

# Professional Cloud Architect – Google Cloud Certification Guide

A handy guide to designing, developing, and managing enterprise-grade GCP cloud solutions



Konrad Cłapa and Brian Gerrard

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enterprise-grade GCP cloud solutions

**Konrad Cłapa**  
**Brian Gerrard**



**BIRMINGHAM - MUMBAI**

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*To my parents, for their constant support.*

*– Konrad Cłapa*

*To Linda, for her constant support and understanding.*

*– Brian Gerrard*



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# Foreword

In 2016, the year in which I obtained all of my Amazon Web Services certificates, I heard the news about Google launching a certification program. Believing that the future is multi-cloud, I wanted to learn Google Cloud Platform. After attending the Google Cloud Next conference in San Francisco, I decided to become a certified Google Cloud Architect. Whilst preparing for the certification, I found that there were no books on the topic, and online documentations were the only source available. Three years later, I finally had this book in my hands. I wish I'd had this book when I was starting my journey!

Having passed all 6 Google Cloud Profession exams and being an author myself, I understand what it takes to pass this professional level certification. Having all of your resources in one place is irreplaceable when preparing for the certification. By buying this book, you can seize the opportunity to have all you need at your fingertips.

If you are still wondering whether you should start your journey with the help of Brian and Konrad, do not hesitate. I can assure you that the Google Cloud Architect certification is becoming one of the hottest on the market. Once a niche platform, Google Cloud is now on a path to truly shine, and is thus attracting more and more companies. With Google Cloud's focus on Machine Learning, Cloud Native applications development, and Data Processing services, the demand for certified specialists is growing by the day.

Don't wait any longer. Read this book, start using Google Cloud, and get certified.

A bright future is waiting for you!

**Yujun Liang**  
**Google Certified Cloud Architect**

# Contributors

## About the authors

**Konrad Clapa** is a lead cloud automation architect working for Atos R&D. He has over 10 years' experience in the IT industry. He holds over 30 IT certifications and is officially the first in the world to pass all 10 Google Cloud Platform certifications. He is also listed among 20 individuals awarded with Google Cloud Certified Fellow title. Sharing knowledge has always been important to him, so he contributes to the community by acting as a leader for a local Google Cloud Developer group and an AWS user group in Poland.

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## About the reviewers

**Antonio Gulli** has a passion for establishing and managing global technological talent for innovation and execution. His core expertise is in cloud computing, deep learning, and search engines. Currently, he serves as the Engineer Director for the Office of the CTO, Google Cloud. Previously, he served as the Google Warsaw site leader, doubling the size of the engineering site.

So far, Antonio has been lucky enough to gain professional experience in four countries in Europe and has managed teams in six countries in EMEA and the US. In Amsterdam, he was the vice president for Elsevier, a leading scientific publisher; in London, he was a site lead for Microsoft, working on Bing, Search; in Italy and the UK, he was the CTO, Europe and UK, for Ask.com and also worked in several co-funded start-ups, including one of the first web search companies in Europe.

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In his spare time, he loves spending time with his wife, two daughters, and one son; he enjoys board games and is constantly striving to further his knowledge.



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# Preface

**Google Cloud Platform (GCP)** is a leading cloud offering that has grown exponentially year on year. GCP offers an array of services that can be leveraged by various organizations in order to bring the best out of their infrastructure. This book is a complete guide to GCP and will teach you various methods of how to effectively utilize GCP services for your business needs. You will also become acquainted with the topics required to pass Google's Professional Cloud Architect certification exam.

Following the Professional Cloud Architect certification's official exam syllabus, first, you will be introduced to GCP. You will then be taught about the core services that GCP offers, such as computing, storage, and network. Additionally, you will learn methods of how to scale and automate your cloud infrastructure and make it compliant and secure. Finally, you will also learn how to process big data and embrace **machine learning (ML)** services.

By the end of this book, you will have all the information required to ace Google's Professional Cloud Architect exam and become an expert in GCP services.

## Who this book is for

If you are a cloud architect, cloud engineer, administrator, or anyone who would like to learn different ways to implement Google Cloud services in your organization, as well as get yourself certified with the Professional Cloud Architect's certificate, then this is the book for you.

## What this book covers

*Chapter 1, GCP Cloud Architect Professional*, discusses the benefits of becoming a certified architect, how to register for the exam, and what to expect when you are in the test center.

*Chapter 2, Getting Started with Google Cloud Platform*, covers the basics of GCP and how it positions itself on the market. You will learn about all the major GCP services that are available.

*Chapter 3, Google Cloud Platform Core Services*, examines the most important GCP services, including computing, storage, networking, big data, and machine learning.

Chapter 4, *Working with Google Compute Engine*, examines how to create and run virtual machine instances on top of the **Google Compute Engine (GCE)** service.

Chapter 5, *Managing Kubernetes Clusters with Google Kubernetes Engine*, explains the basis of containers and microservices. It looks at running and managing Kubernetes clusters on the **Google Kubernetes Engine (GKE)** service.

Chapter 6, *Exploring Google App Engine as a Compute Option*, discusses how to define and run applications on Google App Engine.

Chapter 7, *Running Serverless Functions with Google Cloud Functions*, looks into running serverless functions on Google Cloud Functions.

Chapter 8, *Networking Options in GCP*, discusses Google's networking services. Understanding networking is key to successfully completing the architect exam. We will introduce you to concepts such as **Virtual Private Cloud (VPC)**, before diving further into other concepts such as **Virtual Private Network (VPN)**, networks, subnetworks, and routes.

Chapter 9, *Exploring Storage Options in GCP – Part 1*, considers different storage options. This will allow us to choose the right storage for a given use case. We will discuss object storage alongside relational and non-relational databases.

Chapter 10, *Exploring Storage Options in GCP – Part 2*, looks at storage options such as Cloud Spanner and Bigtable.

Chapter 11, *Analyzing Big Data Options*, discusses how big data is another key topic in the architect exam. Understanding what big data is, and what services GCP offers to handle the complexities of data analytics, will really help you in the test center when taking the exam. In this chapter, we will look at the various services that are available, and when we might choose one over the other.

Chapter 12, *Putting Machine Learning to Work*, examines machine learning in general as well as GCP-related services. This will allow us to understand the use cases and possible implementations of ML using Google Cloud.

Chapter 13, *Security and Compliance*, covers security, which is a feature of all GCP services. In this chapter, we will cover IAM in more detail than we have in previous chapters, to allow you to understand custom roles and service accounts. Additionally, we will look at Google's commitments to compliance; for example, through the **Payment Card Industry (PCI)** regulations.

Chapter 14, *Google Cloud Management Options*, shows you that there are a number of ways to manage your GCP infrastructure and its services. In this chapter, we will look at how to manage your GCP infrastructure and the key management options that are available, including Cloud Shell, SDK, and gcloud, and the steps that are needed to access or install these tools.

Chapter 15, *Monitoring Your Infrastructure*, looks at monitoring your infrastructure using Stackdriver.

Chapter 16, *Case Studies*, discusses how, in the exam, some questions may refer you to several case studies. You should be familiar with these case studies before you take the exam. These involve hypothetical business and solution concepts. In this chapter, we will cover how to find these case studies; additionally, we will also take a look at an example case study and analyze it in order to design an appropriate solution.

Chapter 17, *Test your Knowledge*, goes through exam tips and sample tests.

## To get the most out of this book

As the practical examples throughout the book involve the use of GCP, a GCP free-tier account is required.

**If you are using the digital version of this book, we advise you to type the code yourself. Doing so will help you avoid any potential errors related to the copying and pasting of code.**

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## Conventions used

There are a number of text conventions used throughout this book.

**CodeInText:** Indicates code words in text, database table names, folder names, filenames, file extensions, pathnames, dummy URLs, user input, and Twitter handles. Here is an example: "It automatically creates one subnet per region with predefined IP ranges with the /20 mask from the 10.128.0.0/9 CIDR block."

A block of code is set as follows:

```
<INSTANCE_NAME>.c.<PROJECT_ID>.internal
```

When we wish to draw your attention to a particular part of a code block, the relevant lines or items are set in bold:

```
resources:
- name: {{ properties["name"] }}
  type: compute.v1.instance
```

Any command-line input or output is written as follows:

```
gcloud deployment-manager deployments create networking --config
config.yaml
```

**Bold:** Indicates a new term, an important word, or words that you see on screen. For example, words in menus or dialog boxes appear in the text like this. Here is an example: "Navigate to **Network Services** and then **Load Balancing**."



Warnings or important notes appear like this.



Tips and tricks appear like this.

## Get in touch

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# Section 1: Introduction to GCP

This section will introduce you to the **Google Cloud Platform** (GCP) and outline the Professional Cloud Architect exam.

This section contains the following chapters:

- Chapter 1, *GCP Cloud Architect Professional*
- Chapter 2, *Getting Started with Google Cloud Platform*
- Chapter 3, *Google Cloud Platform Core Services*

# 1

# GCP Cloud Architect Professional

The shift to the cloud is not a new thing, and for many years, companies have been utilizing cost-effective solutions from public cloud vendors to move away from traditional on-premises architecture. The speed at which technology is moving now makes it increasingly difficult for companies managing their own infrastructure to get the most out of their IT systems.

While **Amazon Web Services (AWS)** and Microsoft Azure currently lead the race with enterprise-scale companies, **Google Cloud Platform (GCP)** is emerging as one of the most popular solutions among IT professionals, and interest is steadily increasing. It seems that Google is playing the long game very well. In Q3 2018, ex-CEO of Google Cloud, Diane Greene, estimated that only 10% of workloads are in the public cloud, showing the massive scope for market share still available. Furthermore, in Q4 2018, CEO of Google, Sundar Pichai, said that GCP was the fastest-growing major public cloud provider in the world. Given that companies are continuously moving to split cloud solutions, this means that IT cloud architects and engineers need to understand more than just the current top two providers.

This book, of course, will focus on Google technologies. Many of our readers may have experience of other public cloud vendors—for example, AWS or Microsoft Azure; however, we also cater to those who are new to the public cloud. The ultimate goal of this book is to help you to pass the Google Professional Cloud Architect exam. This book is suitable for both levels of experience. In this chapter, we will look at why you would take this exam, inform you about how to register for the exam, and brief you on what to expect from the exam.

We will cover the following topics in this chapter:

- The benefits of being a certified architect
- Registering for the exam
- What to expect from the exam
- Some tips

## The benefits of being a certified architect

Studying for an exam can be a daunting prospect. Many hours need to be spent to achieve a certification, and it's not always an easy decision to dedicate a lot of personal time to achieve this goal. That said, if you currently work in the IT industry, you will know that the landscape has changed over several years. The public cloud is no longer something that worries companies, and more enterprises are shifting away from traditional on-premises solutions, meaning that the time you invest in learning new technologies will only be beneficial to your career.

But *why take the exam?* There are several reasons why you would take this exam, such as the following:

- You have used GCP for some time and want to have an industry-recognized certification that reflects your current skillset
- You want to achieve a new role or promotion and show that you can dedicate your own time to learning new skills that you don't get to use day to day
- There is no better way to showcase your skills than having industry-led certifications
- You want to get acquainted with modern stack development technologies



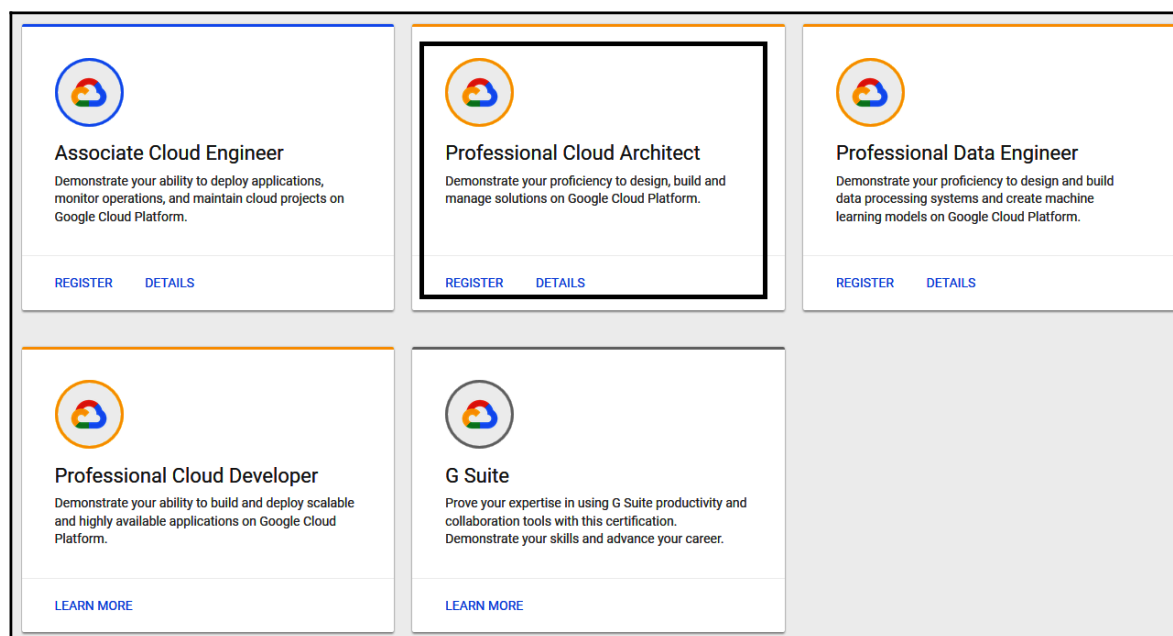
A Forbes article recently showed that the Google Cloud Certified Professional Cloud Architect is the highest-paid certification of 2019. You can read it at <https://www.forbes.com/sites/louiscolumnbus/2019/02/11/15-top-paying-it-certifications-in-2019/#a7923023e7cd>.

Whatever your reason for taking the exam, it is important to be realistic about your expectations.

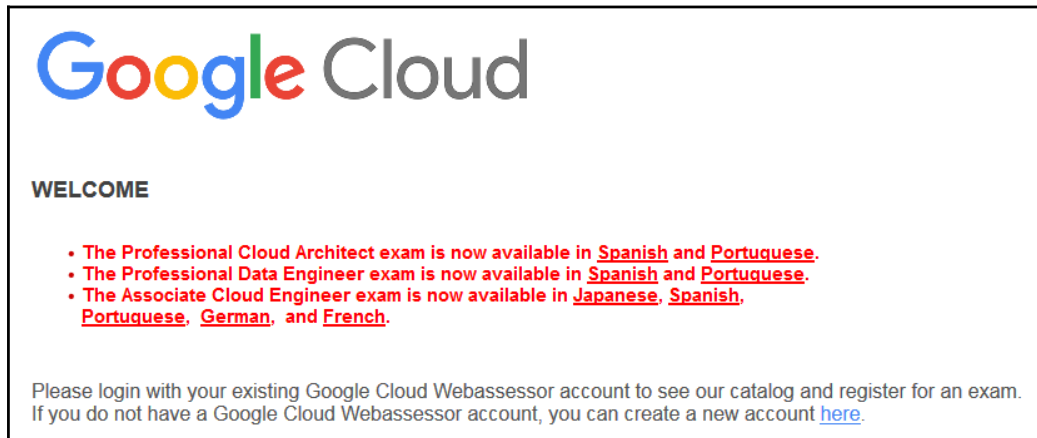
## Registering for the exam

The cost of the GCP Professional Architect exam is 200 USD, and it can be booked in several languages, such as English, Japanese, Spanish, and Portuguese. You can register for the exam by going through the following steps:

1. The first step is to visit the Google certification web page at <https://cloud.google.com/certification/>.
2. You will see that there are many certification paths you can take. Click on the **REGISTER** link under **Professional Cloud Architect**, as highlighted in the following screenshot:

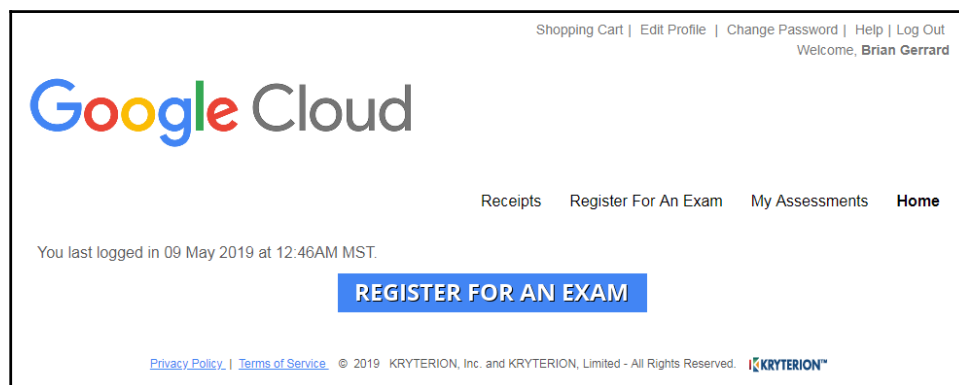


3. Next, you will need a Webassessor account to book the exam. You can create a new account using the hyperlink in the **WELCOME** page:



If you have ever attempted another Google exam, for example, the Associate Cloud Engineer exam, then you can use the same credentials.

4. Next, click on **REGISTER FOR AN EXAM**, as shown in the following screenshot:



5. Select your testing center, as shown in the following screenshot:

Google Cloud

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 Welcome, **Brian Gerrard**

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[\*\*Register For An Exam\*\*](#)
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Choose options below to narrow down the list of testing centers displayed.

Country: United Kingdom

Province/State: All

City: All

Search


Select the Testing Center where you wish to take the test.

**AVAILABLE TESTING CENTERS**

<input type="checkbox"/>	Testing Location Name	Address	City	Province/State	Country	Map	Important Location Information
<input type="checkbox"/>	SureSkills_Belfast	Callender House, 58-60 Upper Arthur Street	Belfast	Antrim	United Kingdom	<a href="#">Map</a>	
<input type="checkbox"/>	Spark Educare Centre	81 London Street , 2nd Floor	Reading	Berkshire	United Kingdom	<a href="#">Map</a>	
<input type="checkbox"/>	Pitman Training Centre_Brighton	The Dock Hub, Wilbury Villas	Brighton	Brighton and Hove	United Kingdom	<a href="#">Map</a>	
<input type="checkbox"/>	Pitman Training Centre_Cambridge	2nd Floor, St Andrews House, 59 St Andrews Street	Cambridge	Cambridgeshire	United Kingdom	<a href="#">Map</a>	
<input type="checkbox"/>	Exams Ltd	Sefton House, Adam Court, Newark Road	Peterborough	Cambridgeshire	United Kingdom	<a href="#">Map</a>	
<input type="checkbox"/>	Pitman Training_Enfield	36-38 London Road	Enfield Town	Enfield	United Kingdom	<a href="#">Map</a>	
<input type="checkbox"/>	Gaia Technologies plc	Woodlands House, Parc Menai	Bangor	Gwynedd	United Kingdom	<a href="#">Map</a>	

6. Next, select a date, as shown in the following screenshot:

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Welcome, **Brian Gerrard**



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*If you are unable to see an available day/time; it is likely there are none available at this location for the time period you are viewing. Please expand your view by selecting another month. Thank you.*

**Selected Testing Center**  
  

- Pitman Training Centre\_Brighton  
The Dock Hub,  
Wilbury Villas  
Brighton,  
Brighton and Hove 20705

**Select Date**  

June, 2019							
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wk	Sun	Mon	Tue	Wed	Thu	Fri	Sat
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24	16	17	18	19	20	21	22
25	23	24	25	26	27	28	29
26	30						

Select date


**Select Start Time**  

10:00 AM  
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7. Finally, review and click **Check Out**. Pay for the exam and you are ready to go. Submit the coupon or voucher code if you have one:

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Welcome, **Brian Gerrard**



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Exam	Details	Price	Actions
Exam: Google Cloud Certified - Professional Cloud Architect (English) Length : 120 minutes	Schedule : Tuesday, 04 June 2019 Start Time : 10:30 (UTC+01:00)  Location : <a href="#">[ Change ]</a> Pitman Training Centre_Brighton The Dock Hub, Wilbury Villas Brighton, Brighton and Hove 20705	200.00	<a href="#">Remove</a>

Coupon/Voucher Code:  [Submit](#)

Subtotal: 200.00

**Total Price: USD 200.00**  
\*Charges are made in USD, currency conversion fees may apply

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Please bear in mind that you can change the selected date after the exam is booked up to 72 hours before the scheduled date at no extra cost. Note that a rescheduling fee will be charged for any changes made within 72 hours of your scheduled exam time.

## What to expect from the exam

There are several resources that Google advises you to take advantage of to prepare for the exam. These consist of online training courses, instructor-led training, and practical labs. All of this information can be found on the cloud architect web page at <https://cloud.google.com/certification/cloud-architect>.

In addition, by visiting the exam guide web page at <https://cloud.google.com/certification/guides/professional-cloud-architect/>, you can see the expected subject knowledge of the exam applicants. The exam blueprint is critical for any exam, and GCP Architect is no different. You should review this guide and make sure you understand each section.

Like most exams, some real-life experience will also help you. The exam is created with cloud architects in mind who have experience with software development and multi-cloud/hybrid-cloud environments. That being said, there is no reason that you cannot pass this exam with the correct amount of study, even if you don't have practical, hands-on experience.

Google offers Qwiklabs that can be used to gain experience in the services offered. It is recommended that you sign up to these to familiarize yourself with the GCP layout and services. Qwiklabs can be paid for either through a monthly subscription, which will give you unlimited access to the labs, or by purchasing credits. Each lab will have a certain number of credits depending on the complexity of the lab. The typical cost of 10 credits is 10 USD. GCP Essentials gives a great introduction to GCP and can be found at [https://google.qwiklabs.com/quests/23?utm\\_source=gcputm\\_medium=siteutm\\_campaign=certification](https://google.qwiklabs.com/quests/23?utm_source=gcputm_medium=siteutm_campaign=certification). It takes around five hours to complete this lab.

Once you are prepared for the exam and have successfully scheduled it, you will need to visit one of the registered test centers. You will be expected to arrive around 15 minutes before the exam and take two forms of identification with you. All of this will be explained in your exam confirmation email. The exam itself will consist of multiple-choice questions that will require one or more answers to be selected. In addition to this, you will be quizzed on case studies of fictional companies. You will, however, have access to these case studies before the exam, and you can refer to them during the exam. In *Chapter 16, Case Studies*, we will go over these in more detail. There will be around 60 questions in the exam, and you will have two hours to complete them. You will receive only a pass or fail, with no indication of your score.

## Some tips

In the exam, we recommend that you make use of the fact that you can mark questions for review and come back to them later. It is a personal preference, of course, but we suggest that you don't puzzle over a question for too long. You will have around two minutes per question to provide an answer. Some of the answers to the questions will jump straight out of the screen at you, and others will take you more time to determine the correct answer. If you are spending too long on a question, then mark it for review and move on, as it's important to get to the end of the test to ensure that the maximum number of marks are scored.

We also recommend booking the exam to give you an incentive. It is easy to procrastinate or worry too much that you are not fully prepared. This is a natural feeling, but having an end date in sight gives you focus and determination. We recommend that you print out the exam guide and work through these points to ensure that you have an understanding of each objective.

Additionally, two hours is a long time to be in the exam center. Ensure that you book the exam at a time of day that you are most alert, to give yourself the best chance of success.

## Summary

In this chapter, we covered what to expect from the exam and how to actually register for the exam, as well as the benefits of being a GCP. Throughout this book, we will introduce you to the services that are needed for a successful outcome. This book's ultimate goal is to assist you in passing the exam; however, we encourage you to do more reading if you wish to deep dive into a particular topic or service that you encounter while reading this book.

In the next chapter, we will get started with the GCP.

## Further reading

Read the following article for more information:

- **Google Cloud Certificate:** <https://cloud.google.com/certification>

# 2

## Getting Started with Google Cloud Platform

In this chapter, we will introduce the concept of cloud computing to better understand what **Google Cloud Platform (GCP)** is. We will take a look at GCP resources and their hierarchy. After that, we will create our first account and set up a project. The billing options will be discussed. We will see how to create a billing account and associate it with the project. Finally, we will take a look at how to export the billing information. It is important to have this introduction before we start talking about GCP services. This will both help you to pass the exam and to perform the basic setup of GCP for real-life scenarios before you can even use the services.

We will cover the following topics in this chapter:

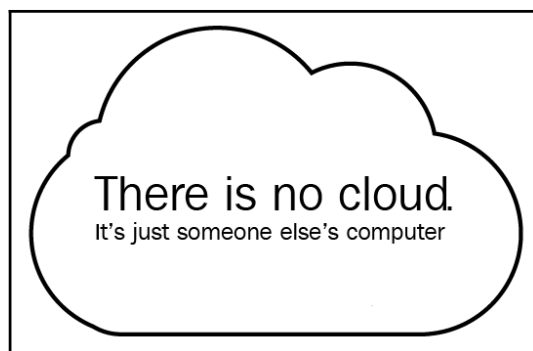
- Introducing the cloud
- Understanding GCP
- Understanding GCP infrastructure
- Basic GCP configuration



**Exam tips:** Having a good understanding of GCP resources is absolutely a must to pass the GCP Cloud Architect exam. Make sure that you go through this chapter with full attention. Read it multiple times if required and play with the creation of projects and billing accounts using your free tier account. Try exporting billing data both to files and BigQuery. You must remember individual **Identity and Access Management (IAM)** roles for billing. Make sure you understand the scope of the services.

## Introducing the cloud

Before we jump into GCP, let's first learn what the cloud is:



It is true—*there is no cloud: it's just someone else's computer*. With the cloud, what we are actually doing is accessing resources and consuming services that are hosted on someone else's computer. If we want to be more precise, the cloud is a pool of computers.

Now, let's look at a more accurate and professional definition used by Google that comes from the United States National Institute of Standards and Technology (<https://csrc.nist.gov/publications/detail/sp/800-145/final>):

*"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (for example, networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models."*

The five essential characteristics of the cloud are as follows:

- **On-demand self-service:** Services are provisioned automatically without manual provider intervention.
- **Broad network access:** Resources are available through the network.
- **Resource pooling:** Resources are pooled from a shared pool, giving the user a sense of location independence. For some of the resources, the location might be restricted.
- **Rapid elasticity:** Services can be elastically provisioned and deprovisioned with capacity being managed by the provider.
- **Measured service:** Resource usage is monitored and can be reported on.

The four deployment models are as follows:

- **Private cloud:** Used by specific organizations, but can be managed by third parties
- **Public cloud:** Used by the general public
- **Community cloud:** Used by specific communities
- **Hybrid cloud:** Composed of two or more different clouds

When we look at GCP, it fulfills all of the five characteristics and fits into the public cloud deployment model. In the next section, we will have a look at GCP itself.

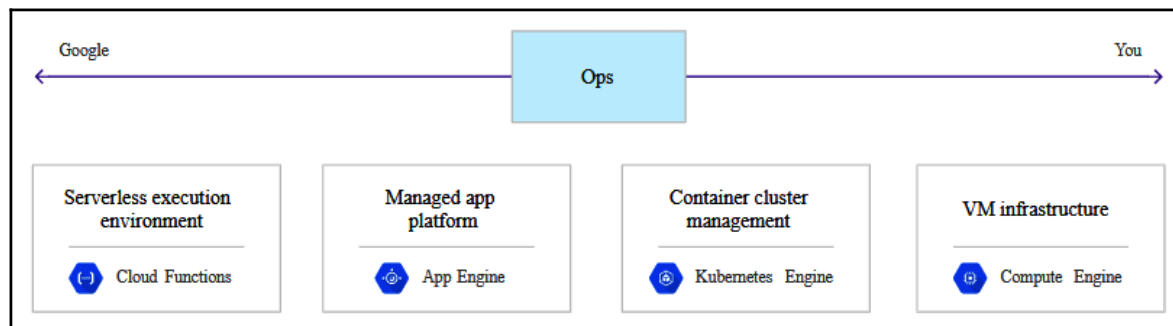
## Understanding GCP

Google has been developing its own tools to deliver services such as Gmail, YouTube, Google Drive, and Google+ for years. These tools have been converted into services that can be consumed by others. Consumers are given the amazing scalability that Google has to use for their own purposes. GCP lets you choose from computing, storage, networking, big data, and **machine learning (ML)** services to build your application on top of them. The number of services is growing constantly, and new announcements are made on an almost weekly basis. New services and features are released, first as alpha then as beta versions, and finally, are made available globally. The early releases are available even earlier for selected customers and partners. This allows the services to be tested by external parties even before the official release!

Google supports several service models, including the following:

- **Infrastructure as a Service (IaaS)**
- **Platform as a Service (PaaS)**
- **Container as a Service (CaaS)**
- **Function as a Service (FaaS)**
- **Managed services**

As we can see, the range of services in GCP is very broad. Looking at the following diagram, we will analyze this range of services offered by GCP:



Source: <https://cloud.google.com/docs/overview/cloud-platform-services>  
License: <https://creativecommons.org/licenses/by/4.0/legalcode>

We can start from very simple IaaS, such as a traditional data center, and end up using functions as services and managed services. The choice of service depends on our requirements. To put it simply, if we need flexibility and control over our **virtual machines (VMs)**, we would simply use **Compute Engine**. This service allows us to provision VM instances or simply lift and shift machines from our existing environment. The trade-off, however, is that you are responsible for managing all of the layers above the VM container. That includes the operating system, any middleware, and any applications on top of it.

When we move to the left of the diagram, the burden of maintaining the infrastructure is taken away from us. With **Cloud Functions**, all we really care about is the coding of a function in a language supported by GCP. Once it's done and published, we access it through the HTTP protocol.

Finally, as we move to managed services, we start to simply consume services that bring us particular business value without having to worry about any underlying parts. They can be used in **Software as a Service (SaaS)** models and consumed through APIs. An example of this is **Dataprep**, which is a data service that allows you to clean up and prepare your data for further analysis. Another example is the pretrained ML model, **Vision API**. Developers can consume this service using the RESTful API to analyze images without having to write any code, except for the call itself.

Hopefully, now you understand that GCP is much more than just a hosting service. It provides you with sets of tools, services, and resources that will help you to develop and deliver your applications. The choice of the services you will use depends entirely on the set of requirements you have. If that feels overwhelming, don't worry. This book is written to help you to go through GCP step by step.

In *Chapter 3, Google Cloud Platform Core Services*, you will get an overview of the most important GCP services. In the following chapters, we will dive into each of them in more detail to get you prepared for the exam.

## GCP differentiators

Every cloud provider has something that differentiates it from others. Each provider has its own strategy for how to deliver value to customers, and the same is true for GCP. Let's have a look at what the key GCP features are that make it stand out from the crowd:

- **Developer focused:** GCP was built with a focus on developers. If you look at the history of GCP, it started in 2008 with a preview release of App Engine, which is a fully serverless platform, allowing developers to run their applications written in languages such as Python, Java, and Go. It provides out-of-the-box load balancing and autoscaling. Developers just need to choose the platform they want to develop on and they can start coding. Also, if you look at **Stackdriver** (a GCP monitoring tool) itself, it provides several tools that can be directly integrated with an application. This allows the developer to use them to monitor and debug their application. Google makes it very clear that GCP was created for developers to help them with their challenges. Having achieved this goal, they are now aiming at large enterprises.
- **The Google Network:** The Google Network is something that differentiates GCP from other cloud providers. Google claims that around 40% of the world's internet traffic is carried by the Google Network, making it the largest network on the globe. This allows the Google Network to provide responses with very low latency as close to the end user as possible.
- **Global scope:** GCP was developed with global availability in mind. You will see services such as load balancing available globally rather than regionally, unlike other providers. This allows the client to concentrate on development and embrace out-of-the-box high availability and elasticity.



- **ML:** GCP offers a great number of ML services for both data scientists and regular developers who have limited knowledge of the topic. ML allows pretrained models to be used, as well as offering AutoML services. The latter allows you to train ML models without knowing how they are actually created. The portfolio of these services is growing very quickly. The key goal of Google is to enable enterprises with ML to make faster and smarter decisions.
- **Pricing:** The VM instances are priced per second with a minimum run time of one minute. This allows you to run the machines for short tests and not have to pay for a full hour of use.
- **Service-level agreement (SLA):** GCP services provide monthly uptime percentage **Service-level objectives (SLOs)**. If the SLO is not met, the customer is eligible for financial credits. Note that this percentage depends on the service and that alpha and beta features are not included with any SLA.
- **Security:** Google uses its 15 years of experience in running services such as Gmail in GCP. Your data is always encrypted with a choice of Google or customer-managed keys.
- **Carbon neutral:** This might not be the most important feature when it comes to functionality, but it is worth knowing. Google data centers are carbon neutral, meaning that 100% of the energy used to power them comes from renewable energy. This includes the GCP data centers.

## GCP locations

As we have already mentioned, GCP has a global footprint that includes North America, South America, Europe, Asia, and Australia. The locations are further split into regions and zones.

It is your decision where your application should be located to provide low latency and high availability:

- **A region** is defined by Google as an independent geographic area that is divided into multiple zones. Locations within regions should have round-trip network latencies of under 1 ms in 95% of cases.
- **A zone** is a deployment area for GCP resources. Note that a zone does not correspond to a single data center; it can consist of multiple buildings. Even though a zone provides a certain amount of fault protections, a zone is considered a **single point of failure (SPOF)**. Therefore, you should consider placing your application across multiple zones to provide fault tolerance.
- **Network edge locations** are connections to GCP services located in a particular metropolitan area.