- Private cloud: In a private cloud, an organization is solely responsible for the management and servicing of its computing infrastructure. The machines in a private cloud can be located on-premises, or it can be hosted with a cloud service provider but routed on a private network.

- Hybrid cloud: The hybrid cloud is a compromise between the cost and efficiency of a public cloud and the data sovereignty and in-house security assurances of the private cloud. Many companies and institutions opt for a hybrid cloud and multi-cloud by using technology solutions to facilitate easy porting and sharing of data and applications between on-premise and cloud-based infrastructures.

Cloud Computing Models

Cloud computing is also categorized into three models of service delivery. They are illustrated as a pyramid as shown in Figure 1-2, where the layers of infrastructure abstraction increase as we approach the apex of the pyramid:

- Infrastructure as a Service (IaaS): This model is best suited for enterprises or individuals who want to manage the hardware infrastructure that hosts their data and applications. This level of fine-grained management requires the necessary system administration skills.

- Platform as a Service (PaaS): In the PaaS model, the hardware configuration is managed by the cloud service provider, as well as other system and development tools. This relieves the user to focus on the business logic for quick and easy deployment of application and database solutions. Another concept that comes up together with PaaS is the idea of **Serverless**, where the cloud service provider manages a scalable infrastructure that utilizes and relinquishes resources according to demand.

- Software as a Service (SaaS): The SaaS model is most recognizable by the general public, as a great deal of users interact with SaaS applications without knowing. The typical examples of SaaS

applications are enterprise email suites such as Gmail, Outlook, and Yahoo! Mail. Others include storage platforms like Google Drive and Dropbox, photo software like Google Photos, and CRM e-suites like Salesforce and Oracle E-business Suite.
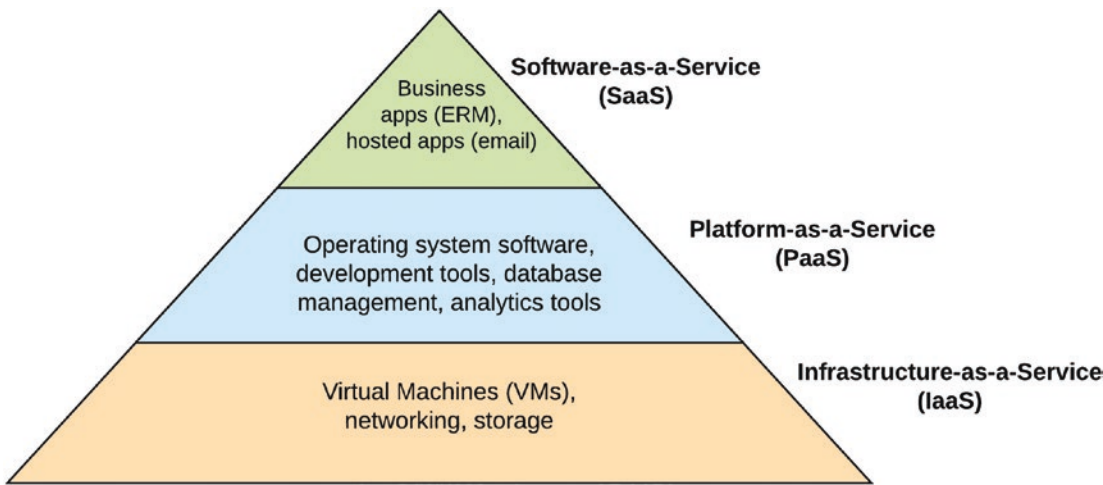

Figure 1-2. *Models of cloud computing*

In this chapter, we summarized the practice of cloud computing by explaining the different categories of cloud solutions and the models for service delivery over the cloud.

The next chapters in Part 1 will provide an introduction to Google Cloud Platform Infrastructure and Services and introduce JupyterLab Instances, and Google Colaboratory for prototyping machine learning models and doing data science and analytics tasks.

An Overview of Google Cloud Platform Services

Google Cloud Platform offers a wide range of services for securing, storing, serving, and analyzing data. These cloud services form a secure cloud perimeter for data, where different operations and transformations can be carried out on the data without it ever leaving the cloud ecosystem.

The services offered by Google Cloud include compute, storage, big data/analytics, artificial intelligence (AI), and other networking, developer, and management services. Let's briefly review some of the features of the Google Cloud ecosystem.

Cloud Compute

Google Compute offers a range of products shown in Figure 2-1 for catering to a wide range of computational needs. The compute products consist of the Compute Engine (virtual computing instances for custom processing), App Engine (a cloud-managed platform for developing web, mobile, and IoT app), Kubernetes Engine (orchestration manager for custom docker containers based on Kubernetes), Container Registry (private container storage), Serverless Cloud Functions (cloud-based functions to connect or extend cloud services), and Cloud Run (managed compute platform that automatically scales your stateless containers).