CLOUD COMPUTING

AMDATU: AN OPEN SOURCE MULTI-CLOUD STRATEGY

Luminis Cloud Services

"Chains of habit are too light to be felt until they are too heavy to be broken"

Warren Buffet

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Transitions in computing

We are living in a world of hypercompetition[1]; an increasingly global world where organizations are benchmarked, compared and chosen by partners, employees, suppliers and customers. Remarkably, however, is that this results in an ever-more individualized marketplace that requires new levels of efficiency and innovations aimed at increased agility and responsiveness.

Customer focused

One of the overall trends we find is the evolution towards personalized computing. On the one hand, the increasing number of mobile devices results in finer-grained interactions between users and organizations. On the other hand, customer-oriented systems evolve towards more localized and personalized behavior by using profiling and recommendation algorithms to deepen the relation with customers.

Financial challenges

So, how do organizations find a balance between the changing business environment and the speed of change within their own IT? Given that organizations now spend a significant amount of money on IT purchases, the emerging practice of using utility computing as a basis for corporate IT has been under the radar for some time. Especially because developments in technology are often happening faster than the rate at which enterprises are able to absorb them. Depreciation benefits (on ageing equipment), while useful, are no longer enough. Whether the situation demands a launch of a new product or service or the need to satisfy consumer-demand through viral or social services, information technology emerges as the obvious ingredient for every board member, forcing them to "*rethink IT*".

Enter Cloud Computing

An important ingredient in "*rethinking IT*" in our opinion is Cloud Computing.
For some, Cloud Computing is one of the biggest technological revolutions to emerge in recent times. For others, it is just the natural evolution of a set of technologies aimed at achieving the long awaited dream of utility computing. We at Luminis are convinced that Cloud Computing is a disruptive innovation where the full potential of it is much more than a cost-focused return-on-investment model. Not only will the cloud journey help organizations to be more innovative in rolling out new applications, user interfaces and processes for their end-users and customers, it will also help them to financially de-risk businesses from locked-in IT investments.

[1] *See also: http://en.wikipedia.org/wiki/Hypercompetition*

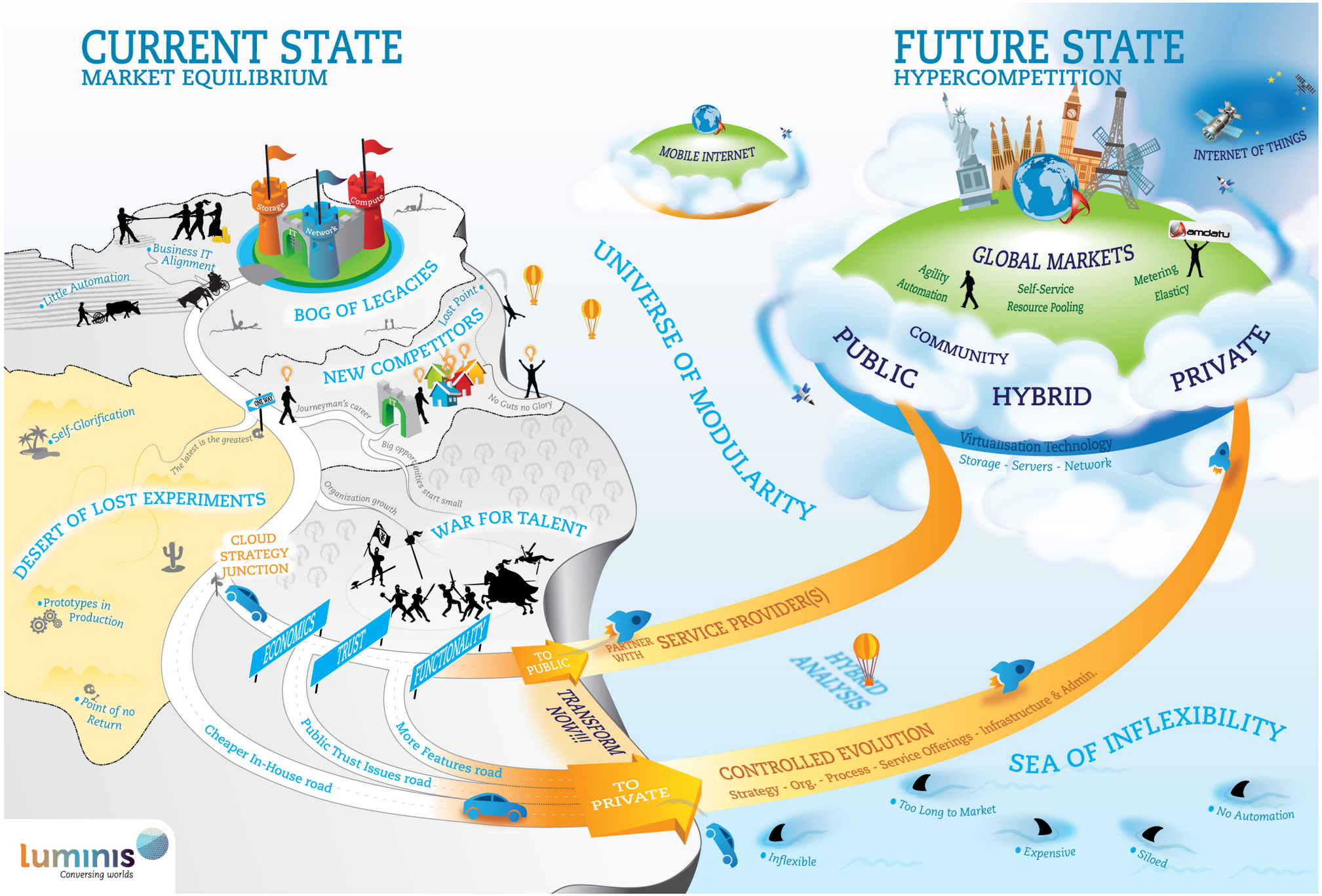

Figure 1: The Cloud Computing Landscape.

What is Cloud Computing?

In order to create a common ground for discussions about Cloud Computing, we adhere to the definition of Cloud Computing from NIST[2]:
"Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."
This cloud model promotes availability and is composed of five essential characteristics:

- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service

Fundamentally, this makes it possible to apply Cloud Computing resources using pay-as-you-go subscriptions.

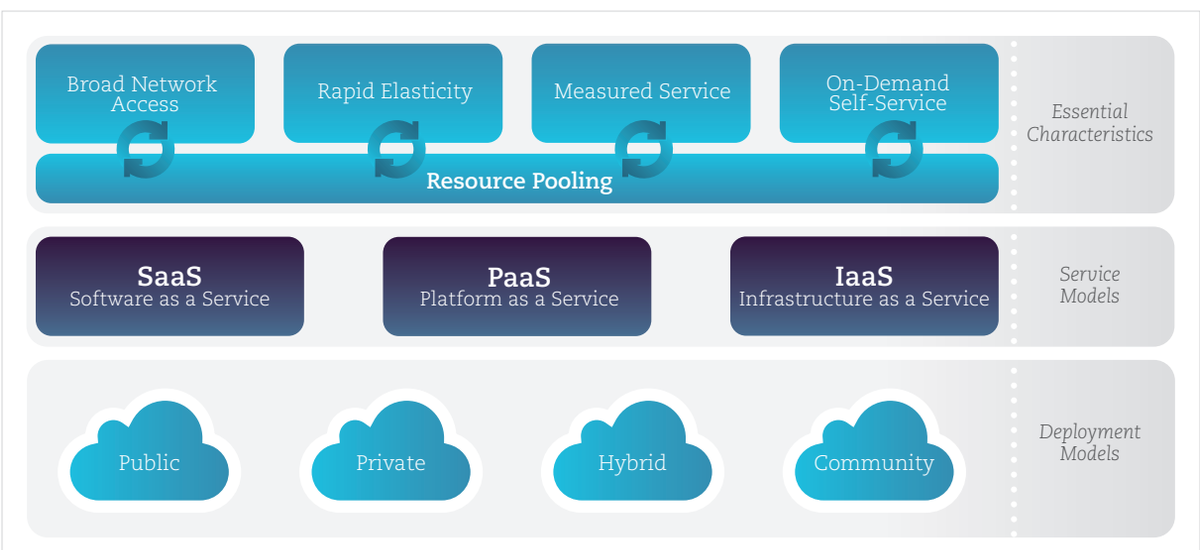

Figure 2: Cloud Computing according to NIST.

The key concepts that are explained above find their origins in the virtualization of all underlying computing, storage and networking resources. Furthermore it assumes that processes are automated as much as possible and tasks are standardized in a way that they can be offered as easy-to-use services on an on-demand basis. The commoditization and the drive towards economic efficiency have led to massive concentrations of the hardware resources required to provide these services. This encourages economies of scale - for all the kinds of resources required to provide computing services using subscription-based pricing schemes. These schemes enable customers

[2] *See also: The National Institute of Standards and Technology (http://www.nist.gov)*

to move away from an IT-strategy that is based on ownership, which usually incurs a considerable upfront investment, towards a usage-based strategy, where companies only pay for the IT services they use.

Apart from the economic benefits (i.e. savings) by moving from a CapEx to an OpEx[3] model there are other benefits in adopting Cloud Computing. An illustrative example is availability[4]; enterprises, especially in the SME segment, may acquire at a marginal cost, top-class technologies, which would otherwise be out of their budget range.

[3] *See also: http://en.wikipedia.org/wiki/Capital_expenditure and http://en.wikipedia.org/wiki/Operating_expense for a more in-depth explanation.*

[4] *See also: http://en.wikipedia.org/wiki/Availability*

Deployment models

Depending on the level of privacy and sharing, cloud resources can be used in different deployment models.

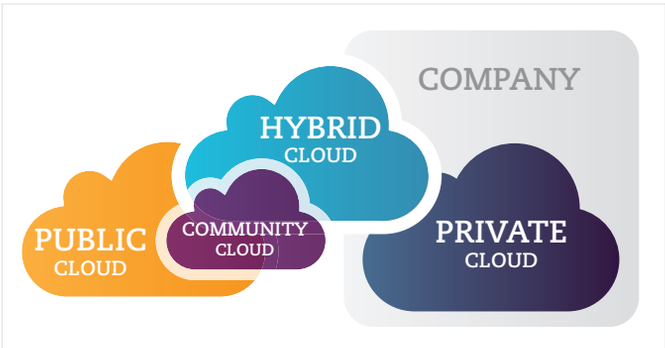

Figure 3: Deployment models for Cloud Computing.

Private clouds

Private clouds are dedicated to individual organizations and are usually located at the organization's premises or else its management is outsourced to a third party (usually via server hosting). Private clouds are under the strict authority of an organization. A private cloud can be compared to a conventional data center - with the difference that technological arrangements are implemented to optimize the use of available resources using virtualization techniques.

Public clouds

A public cloud is owned by a provider specialized in delivering services to multiple organizations or individual users. These services can only be accessed via the Internet, which entails transferring data processing operations and/or the data to the service provider's systems. Therefore the service provider plays a key role with respect to the effective protection of the customers' data. Therefore, in a public cloud, users are obliged to transfer a major part of their control over data to the service provider, along with the data itself.

Hybrid clouds

Alongside "*public*" and "*private*" clouds, there are also "*intermediate*" or "*hybrid*" clouds where services provided by private infrastructures co-exist with services purchased from public clouds. Reference should also be made to the "*community clouds*", where services are shared by several organizations for the benefit of a specific user community.

Service models

Flexibility and simplicity in configuring cloud systems allow their "*elastic*" dimensioning, i.e. these systems can be adjusted to the specific requirements in accordance with usage-based approaches. Depending on these requirements, there are 3 different levels of cloud resources available on the market today:

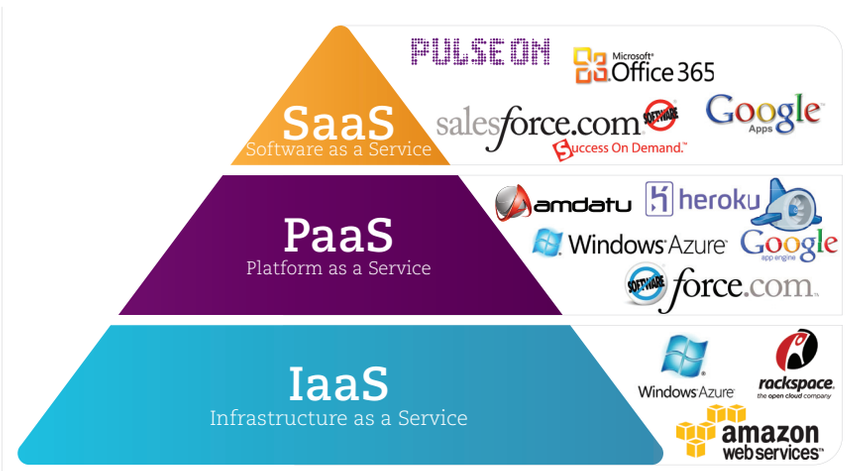

Figure 4: A schematic overview of Service Models.

Infrastructure as a Service (IaaS)

IaaS propositions enable customers to make use of a technological infrastructure using pay- or charge-as-you-go contracts. This infrastructure consists of virtual resources like processing, storage and networking that are managed by the IaaS provider. IaaS propositions offer simple, effective and efficient means to replace corporate IT systems or use it to extend them. IaaS providers usually have physical, complex infrastructure at their disposal that spans multiple geographic areas. Examples of IaaS providers are: Amazon EC2, Google Compute Engine and Microsoft Azure.

Platform as a Service (PaaS)

A PaaS proposition offers solutions for the advanced development and hosting of applications. PaaS services are usually aimed at organizations that develop and host cloud-based applications. Again, the services delivered by a PaaS provider make it unnecessary for the user to rely on additional or specific hardware or software at internal level.
Examples of PaaS providers are: Heroku, Google AppEngine, Amdatu and Force.com.

Software as a Service (SaaS)

A SaaS proposition is aimed to deliver end-user applications and makes them available to end-users. The applications are accessible from various client devices through either web browsers (e.g. web-based email), a native application or a program interface. These services are often meant to replace conventional applications (typically installed on the users local systems).
Examples of SaaS applications are: Gmail, Office365, PulseOn and Salesforce.

A Cloud Computing strategy

Currently, there are no standard data formats or other definitions that guarantee a mature level of interoperability and portability between different cloud providers. If a cloud user wants to migrate from one cloud provider to another, this lack of interoperability may result in the impossibility or at least difficulties to transfer the user's (personal) data to the new cloud provider (so-called vendor lock-in). The same holds true for services that the user developed on a platform offered by the original cloud provider and the use of the services offered by cloud provider A but not (or in an altered form) by cloud provider B.

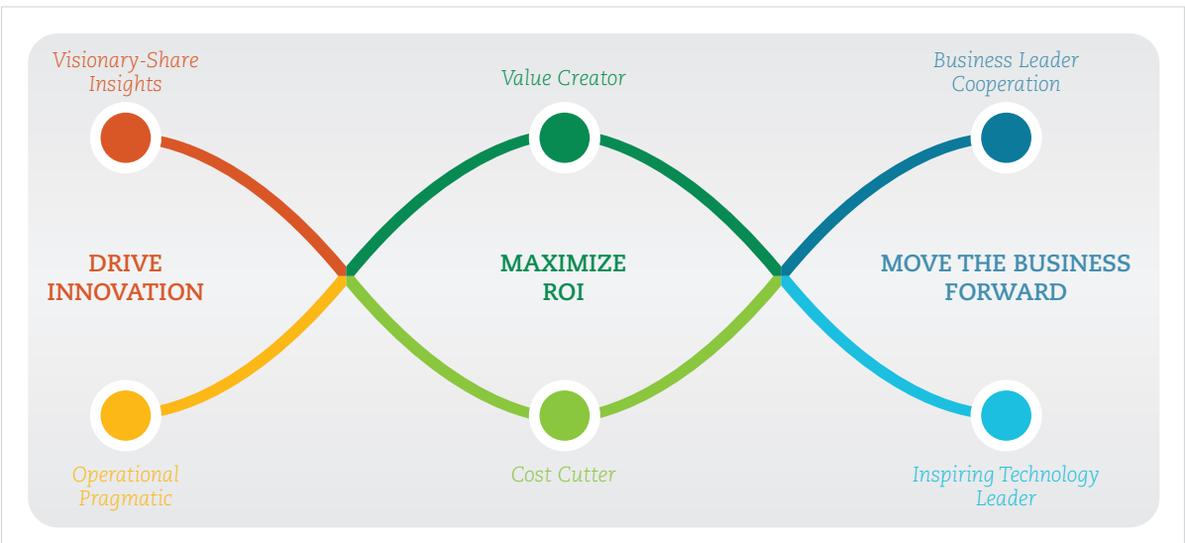

Figure 5: The flows of a cloud strategy.

Handling lock-in

This lack of standardization is no surprise for the experienced IT professional and sets the stage for the need for a coherent strategy with respect to Cloud Computing. Foregoing all importance of the strategy process itself, a number of different forces apply in constructing an effective Cloud Computing strategy. In the first place, Cloud Computing has a strong innovation drive. Any Cloud Computing policy should start there. Whether it is time-to-market or economies of scale, there will be a different balance between alignment with visionaries and the existing, often operationally focused, partner strategy. One of the key differences here is the drive for open innovation in order to attain the first-mover advantage; a radically different strategy where the emphasis shifts from the existing "*linear innovation*"[5] to "*lead-user innovation*"[6].

Because of the changed levels of agility and efficiency, new business-opportunities and markets can emerge. With this new flexibility, value chains that are usually linear evolve into value networks, where multiple companies cooperate to create value for customers. This drives different ROI strategies and new partnership-policies.

Finally, any effective Cloud Computing strategy should embrace the enabling effects of IT into their

[5] *See also: http://en.wikipedia.org/wiki/Linear_model_of_innovation*

[6] *See also: http://en.wikipedia.org/wiki/User_innovation*

business. This means that IT governance needs to be based on the assumption that business and IT have become inalienable counterparts (as opposed to the notion of the designer approach to business, where IT inherently follows the dynamics of the market).

How the Cloud Amps Up Innovation

To quote Jack Welch "*If you are not moving at the speed of the marketplace you're already dead - you just haven't stopped breathing yet*". Innovation is of great importance for any self-respecting company, especially in a rapidly changing world. If the competition can deliver a service or product earlier, you start with a handicap and from thereon it is an uphill battle to try and compete against existing and perhaps even accepted ideas.

An example of this is LinkedIn; one of the dominant social networking sites that has become a mature Silicon Valley company in 10 years. With its LinkedIn Labs (http://www.linkedinlabs.com/) LinkedIn manages to launch an astonishing series of new products at a high frequency, almost in defiance of normal organizational gravity. How? LinkedIn leverages Cloud deployments to cheaply scale up new products and turbo-charge innovation. Take for example the InMaps service (http://inmaps.linkedinlabs.com/) with which they try to help people to analyse their professional network. This service was not launched on the basis of an extensive market research but much more as a means to deeper relations with users and a service to gain extra attention.

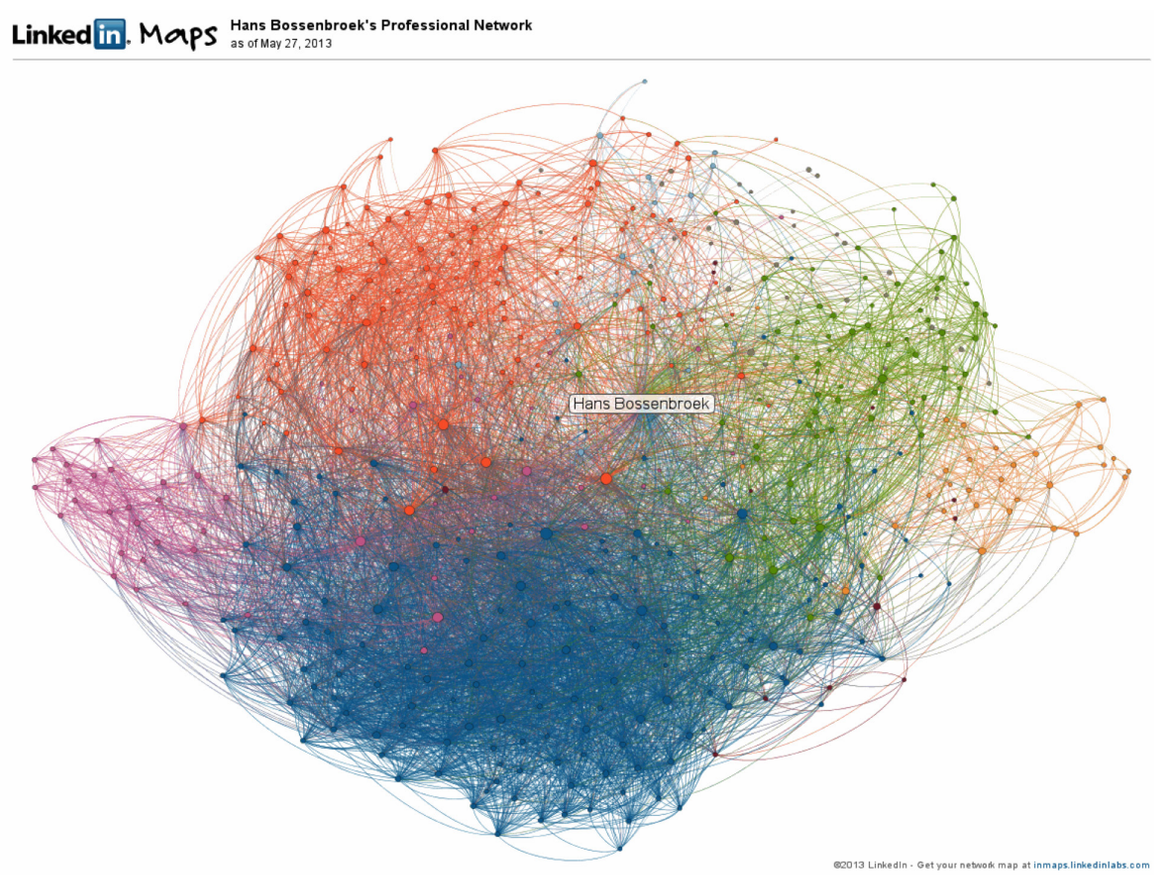

Figure 6: An InMaps representation of a LinkedIn profile.

The cost of deploying an entirely new application in the Cloud is so much cheaper and easier than in a traditional datacenter. There is no need to buy new servers, rent co-location capacity, or hire IT staff. Likewise, Cloud deployments are very easy to dismantle without cost penalties when new products simply don't work out. The broader implication for innovative companies is, rather than worry about buying huge amounts of hardware to launch a new product, or signing rigid co-location agreements, it's far easier now to build lots and lots of new applications, try them out on the Internet, and then either scale them up or shut them down. This goes not only for applications as a whole but also for the individual features that together make up the application. In software engineering we make a lot of fuss about requirements, however to quote Steve Jobs: "*A lot of times, people don't know what they want until you show it to them.*" The result of this is that especially for mass-market products, you have to continuously test with customers whether new features are moving a product, service or solution in the right direction. This requires testing with customers before and after the deployment of a service, in order to make this beneficial it is crucial that you have very short release cycles (and thus have a high speed of development).

For companies like LinkedIn, the ability to try out lots of different things is a key part of their innovation strategy. In other words, dramatic decreases in CapEx and OpEx for a new idea mean lots more new ideas get created and hopefully some are homeruns.

Another effect of Cloud Computing is that it provides an infrastructure for using services provided by others. These infrastructural services provide you with the means of finding external services, using them in a secure way and paying for the use of them. In effect it supports open innovation[7] thereby potentially reducing costs and increasing your speed of innovation even more.

One caveat is in order. Just because it's Cloud doesn't mean it is push button simple to bring up a new application. Writing software for the cloud poses some of the most difficult challenges in programming. Cloud systems are inherently parallel and distributed, running computations across many servers, possibly in multiple datacenters, and communicating with a wide range of clients with disparate capabilities. Individual computers and communication links are commodity components, with non-negligible failure rates and complex failure modes. Moreover, cloud applications generally run as a service, gaining economies of scale and efficiency by concurrently processing many clients, but also facing the challenges of handling varying and unpredictable loads while offering a highly available and reliable service in the face of hardware and software failures and evolution. These problems, of course, come in addition to the familiar challenges of constructing secure, reliable, scalable, elastic, and efficient software.

The portability aspect described earlier and the caveat described above are the main reasons for the development of the Amdatu platform, which is described in the next section.

[7] *See also: http://en.wikipedia.org/wiki/Open_innovation*

Amdatu: an open source initiative

The overall driver under Cloud Computing is the pervasive Internet as the catalyst for the build-up of a "*tsunami*" of innovative ideas, products and services. Change is happening at an increasing speed, offering opportunities for the innovative and disaster for those that resist change. Organizations' ability to respond to threats and opportunities is a correspondingly key factor determining their continuity. These changes also place new demands on the way that technology expertise needs to be delivered and shared. Existing approaches to delivering technology and related services are too slow, ridged and reactive; its time to re-think how technology experts play their part in the context of accelerating change and uncertainty.

What is Amdatu about?

Amdatu is both a philosophy and an open innovation platform.

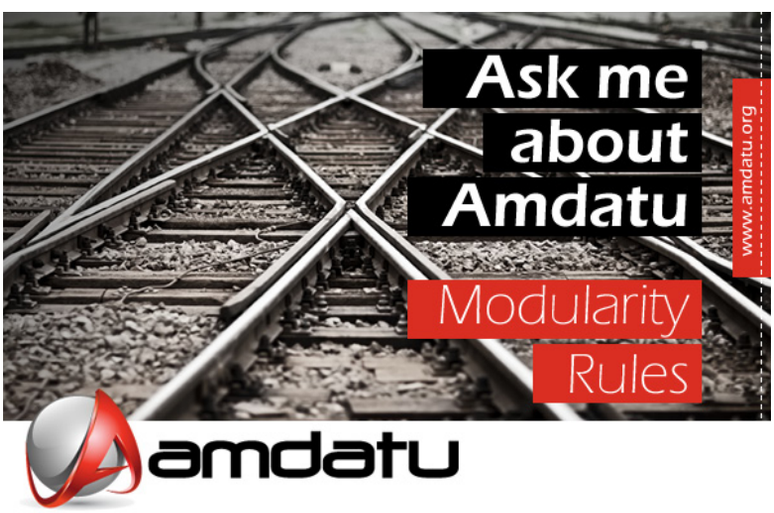

Figure 7: The Amdatu call to action.

The underlying mental framework relates to the rapidly decreasing relevance of a number of (20th Century) concepts and business strategies; this is especially true of strategies based on the monopolization of ideas, the ownership of information and customer lock-in. As ideas and information are exchanged with increasing speed and traditional barriers for (remote) collaboration are removed, the relevance of these concepts is being supplanted by strategies focused on rapid, collaborative evolutionary innovation. These superior concepts emphasize the increasing relevance of community-support, dynamism and speed.

This philosophy was embraced by a number of Dutch organizations and resulted in the formation of the Amdatu Foundation. The goal of this foundation is to establish a community aimed at fostering high-speed, open innovation by applying a modular development strategy for Cloud Computing.

What is Amdatu?

Amdatu is an open source project[8] which is focused at a community effort that supports the development of scalable cloud applications using a modular development strategy. In order to do so, it has designed an architecture style based on the following founding principles:

- Adhere to standards that promote speed and open innovation
- Abstract from underlying infrastructure to prevent undesired lock-in
- Embrace Cloud Computing principles to optimize elasticity and multi-cloud computing
- Organize according to accepted Open Source principles to grow a community

It is outside of the scope of this document to elaborate on these principles, but we think that a description of the Amdatu architecture style will illustrate them sufficiently.

The Amdatu architecture style

The main challenges that have resulted in the Amdatu architecture style have always been adaptability, speed of development and technology abstraction. Specifically when observed from the Cloud Computing perspective each of these concerns plays an important role in any serious application.
Adaptability is directly related with the new levels of business agility caused by the transition from ownership to pay-per-use pricing. Adaptability refers to the capability to change the structure and functional behavior of an application at runtime, which is relevant in the 24x7 Cloud economy.
Another aspect of Cloud Computing is the ever increasing pressure on Time-to-Market. This is directly related to the speed of development for applications. In order to optimize the speed of development, one needs to adopt a software development strategy that is consistent throughout the entire lifecycle. This means it must support all kinds of component-use, -reuse and -disposal.
Finally, it is clear that any infrastructure lock-in strategy that impedes either business innovation or interaction with customers must be prevented. Amdatu was therefore conceived as an abstraction from underlying infrastructural technologies.

Effectively, this has resulted in an uncompromising adoption of a modular development strategy. This strategy[9] assumes that any software system can be seen as a dynamic set of components throughout its entire lifecycle (from analysis and design up to development and runtime).
When using a modular development strategy, any system can be seen as a set of components, where:

- Any component can only be accessed through a designed service interface.
- Every component is responsible for its own information or data.

[8] *See also: http://www.amdatu.org*

[9] *Modular programming was conceived in the early 70's by E. Dijkstra (see also: https://en.wikipedia.org/wiki/Modular_programming).*

In combination with the underlying principle to abstract from infrastructure technology, the next diagram illustrates the fundamentals of a component-based system that adheres to the architecture style of Amdatu.
It describes how clients are connected with Cloud services using REST. Clients are either developed in HTML5 and JavaScript in order to attain a mature level of cross-device capability or using a dedicated native technology.

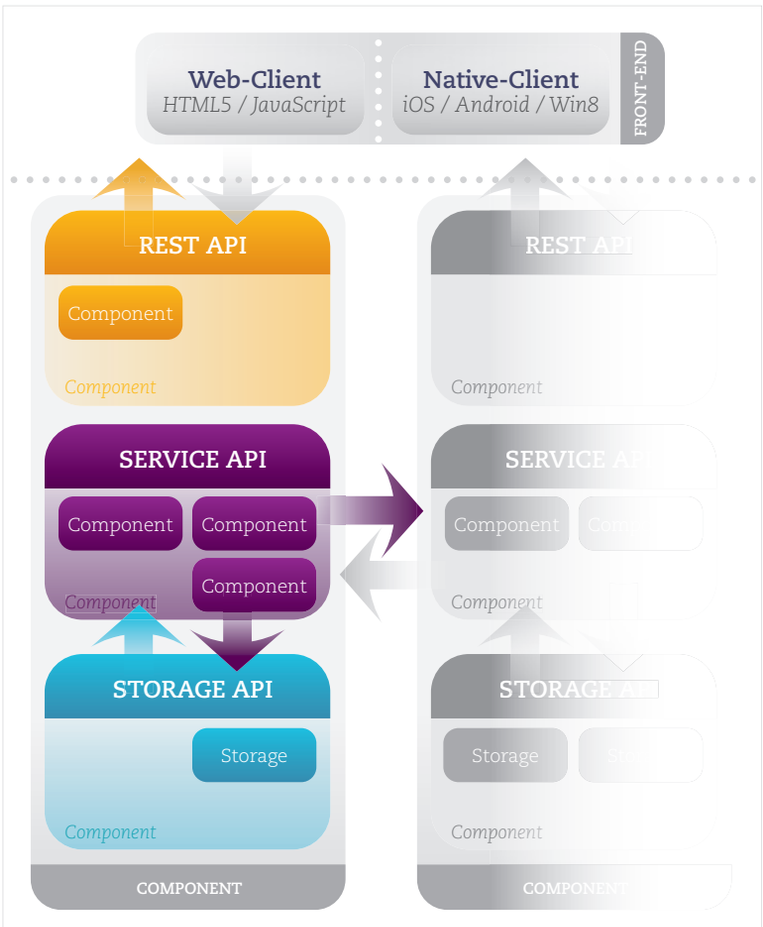

Figure 8: A component overview in Amdatu.

The Amdatu architecture style not only requires that applications are built using components, it also features a number of layers that isolate specific concerns. These layers are illustrated in the next diagram.

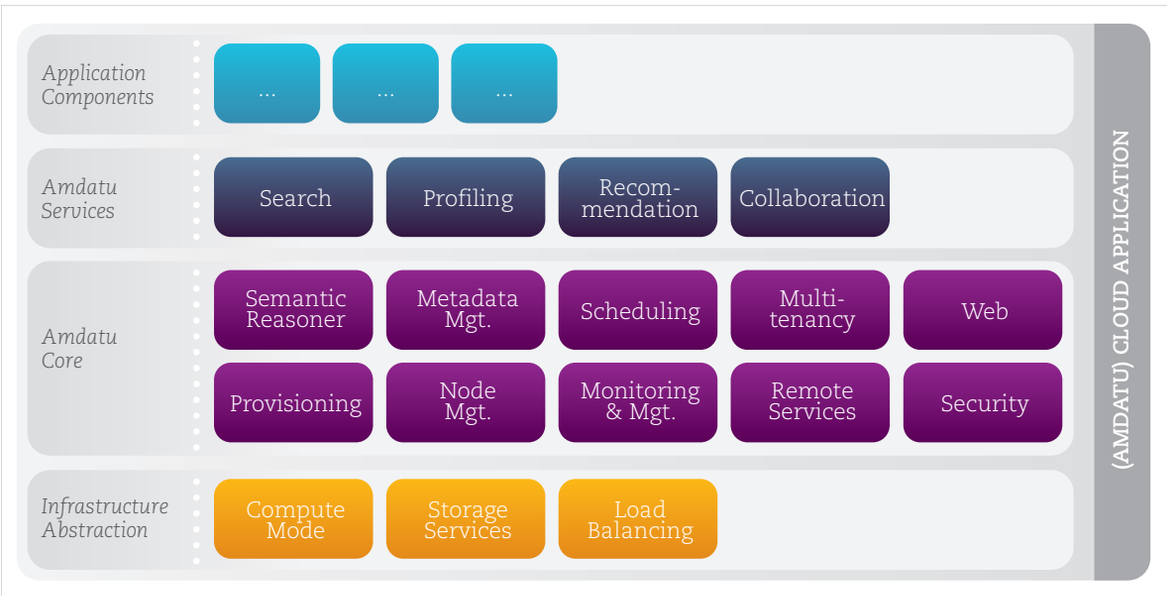

Figure 9: The logical Amdatu architecture.

Implementing Amdatu

Developing a robust and scalable cloud application is no simple task, even with Amdatu as a starting point. For that reason, Luminis provides on- and off-site development services in the form of training and development mentoring as well as project execution. Furthermore, Luminis also offers all kinds of hosted Cloud services based on Amdatu.

More Information?

For more information about Cloud Computing or Amdatu, you can either contact the nearest Luminis offices or the authors of this document.

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