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Introduction

Ever since my childhood I had a fascination with clouds. Real clouds up in the sky, white and fluffy or gray and gloomy, afforded an ever-present drama unfolding above for the curious spectator looking toward the heavens, as inquisitive children are wont to do. Maybe it was because of ample exposure to the perennial cloudiness of my native West Denmark with its rich variety and texture across seasons, but I always found clouds to be mysterious and captivating.

Today my interest is intact, although the clouds I study are no longer up in the sky but somewhere in cyberspace, even if following them doesn't afford the same ever-present drama. This book is about understanding the language and logic of cloud computing, what technologies are available and the nature of the vendors who supply them, and how the economy and security of the cloud and working with it impacts an organization. It is an attempt to explain and describe the basics for interested readers with little or no technical background to get an overview of what the cloud is and be able to participate in intelligent discussions about how to use it.

My own way into cloud computing has followed an uneven path. By the mid to end 2000s, the cloud was emerging as an interesting new technology. I was working as an enterprise architect and started to look into what this new thing had to offer. The cloud caught on as the go-to marketing buzzword and quickly it assumed a meaning equivalent to fairy dust, which when sprinkled on any technological solution, would magically transform it and make it better in all discernible ways.

A few years later I founded my own startup, which delivered a Software as a Service (SaaS) product built entirely on cloud infrastructure, which demonstrated to me the power of the cloud. No need to buy servers and rent rooms to set them up and run them. This was the first proof for me that although the cloud was not quite fairy dust, it was definitely the future. Even if it wasn't decidedly easy, it was not as hard as just a few years earlier to build a company from scratch entirely in the cloud.

Fast forward about a decade, and I found myself in the United States serving the city of New York by helping them deliver on an ambitious new cloud-first strategy, again as an enterprise architect. For all new development it should

first be considered if it could be built in the cloud. This was a fascinating transition to the cloud that many modern companies of any scale are finding themselves in. These experiences alerted me to many of the themes and practical insights that have informed this book.

Over the course of more than a decade, I have had the privilege of working with all five big cloud vendors to some extent and a few of the smaller ones. It is interesting to see the emerging patterns and how they all have something valuable to offer.

As a side note, I have chosen to focus on what I call the big five cloud vendors: AWS, Google Cloud Platform, IBM cloud, Microsoft Azure, and Oracle. There are other vendors out there, and I encourage you to explore them on your own.

The trajectory of the cloud since the end of the 2000s until now follows the consultancy Gartner's so called "hype cycle." It started at the peak of inflated expectations and went down through the trough of disillusionment and is now on its way up toward the plateau of productivity. Getting caught up in the hype is easy, but to really understand and appreciate the transformative power of the cloud in starting a new business or running an established business of any size, let us consider a thought experiment where we are starting the same business in 2005 and in 2020.

Imagine you are starting an online store. First you need a website in order to start selling. If you want to start small, you can go down to your local electronics store and buy a few PCs. If you want to start bigger, you order a rack and computers from a wholesale supplier. Next you have to find out where to put these computers. If you don't already have a spare room, you have to rent that spare room somewhere. In the beginning you might get away with just that but quickly you would need to buy additional machines and rent a similar room somewhere else in order to have a backup site in case the first one fails. If you don't have a backup and there is a fire or flood, your entire business would be gone with the computers. Speaking of fire, don't forget to install a fire suppression system for your server rooms. But these are not the typical sprinkler systems, since water would damage your machines just the same as fire. These are highly specialized systems based on a mixture of gases and chemicals. On top of this you have to carry out fire drills. Of course you could say that this is excessive and not necessary, but try to explain to the venture capital fund you are pitching a $5 million investment to that if there were a fire, their entire investment would be gone.

I think at this point you can see that even before you can start building your shop and website, you have to invest a lot of time and money to just get started. When you are ready, you need to buy licenses for software for the web shop and other supporting business functions like accounting, salary, warehouse management, HR, and marketing.

When all that is paid, you have to hire and maintain a team of operations specialists to maintain, upgrade, and patch all the software that you just bought.

Not only do you have high upfront costs to purchase hardware and software, but you also have monthly costs for data center rental and operational staff even before you start selling anything.

Now, contrast this with starting the same company in 2020. The first thing to decide now is not where and what equipment to purchase, but how much of the technology stack you want to be responsible for yourself. You could just go to a site like Shopify and configure it there. The ERP system and other software to support salary, a call center, and customer support are all similarly available instantly and configurable. All of this will typically run for a fixed monthly fee.

If you want more control or have more specific requirements that are not served by these standard systems, you could still procure the servers you need, but now that can be done instantly from cloud providers. You can often even choose them preinstalled with the business software you want. You don't have to rent rooms in multiple locations and install fire suppression systems; you just configure your servers to be in different data centers of the cloud provider. Even in this scenario there is no upfront cost and everything can be run for a monthly fee.

Whichever route you take in the cloud today, you can start your company over your morning coffee at Starbucks and have it up and running in the afternoon over mojitos at California Pizza Kitchen while waiting for your chicken tequila fettuccine.

This applies not only to online shops but to virtually any type of company or organization at any scale. The specifics of the benefits will differ and depend, but the potential is there for anyone. However, to benefit and harness this potential, it is necessary to understand the cloud and how it works. This is what we will do in this book.

- **Chapter 1, Cloud Foundations,** lays the foundation for understanding what the cloud is. We look at the history of the concept to understand where it comes from. But understanding the term is not the same as understanding the concept, which is why we investigate how best to conceptualize it.

- **Chapter 2, Why Cloud?,** provides an overview of the future of cloud computing and an account of the major drivers for organizations to move to the cloud. Economy is a common one, but security, agility, scalability, and sustainability are other drivers. These drivers are not equally relevant to all organizations, but there is something for everyone.
- **Chapter 3, The Genealogy of Cloud Computing**, is a history of different technical developments that led to the cloud in its present version. The traces go back deep in history and help explain certain features that may at first appear puzzling.
- **Chapters 4 to 8** introduce the major players in the cloud industry: IBM, Oracle, Microsoft, Amazon, and Google. The vast majority of customers will end up using cloud solutions from one of these five major cloud vendors. Understanding their history, target groups, strengths, and weaknesses makes it possible to select a better choice of fit between an organization and vendor.
- **Chapter 9, Cloud Vendor Profiles**, compares the big five cloud vendors on five key parameters—customer orientation, vision, product packaging, end user target, and cloud focus—in order to analyze the key differences between them.

  The cloud impacts many different areas, but four stand out: technology, security, economy, and work. The next four chapters dive into each of these to describe in more detail how the cloud impacts them.
- **Chapter 10, Cloud Technology**, presents an overview of SaaS, PaaS, and IaaS. The infrastructure services section dives into the first of the three major categories of cloud services. These are the ones close to a traditional data center and are particularly versatile. We see how the basic features of a network—compute and storage—are being packaged as services to be consumed. There is a high degree of uniformity across vendors in this category. Platform services present more integrated and focused functionality like databases and messaging solutions used by applications. These services abstract the basic infrastructure services and can be used without having to worry about most operational processes like

upgrades and patching. Here, functionality starts to diverge a bit more. We focus on a few sub-categories. Software services talks about the category closest to the end users. We see examples of this and look into the major subcategories where SaaS is employed at scale. These differ most across vendors and allow for little individual tailoring.

- **Chapter 11, Securing the Cloud**, focuses on the main aspects of what it takes to secure the cloud. We look at it from a holistic risk-based angle and go through the different classes of services and features that cloud platforms usually offer to increase security in the cloud.
- **Chapter 12, Cloud Economy,** touches on how the economy of the cloud differs and how it needs to be approached. In this chapter we look at the possibilities that exist for managing and optimizing the economy in the cloud. There are different features that allow the organization to get insight into and control the economy of cloud deployments.
- **Chapter 13, Working with the Cloud**, looks into how the cloud impacts work in a traditional IT department. We describe how the cloud affects the job market. Because usage of the cloud is expanding rapidly, it is changing the skills needed in the contemporary job market. Cloud skills are already in short supply. A number of new roles appear, and old roles are being adapted to the cloud. Another thing to keep in mind is that traditional roles are being redefined, which necessitates retooling and an effort of employees to get out of their comfort zone.

  The final chapter helps the reader put the book into an actionable perspective.

- **Chapter 14, Adopting the Cloud**, will provide a number of patterns of adoption at the organizational level. Not all organizations can spring forth as cloud-native like the hotshot startups that have captured the agenda of cloud computing so far. Many companies are much more selective and constrained in their adoption. This chapter describes how organizations can approach cloud adoption in a structured and proven way. The goal is to describe the most common ways organizations can approach cloud computing.

The book can be read in a sequence. Chapters 1-2 can be read as an introduction to the cloud for the non-technical reader seeking a primer. This will give you a basic understanding of the cloud as a computing phenomenon and the impact of the key aspects of economy, security, and work.

Chapters 3-10 provide an overview focused on the technical aspects of the cloud that allows readers with an interest in technical perspectives to orient themselves in the modern world of cloud computing. Chapters 11-14 can be read in isolation by managers at any level who are responsible for managing or adopting cloud technologies. Those chapters introduce the most important themes relevant to creating a strategy for cloud computing.