business-related services and content provide virtual business processes to ensure the availability of cloud services.

Companies representing adjacent industries in the context of ICT also increasingly have a part to play. Including specialists such as business process outsourcing providers, these companies are already excellently networked with firms and industries that are currently experiencing a structural transition. Their primary focus is on cutting costs and standardizing processes. At the same time, specialized consultants entering the market for cloud services are opening up another area of potential growth. At manageable cost, they are in a position to translate their knowledge into applications and market these as SaaS offerings on a platform. Vertical services harbor particularly attractive opportunities: US health insurer Aetna, for example, developed what it calls its Collaborative Care Solution, a service whose aim is to improve the efficiency of medical care. As a result, doctors, nursing staff and therapists can all access patient data in the cloud.

10) Saugatuck Technology (2011): The cloud and business services: Key trends and directions through 2015
Like business models, revenue streams too will become increasingly fragmented in the cloud economy. All kinds of new pricing models are springing up. In the current phase of development, existing B2B cloud business models are nowhere near exhausting the possibilities. Few customers will suddenly decide to source all their software in the cloud. In most cases, on-premises solutions are combined with cloud applications. The better providers’ USPs as they seek to set themselves apart in the eyes of their target groups, the fatter the potential margins. Apart from subscriptions based on the fee-per-term concept, it is also possible to put a price on substantial improvements to solutions that are already in use. Complementary advice, hotlines and other services too can be sold at a premium. As we know from B2C business, combinations of a free basic version and a fee-paying version fitted with more features and functions is another viable option.

If providers succeed in creating platforms that bring all these business models and the associated players together, and if they can broker and coordinate interaction between these players, cloud ecosystems can evolve into the centers of gravity described above.

4. Creating a premium environment for the cloud economy

The three success factors we have looked at so far show how European players can position themselves strategically in the cloud economy. However, if they are to succeed under the new market conditions that are now taking shape, the framework within which they operate must be conducive too. In the cloud surveys conducted up to now, customers have repeatedly stressed the lack of adequate technical, legal and commercial standards. International corporations, for example, find themselves faced with complex legal challenges relating to the handling of personal data, for example, or the handling of data and metadata in the context of products that are subject to export controls. Nor do issues such as cyber-crime, industrial espionage and cyber-warfare do anything to allay their fears. In a nutshell, lack of transparency and lack of trust remain critical obstacles to the cloud economy’s breakthrough.

By the same token, however, cloud providers that manage to foster customers’ trust by providing transparent and reliable offerings stand to take the lead in competition. Similarly, those countries or regions that create legal certainty and offer incentives to invest in the cloud will attract the best cloud providers.

This is where our solution strategy kicks in: Our aim is to develop an end-to-end concept that defines reliable conditions for cloud providers and users alike. We paint a picture of the ideal climate in which the cloud economy could flourish and grow. We also submit practical recommendations on how these goals can be achieved. The concept comprises three component parts (see Figure 4):

1. Harmonized pan-European legal norms that create legal certainty in the cloud within Europe’s internal market
2. A European “gold standard” for cloud computing. This would ensure that legal conditions and criteria are met and make the quality of offerings transparent
3. A growing pool of expertise and experience in dealing with and applying cloud business models
If this premium environment can indeed be put in place, Europe could position itself more forcefully as an incubator and marketplace for cloud business models, as it has already done in other industries (Europe is the quality leader in the automotive industry, for example).

**Figure 4: Cornerstones of a premium cloud environment**

1. Harmonized legal norms in the EU

European ICT providers will be unable to leverage the full benefit of cloud computing unless a suitable regulatory framework is put in place and the internal market really works. Special importance must be attached to the European Data Protection Directive. In its present form, this directive – and especially its implementation in member states – is impeding the evolution of the cloud economy in Europe. The current revision process nevertheless presents an ideal opportunity to align it with the needs of cloud services while at the same time consolidating Europe’s high standards of data protection and data security.

At present, the EU Data Protection Directive must be translated into the national laws of the member states before its provisions become legally binding. Unfortunately, different member states vary considerably in the way they have gone about this process of legal implementation. Any cloud provider selling its services in several EU countries therefore has to deal with multiple jurisdictions and national variations of data protection laws, all of which drive up the cost to providers while adding to the uncertainty among cloud users. Providers and customers normally have to reach agreement on two matters: on the terms under which data can be passed on in the context of commissioned data processing; and on the technical and organizational steps to be taken to protect the data. Both aspects are governed by the laws of
different countries. The former contractual relationship is subject to the laws of the member state in which the customer is domiciled. Conversely, the latter is governed by the laws of the member state in which the cloud provider is established.

Matters become even more complicated when cloud providers work with subcontractors, e.g. with providers of infrastructure services or even add-on services such as geolocation services and search engine services. If these subcontractors are based in different EU countries, the number of bodies of legislation that must be taken into account increases exponentially. Even more red tape is generated if customers or subcontractors are involved that are domiciled outside the EU. In such situations, every single transaction must be examined to verify whether the contractual partner’s data protection provisions accord with those of the EU. If not, additional contractual clauses must be inserted to achieve compliance with EU data protection laws (if this is at all possible).

These are the problems that must be resolved without watering down Europe’s high standard of data protection. A revised directive should lead to full harmonization – a goal that might best be achieved by an EU regulation. The provisions of an EU regulation would be applicable “as is” in all 27 member states. The new ruling should also ensure that contractual matters are governed by the laws of the country in which the cloud provider is domiciled. This principle should be valid for contractual relationships between all parties responsible for data processing in all 27 member states. Overall, this approach would considerably reduce transaction costs for both cloud providers and cloud users. Furthermore, the standard contractual clauses established by Commission Decision 2010/87/EU should be revised. These standard clauses have proven to be an efficient tool to define the terms of conditions for commissioned data processing, especially in cloud computing, where providers need to engage multiple subcontractors. So far, however, the decision applies only to data processing providers established in third countries; and this gives them a competitive advantage over European providers, who are prohibited from using these clauses with subcontractors in third countries. To remedy this situation, the decision should be amended so that standard contractual clauses can also be used by European vendors and serve as a basis for commissioned data processing within and beyond the EU.

2. A “gold standard” for the European cloud

On the basis of a harmonized legal framework, a standard would need to be established. The standard should include common and measurable criteria and be accredited by independent auditors. This arrangement would make it easier for customers to evaluate offerings and verify compliance with legal requirements. A standard that focused on users’ three key concerns – trust, security and compliance – would be especially valuable (“golden”). Moreover, having one common European standard rather than the multiple national standards that are currently being hammered out would reduce costs and give cloud providers greater legal certainty. The industry and the political community could and should work together to design this standard. Data security and data protection, data portability (ensuring that data is supplied to customers in a form that all providers in the cloud can read) and service level agreements should be the core issues covered.
The auditing structure could be based on the technical/organizational measures (TOMs) described in Germany’s Data Protection Act. Data security is a good example: in an audit, cloud providers would have to prove that they comply with all legal and contractual obligations related to all the customer data entrusted to them throughout the entire data processing and transmission process, and that no unauthorized parties can read, copy or modify this data or pass it on to third parties. Furthermore, they must verifiably ensure that the data is protected against loss and that it is used and processed only for the contractually agreed purposes.

The benefits of a European gold standard are self-evident. Customers in the cloud would only need to check whether this or that provider is in possession of a valid cloud certificate. The expense to the provider is often cited as a drawback – an important consideration for precisely the small and medium-sized companies that we have identified as catalysts of the cloud ecosystem. Accordingly, the requirements would indeed have to be aligned with their needs too, so SMEs should be involved in development of the standard from an early phase. It would also be conceivable to complement the gold standard with a variety of secondary standards (such as “silver” or “basic”, say) to make it easier for smaller firms to enter the market. In addition, compliance with the standard should be voluntary for all cloud providers.

The existing audits and certificates, which cloud providers currently use for lack of alternatives, originally emerged in the context of traditional commissioned data processing. However, they are not enough to make due provision for the legal framework with regard to data protection, for example. Nor do they take account of the kind of global supply models that will be necessary for scalable cloud services. As things stand, infrastructure is usually accredited to ISO 27001, while operations are awarded ISAE 3402 or SAS 70 II certification. In Europe, initial cloud-specific quality seals such as Eurocloud’s Star Audit are just beginning to establish themselves. What is still lacking is binding legal recognition on the part of the relevant government agencies (for data protection and data security). At the present time, only SaaS providers can be accredited, but not providers of either platforms or infrastructures. Moreover, the standard has so far only been introduced in Germany. Yet despite these limitations, Eurocloud’s Star Audit lays a firm foundation for the development of a harmonized European cloud gold standard.

Clearly, a European gold standard for cloud computing should accommodate existing global standards to the greatest extent possible. At the same time, the endeavors undertaken in this area should lay a basis that will enable Europe to play an active part in shaping new, internationally valid agreements.

3. Knowledge and usage

Europe already has plenty of SMEs that are experts in data protection and data security. In their capacity as quality leaders, they are ideally placed to drive a premium cloud environment. Experience – some of it painful – has in recent years helped a number of corporate groups to master challenges that are of great importance to the development of cloud standards: from successful launch of
automated compliance management systems (in the case of Siemens, for example) to improved data protection and data security thanks to policies, processes, systems and corporate governance (such as the Data Privacy, Legal Affairs and Compliance unit that Deutsche Telekom has attached to its Board of Management). The pressure that built up as market players sought to get a handle on these problematic aspects has brought forth structures, processes and IT solutions that can now be used as an advantage in the context of a cloud ecosystem.

In the medium term, both the industry and governments will have to tackle the issue of qualifications. Theoretically, new occupational training courses could be established, training and development programs formulated for SMEs and/or specialist subject areas defined for academic study courses in the wake of adequate requirements analysis. At the same time, grants and subsidies for research projects (into success factors and future development trajectories in the cloud economy, for example) will contribute to the accumulation of knowledge. New knowledge platforms to pool findings and best practices could be among the outcomes.

Industrial policy action could likewise accelerate the emergence of a strong European cloud sector. Moves to promote business startups in the orbit around university institutions could, for example, help to steer Europe’s creative potential in the direction of the cloud.

The creation of a premium cloud environment on the basis of harmonized legal norms in the EU, a European cloud gold standard and in-depth expertise are essential prerequisites for growth in Europe’s cloud industry. A powerful position on the sizeable European market would also leave any company well placed to succeed on the global stage. Those that help shape developments now can reasonably hope to gain a competitive advantage as providers in the global marketplace.

Obviously, the implementation of these proposed initiatives to promote cloud computing will require significant investments. The European Commission and member states though can leverage existing EU public funding instruments. The current EU Research Framework Program (FP7) already supports projects related to cloud computing. The new Horizon 2020 program should put an even higher emphasize on the cloud. The EU should also continue to leverage the Competitiveness and Innovation Program (CIP) to support EU wide pilots of innovative cloud services. Most importantly, however, would be a more effective use of EU structural funds. As it stands now, only half of the budgets that member states allocated to the ICT related programs have actually been spent. We therefore encourage managing authorities for EU structural funds in member states to issues calls for proposals for cloud computing projects in order to take advantage of the unused EU funds. In particular, they could be used to promote cloud computing in the public sector, the uptake by SMEs or even the creation of specific cloud clusters and ecosystems. Moreover, the new EU Cohesion Policy should make explicit reference to cloud computing as a priority for the new funding period (2014–2020).
European ICT companies should press ahead with their activities to drive the evolution of cloud ecosystems. They have the chance to adopt a leading role as platform operators or service providers in the cloud economy. Governments must stimulate growth by clearly spelling out the rules of the game and pursuing a focused industry policy. The European Commission itself should pioneer developments by harmonizing rules and initiating an EU industrial policy for cloud computing. We welcome the initiative of EU Commissioner Kroes to prepare a comprehensive EU Cloud Computing Strategy. Furthermore we submit the following recommendations:

1. **Create a common EU legal framework for cloud services**

   The EU can take legislative and regulatory action by harmonizing the rules that govern data protection and data security. It can also promote a digital internal market to make it easier for cloud services to be marketed across borders.

2. **Support a European gold standard for cloud computing**

   A European gold standard for cloud computing should be driven by the industry. The EU and national government agencies can support the emergence and acceptance of this kind of standard by:
   - harmonizing the demands of public authorities throughout Europe and defining them in relation to the gold standard
   - ensuring that national data protection and data security authorities recognize the standard
   - referring to the standard in legal documents
   - factoring the standard into the award of public work contracts

3. **Promote cloud research**

   The cloud economy is a critical area of innovation right now. It is important to deliver central backing that translates into broad-based implementation. The EU and its member states should give cloud computing high priority in public R&D programs. The focus should be on how cloud ecosystems and corresponding centers of gravity can be cultivated in Europe. Issues such as interoperability, scalability and data security can serve as the initial point of departure.

4. **Support the uptake of cloud computing by SMEs**

   Cloud computing can be especially beneficial for SMEs. They are the heart of the European economy. An effective usage of the cloud would drive innovation and competiveness in Europe overall. However, uptake by SMEs in Europe is rather slow due to a lack of skills and awareness, hesitation to adapt business models to the cloud or security concerns. We recommend to create a dedicated EU-wide program to foster the uptake of cloud computing by SMEs. Measures could include tax incentives, training seminars and an EU portal for the exchange of best practices.

5. **Position the public sector as a pioneering user**

   The public sector is the biggest buyer of IT products and services in Europe. If all public organizations were to use cloud services, market penetration would increase substantially. The EU and national governments should encourage the public sector to become early adopters of cloud computing. Possible ways to do this include developing a set of cloud procurement guidelines, offering financial incentives for innovative cloud projects, setting up a European platform for best-practice sharing and include cloud services into budget planning.

6. **Maintain the momentum of progress**

   An EU-wide cloud initiative needs a concept whose objectives are broken down into milestones and clearly defined areas of responsibility. A made-to-measure monitoring system should oversee implementation of actions. When the parties involved see measurable progress, this will encourage them to stay committed to a Europe-wide cloud program.

The strategic importance of building a leading cloud industry thus places obligations on governments and industry alike. The two sides must work hand in hand to realize growth effects at both macroeconomic and corporate level, both inside and outside the ICT industry.
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