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Cloud Computing and Startups

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2.1 Introduction

Early stage companies, typically referred to as startups, usually have very small resources to play with and, at the same time, a strong demand for flexibility and scalability. To be able to develop business ideas into services quickly, and at the same time be able to adapt to the customer feedback is vital for these companies. Cloud computing brings the ability to scale both
Cloud Computing: Methodology, System, and Applications

FIGURE 2.1
The Iterative Process of Innovation.

The match between startups and cloud computing was identified early, making many of the startups early adopters of this paradigm shift. In this chapter we look more closely at how cloud computing accelerates the highly iterative innovation cycle for startups (see Figure 2.1). A number of examples is given; we also discuss how cloud computing changes the overall landscape for startups and investors in startups.

2.2 Time to Market
During the development, from the very first idea to a product or a service, time to market is often considered as one of the key components for success. Even if the value of being the very first to a new market is hard to evaluate [49, 473], the ability to adapt rapidly to competition and customer need is not. Figure 2.2 shows a historical perspective on the increasing intensity of the competition. Quickly launching early prototypes for customer feedback is very useful for choosing the right path to a new service. This is one of the strong features of the cloud computing concept, to be able to do rapid and adaptive development to explore new markets. A very similar process occurs also in larger corporations, especially in research and development departments but
also in the interaction with customers and partners. The main difference is that in larger companies development more often relies on hybrid clouds, consisting of a combination of internal infrastructure and services together with public cloud offerings.

Failing is not a bad thing, this is a part of the learning process. Not being able to reach the market in a quick way can mean running a failed company longer than necessary. Using flexible and scalable technologies, the startups can quickly change direction and try new angles. Let us now look more closely at the essential cloud characteristics [541] and their implications on startups.

2.3 Cloud Computing Implications

2.3.1 On-Demand Self-Service

**Description:** The user can — without any human interaction with the cloud service provider — provision computing capabilities, such as server time and network storage, in an on-demand self-service manner.

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**FIGURE 2.2**
Over the Years the Time It Takes for a Competing Product to Be Released to Market Shrank Dramatically.

![Graph showing the decrease in time for a competing product to be released to market over time.](image)
Implications for startups: the company can easily and swiftly get needed IT infrastructure in place. Especially for smaller newer companies, and even more so for not-yet-started companies, negotiating sales contracts is not their strongest side. In addition, the need of server time and network storage is highly unpredictable for early stage companies, making the on-demand self-service characteristics of cloud computing even more attractive. One early example: Yieldex [781] during startup phase used Amazon Web Services to demo the capabilities of their publishing service for investors with a total cost of 40 USD for the first month. This was made possible by allocating cloud resources for the actual meetings, and releasing them directly after the meetings, with no human interaction, and on-demand.

2.3.2 Broad Network Access

Description [541]: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and PDAs).

Implications on startups: Using cloud services and distribution platform for mobile clients a whole new field of services arises. With this delivery chain, the smallest company can grow overnight into a much larger one by offering services in a scalable way. The most famous examples include the Apple App Store distribution platform and Android applications that often rely on the Google App Engine-based backend.

2.3.3 Resource Pooling

Description [541]: The provider’s computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.

Implications on startups: Resource pooling is one of the reasons why public IaaS can be more cost-effective than owning own infrastructure. However, unless a startup is building a service on top of a private cloud, the price tag for a certain cloud service is much more important.

2.3.4 Rapid Elasticity

Description [541]: Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out, and rapidly released to quickly
scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

**Implications on startups:** Through rapid elasticity, the company can quickly adapt its service to address the customer demands. This results in a cost effective scalable business model very useful for both small and medium companies. From services built directly on IaaS, Animoto [90] is the more well-known example, porting its photo presentation application to Facebook, generating a large peak in usage. Animoto was prepared for this, using RightScale and Amazon to handle the peak in an economical way. Dropbox [243] and other storage services sell space on demand in an elastic way avoiding large overhead in capacity.

### 2.3.5 Measured Service

**Description [541]:** Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported providing transparency for both the provider and consumer of the utilized service.

**Implications on startups:** Being able to calculate the cost of a certain business transaction is very useful for making decision, for example, for establishing a price-list for the end customer. Resource usage metrics of the cloud services make this process much easier, as they can be directly converted into monetary values and service level agreements (SLAs).

### 2.4 Changes to the Startup Ecosystem

Cloud computing opens up a new way of launching startups. By creating scalable business models with consumption based pricing, the startups can evolve with a higher degree of cost control than earlier. Customer needs and behavior are hard to predict, which means a high risk of developing wrong or too costly services. With a higher level of agility, companies get a better control of cost versus revenue.

In *The Future of Web Startups* [Graham 2007] Paul Graham lists a number of changes to the startup ecosystem, changes that since then have come true — especially for Paul Grahams own Y Combinator [779]. More startups are launched, with faster turn-around from testing to the next step (continuation or end). Many of these startups are web based, most of them rely on cloud computing, many with cloud computing as part of their offering.
2.4.1 Lowering the Barrier to Entrance

As a result of the availability of low cost cloud computing services, mature open source software stacks, high-quality connectivity and novel mobile service platforms, more entrepreneurs start web-based companies in a shorter time. For similar reasons, many new-formed companies can operate further than before without the need for external investments. This results in a change in the overall investment chain, with a shift of control to the favor of the entrepreneurs.

By Figure 2.3 we try to give an idea of the implications on the startup-investor ecosystem. Cloud computing together with a number of earlier changes in IT (open source, network, mobility, commodity low cost hardware) lowers the cost for startups to start. Due to the quick launch through cloud computing, the entrepreneurs get quick feedback on their ideas — as well as the investors get quick feedback on their investments. This lowers the risk and need of initial capital, enabling more investments and startups to launch. At the same time startups can now develop longer before involving external capital, if involving it at all.

All the above mentioned features of cloud computing are very appealing also from the investors point of view. Investors, for example, business angels, venture capitalists, the entrepreneurs themselves, do not have to make heavy IT infrastructure investments at the early stage of the companies, which has been the case for at least a decade. They can get relatively quick feedback and only later, once the company matures, an option of purchasing their own infrastructure could be considered, for security reasons or total cost minimization. It also means that if at some point a certain startup fails to meet expectations, shutting it down is as easy as stopping the virtual machines, without the hassle of the IT infrastructure leftovers.

2.4.2 Seed Accelerator Programs

In Figure 2.3 we also point at the investor’s point of view: they now need to evaluate more startups if they want to get involved early. This is not possible in most venture capital firms due to low staffing, and new models are needed. One of these is to get involved in a so called seed accelerator.

The seed accelerator program [42, 190, 779] is a new model of funding and assisting startup companies. The model is especially suitable for quick-starting web and media based technology and service businesses with a relatively low entry barrier. Cloud computing is the key for many of these startups. Y Combinator [779] was the first seed accelerator, specializing in web services. Y Combinator invites technology focused teams to develop their service within the seed accelerator for a short period of time, typically 12 weeks, twice a year. During this stay the teams evolve, from idea to early stage company, exposed to the network of investors and services (marketing, sales, legal). Successful examples from Y Combinator includes Dropbox [243], Zencoder
FIGURE 2.3
Evolution of a Startup Ecosystem to Today’s Cloud-Based Startups and How It Affects Startups and Investors.
FIGURE 2.4
The SICS Startup Accelerator, Interacting with External Cloud Based Companies and Developing Cloud Focused Startups in ×2-jobs.

[791], and Heroku [347] — all based on cloud computing. In mid-2010 about 25% of the teams had found investors during the 12 weeks stay in the seed accelerator. In exchange for this service Y Combinator takes 2 to 10% of the company. Through seed accelerators, venture capital companies can sometimes get an early view of the upcoming startups. In the Y Combinator case, Sequoia Capital [640] is a partner backing the overall investment process.

2.4.2.1 SICS Startup Accelerator Projects and Services

Y Combinator has inspired a number of new seed accelerators, for example, Aalto Venture Garage [42] and SICS Startup Accelerator [683]. In the SICS Startup Accelerator case (see Figure 2.4) focus is on active interaction also with external cloud based companies, including larger corporations:

- ×2 job is a 9 month long MSc thesis work (or on the same level), with the goal of starting companies from the outcome of the work. These ×2 jobs are in close collaboration with local innovation support organizations in the region.
Cloud Computing and Startups

- Incubator support projects, where SICS Startup Accelerator is supporting incubators on the technology side, e.g., architecture and design.
- Corporation support projects, where SICS Startup Accelerator is supporting larger size companies on innovation in the cloud area.
- Corporation analysis work for larger organizations and companies.

The number of seed accelerators has been increasing rapidly in the last years to accommodate a growing demand for such services.

2.4.3 Cloud Innovation Platforms

The Cloud Innovation Platform is one of the services that a Seed Accelerator could offer. It comprises a set of prepared and tested ready-to-go recipes to even further accelerate the development of startups.

The Cloud Innovation Platform consists of a common set of cloud services available for testing and development — a set of cloud services that will be constantly improved and extended, based on the feedback from its users. The Cloud Innovation Platform addresses two main issues: the basic scalable IT functionality needed for implementation of the startup's idea, typically mimicking and incorporating IaaS offerings, both private and public; and a specialized functionality for novel media and content delivery, payments and accounting services, and modern programming models.

A Cloud Innovation Platform can be used both for development of the new services and education in the best practices of cloud computing usage, for example, for the enterprise clients considering migration of the internal IT systems to the cloud.

A very important requirement for the Cloud Innovation Platform is its interoperability with other cloud offerings. Ability to move away is a startup-friendly approach that most of the public Platform-as-a-Service offerings, for example, Google App Engine or Microsoft Azure, lack.

2.5 Evolution of the Cloud-Based Company

Like any living organism, startups change over time. They can grow into something bigger, get “eaten” by another company or simply die. Figure 2.5 shows the most typical stages of the startup development.

The usage patterns of cloud computing change with the size and profitability of the company. For example, early stage companies with very little financial capabilities often have no other reasonable option but to go with a public cloud offering for all of their needs. Large and wealthier companies with higher demands on security could choose a more restrictive solution by creating a
hybrid or private cloud for some of the more mission critical tasks. Figure 2.5 depicts a conservative approach of the companies of different sizes to satisfying certain goals.

2.5.1 Costs and Risks

Balancing out costs and risks is a complicated but necessary step in making a certain business decision, for example, in uptaking a certain set of cloud services. One of the key selling points of the public cloud providers is that using their offer is more optimal if you take into account all of the cost components. Whether it is actually true often comes down to a specific customer situation. In some cases, a potential cloud customer possesses something that can make using out-of-the box cloud computing a bad decision. Some of the more important decision modifiers include availability of server administration know-how, usage of the data regulated by a certain policy, and existence of the in-house infrastructure.

Below we list and explain major cost inflicting factors of the IT infrastructure from the perspective of the consumer of the cloud resources. We also provide a brief introduction of the risks associated with using cloud computing.

2.5.1.1 Cost Components

Consumed resources

The charging model of the cloud providers often includes a pay-as-you-go model. That means that they break down the service offering into many components and charge you according to the monitored consumption. Typical components include virtual machine uptime, average storage used in a month,
FIGURE 2.6
Adoption of Cloud Deployment Models by Companies of Various Sizes and the Trend toward Wider Cloud Adaption.

inbound and outbound network. Quite often there are also more services offered that can be used for creating applications running in the cloud: message queues, databases, identity providers, content distribution networks and so on. While from the sales point of view these services are independent from each other — for example, you can use AWS EC2 with your own data storage rather than using AWS S3 — but in practice this often leads to a considerable overhead, for example, increase in network traffic.

The pricing policies are also quite diverse. Apart from the basic pay-as-you-go one, there are policies that offer you service at a reduced quality for a cheaper price. This is the case for AWS S3 Reduced Redundancy Storage that has a lower SLA on the durability due to a smaller number of replicas of the data being stored. AWS also offers reduced price in case of a certain upfront commitment — AWS EC2 Reserved Instances — and a market-based bidding system for the computational resources — AWS EC2 Spot Instances.

In case of a small resource consumption these policies are not really important. However, for a larger consumption, and also in case of a sustainable business, it is definitely worth taking a look at potential cost optimizations by switching to another pricing policy.

Administrative overhead

Depending on the level of cloud computing offering (IaaS, PaaS, SaaS) there are different needs for administrating services. While buying an Infrastructure-
as-a-Service offering does relieve you of a need to manage hardware, network and application administration is still required. This can be quite expensive unless you have that know-how inside the company. For PaaS and SaaS the overhead is smaller and the required skills are typically closer to the consumer of this service.

**License costs**

The Cloud computing paradigm was quite disruptive with respect to the standard software licensing models, as it essentially requires the ability to be able to rent licenses. Moreover, if a company has already bought a set of licenses, it can easily be the case that they cannot be used for running in a cloud, as it is outside the domain of a company, or that they are linked to a number of working machines, which makes the flexibility of the cloud not really usable. One of the solutions to this problems was creation of the virtual appliance marketplaces. They provide means for the software vendors to publish their products as specific software package or even full virtual machine image, so that once it is running, the client is paying extra for the uptime of the virtual machine that goes directly to the software vendor. Examples include GoGrid Exchange [307] and Amazon DevPay [235].

### 2.5.1.2 Risks

Security is often being named as one of the main obstacles on the way to cloud computing adoption [251]. Most of the time it means that the risks connected with such a decision are either too high or too complicated to evaluate. While the concept of outsourcing IT-processes is not new at all, and so the concept is familiar, there are several new threats introduced by the cloud computing that both startups and more mature companies should consider. Cloud Security Alliance [211] has produced several documents addressing these new threats, mostly from the security and technological points of view [212]. For most of the startups, however, functionality is more important than the security guarantees. Picking a cloud provider with the most comfortable set of services, and trusting it, is the most popular way to go. While acceptable behavior in the beginning, when the overhead of the security analysis is too high, risks should definitely be more thoroughly analyzed once the startup has started to grow.

Apart from the technological risks, there are also risks related to the way companies operate. Nowadays almost all of the companies generate and store a lot of data. This leads to a risk of vendor lock-in, even if the interfaces are compatible and transition could be smooth. Data storage inflicts a constantly raising cost as most of the time companies tend to save as much information as possible. This makes storage cost optimization a very important problem. However, even if you find a cheaper option for data storage, the “momentum” of the existing data can be a problem — transferring petabytes of data is neither fast nor cheap.
TABLE 2.1
Importance of IT Requirements for Companies of Various Sizes.

<table>
<thead>
<tr>
<th></th>
<th>Startup</th>
<th>SME</th>
<th>Large company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalability</td>
<td>High</td>
<td>Average</td>
<td>Low (stability is more important)</td>
</tr>
<tr>
<td>Security</td>
<td>Low</td>
<td>Average</td>
<td>High</td>
</tr>
<tr>
<td>Risk analysis</td>
<td>Low</td>
<td>Average</td>
<td>High</td>
</tr>
<tr>
<td>Cost optimization</td>
<td>Low</td>
<td>Average</td>
<td>High</td>
</tr>
<tr>
<td>Vendor lock-in</td>
<td>Low</td>
<td>Average</td>
<td>High</td>
</tr>
</tbody>
</table>

2.5.1.3 Evolution of Requirements

With the development of a company, its requirements for supporting IT infrastructure change to reflect priorities of a company. Table 2.1 lists major changes in a company’s requirements based on its size. For example, while for a small company the ability to scale their business quickly is very important, for medium size, and especially larger ones, stability and predictability are of a higher value.

2.6 Summary

Cloud computing characteristics map to the needs of startups very well. So well that a new group of cloud specific startups is now rapidly evolving. On one hand, one could argue that it is just the same active group that has quickly picked up a new technology, but on the other hand the number of startups evolving and how fast they can get started and how far they can go on low funding is a game changer. Startups have always been very good at bootstrapping, getting as far as possible on no or very little funding. But now, with cloud computing and high quality open source software, better and less expensive network, a more open mobile market, and more evolved customer base, the bootstrapping can take you very far, possibly all the way to a self supported profitable business.

For investors the market is also changing, creating a need for very early stage, close-to-the-founder, technology knowledgeable services — the seed accelerators. The seed accelerators act as an early investor — helping the startups with technology decisions — and at the same time helping future investors in the identification of interesting objects.