Building a Next-Generation SaaS Application

Why You Should Consider
Google Cloud Platform

Google Cloud

Google Cloud

Table of Contents

What is a Next-Generation SaaS Application?

The idea of software as a service (SaaS) has been with us for at least twenty years. In that time, SaaS has become the default for most software companies. Yet a substantial fraction of existing SaaS applications — probably including those your organization has built — are due for a major update.

To understand why, think about how SaaS applications were originally created. They used the platforms of the time, which meant building on virtual machines (VMs) and a database management system (DBMS). Figure 1 illustrates this approach.

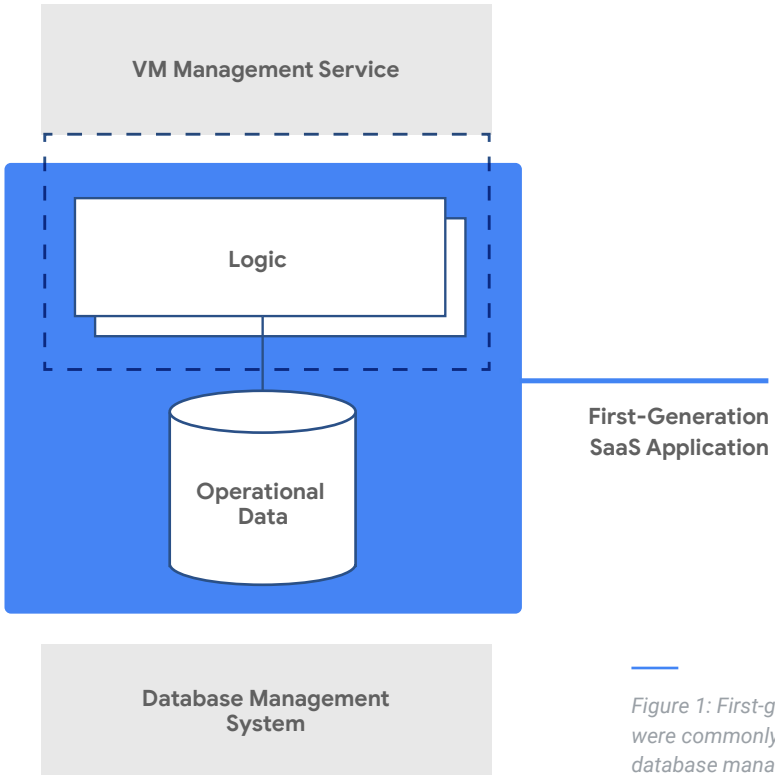

Figure 1: First-generation SaaS applications were commonly created using VMs and database management systems.

Many SaaS companies have been successful with this first-generation architecture (although note that the web tier isn't shown in the diagram). Running logic in VMs, typically using some Infrastructure as a Service (IaaS) technology, provided reliability and scalability. Using a standard relational DBMS, such as MySQL or SQL Server, worked in some situations,

while a NoSQL DBMS, such as Cassandra or MongoDB, was sometimes a better choice. If you're like most SaaS providers today, you probably have one or more first-generation applications created using this approach.

Yet no startup today creates SaaS applications like this. Cloud platform technology has advanced significantly, something that new SaaS applications can take advantage of. Figure 2 shows how these next-generation SaaS applications commonly look.

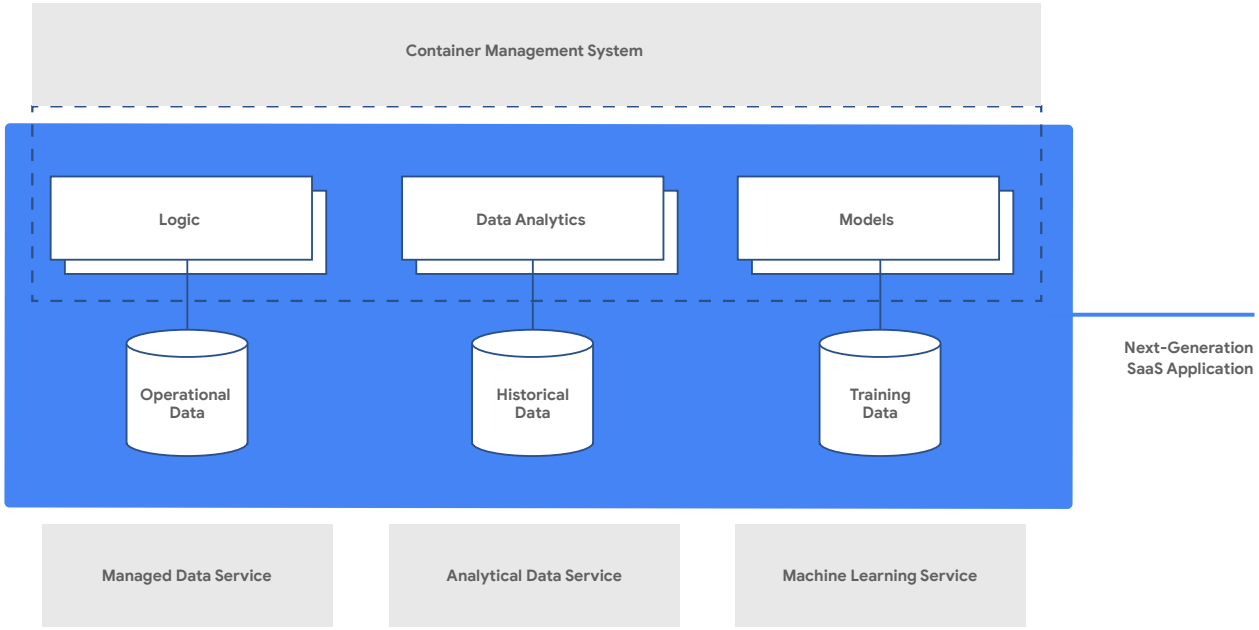

Figure 2: Next-generation SaaS applications use containers, managed data services, data analytics, and machine learning.

The improvements in technology are substantial, and creating a true next-generation SaaS application means embracing all of them. Here's a quick summary of what's required:

- **Rearchitecting logic with containers:** Rather than running the app's core business logic in VMs provided by IaaS, next-generation SaaS apps run in containers provided by a container management service, such as Kubernetes. Containerizing applications can provide many benefits, including making your software easier to update, improving its reliability, and lowering your costs.

- **Modernizing data with managed services:** Rather than rely on a traditional DBMS for operational data, next-generation SaaS applications are likely to use cloud-native managed data services. These services provide massive scale, both for relational and NoSQL scenarios, and they require much less administrative work.

- **Integrating data analytics:** Cloud data warehouses were in their infancy when first-generation SaaS applications were created. Today's offerings are much more powerful, and they're also easier to use. Next-generation SaaS applications take advantage of this by directly incorporating analytics on historical data. This lets SaaS providers better understand how customers use their applications, perhaps even personalizing what each user sees.

- **Adding intelligence with machine learning:** Machine learning (ML) technology has also improved mightily since the era of first-generation SaaS applications. Whatever your application does, you can probably make it better by using either pre-trained models, which support language translation, computer vision, and more, or by assembling your own training data, then incorporating custom ML models into your app.

There's one more thing every SaaS vendor needs to do: Think hard about which cloud platform company will be your best business partner. If you've been running and selling SaaS services for several years, you know what a good platform partner looks like. When you're deciding which cloud platform to choose for your next-generation SaaS application, don't forget the importance of these non-technical aspects.

Google Cloud Platform (GCP) has a strong offering in every one of these areas. Even if your first-generation SaaS application is running on some other cloud platform today, you should realize that creating a next-generation application is a substantial undertaking. Given the amount of effort required and the importance of choosing the right supporting services, your best option is to consider all possible platforms. What follows will give you a good sense of why GCP is likely to be the best cloud platform for your next-generation SaaS application.

Building a Next-Generation SaaS Application With Google Cloud Platform

Choosing a cloud platform is among the most important decisions any SaaS company makes. And while the four aspects just described are critical — we'll look at each one in more detail later — the platform you choose must also provide the fundamentals: security, reliability, and global scale.

Google Cloud Platform is strong in all three areas; no organization has more experience than we do in creating and running secure, reliable, planet-scale solutions. Yet providing a platform for successful next-generation SaaS applications requires more than these basics. It also means supporting the four areas described above. The rest of this section describes what GCP offers in each of them

Rearchitecting Logic With Containers

Today's dominant container management service is Kubernetes; every major cloud platform supports it. Yet Kubernetes was invented by Google, then released by us as open source. Because of this, we had a substantial head start, offering Google Kubernetes Engine (GKE) in 2015, well before our competitors. In fact, the *Forrester New Wave™: Public Cloud Enterprise Container Platforms, Q3 2019* says Google "Leads the pack with unparalleled Kubernetes expertise."

Rearchitecting a SaaS application into containers lets you update the app more easily. Rather than deploying full VMs, you can instead deploy smaller containers more often with improvements and bug fixes. Rearchitecting can also save money, because Kubernetes packs containers into VMs more efficiently. This higher VM utilization can lower your compute costs by 20% or more.

Rearchitecting also helps minimize platform lock-in. Since Kubernetes is available today on most major cloud platforms, it's possible to move code and developer skills across these environments. And suppose some of your customers want your SaaS application running in their own on-premises datacenter? Kubernetes by itself isn't always sufficient to address this challenge — you might need more. To provide this, GCP also provides Anthos.

Anthos is software that can run on GCP, on your customers' own computers, and even on other cloud platforms. It includes several things:

- Kubernetes itself, the foundation for containerized software.
- Anthos Service Mesh, Google's incarnation of the open source Istio. This component lets you control and monitor traffic flows and API calls between containers. It's especially useful with containerized applications that use microservices.
- Cloud Run, a technology for running serverless logic. Built from the open standard KNative, this component gives you the option of writing serverless functions while hiding the containers in which those functions run.

Anthos can also apply policies consistently across multiple Kubernetes clusters, something that's especially useful with large clusters.

All of these things are provided as a software-only solution. Unlike other cloud platforms, which require their on-premises analogs to run on specific hardware configurations, Anthos lets you deploy the same code both in the cloud and in your customer datacenters. It's a true multi-cloud solution.

Another important aspect of rearchitecting into containers is your choice of tools. Creating effective CI/CD pipelines is essential to get the most out of a containerized application. GCP lets you use a wide range of tools, including Jenkins, GitHub, and others; you're not forced to use only what we offer. Still, we provide a strong set of options, including Cloud Code, Cloud Build, and more. In fact, Cloud Build, which is the source of the open source Tekton project, is the leader in *The Forrester Wave: Cloud-Native Continuous Integration Tools, Q3 2019*.

It's hard to overstate the importance of containers in creating your next-generation SaaS application. Breaking a monolithic application into containers (and perhaps microservices) has many benefits. SaaS companies that don't do this run a substantial risk of falling behind their more modern competitors.

Modernizing Data With Managed Services

When first-generation SaaS applications were created, cloud-native managed data services were still fairly new. Despite their potential advantages, the safe bet was to use a more familiar DBMS for operational data. Today, however, using a managed data service offers clear advantages over relying on a self-managed DBMS. Those advantages include:

- Scalability, because managed data services are explicitly designed to support global-scale applications that use massive amounts of data.
- Lower management costs, since much of the work required to keep a traditional DBMS running is done automatically by the service itself.
- Familiarity, with support for both relational and NoSQL approaches.

GCP provides a powerful and diverse set of managed services for operational data. (In fact, Gartner's 2019 Magic Quadrant for Operational Database Management Systems, puts Google in the Leaders quadrant.) Those services include:

- Cloud Spanner, a massively scalable relational database with SQL semantics, ACID transactions, and up to a 99.999% service level agreement (SLA). No other cloud platform offers this combination of familiarity — it's just SQL — and transparent scalability. Even if you don't think your SaaS application needs vast amounts of data, having this kind of scale available at the click of a button will save you the headache of moving to a new database technology as adoption of your offering grows.
- Cloud Bigtable, a NoSQL wide column data store. A key use case for this technology (used by Spotify and others) is consuming lots of data, then using that data to make recommendations. Bigtable also supports the familiar HBase API.
- Cloud Firestore, a NoSQL document database. Like Spanner, this data service has strong transactions, five 9s of reliability, and full consistency. The primary difference is that Firestore provides a document-oriented model for data rather than a relational model.

All three of these services are managed, so you can expect the time and money you spend on database administration to be substantially less than what's required to run a traditional DBMS. But, like virtually all cloud-native managed data services, these services are available only in the cloud. What if your SaaS application also needs to run on-premises for some customers?

One way to allow this is to build your application logic on Anthos, as described earlier, then use a traditional database that can also run on-premises. GCP's Cloud SQL service can be a good option here, as it runs managed instances of MySQL, PostgreSQL, and SQL Server. Another option is to use an open source database provided by one of our partners, such as MongoDB or DataStax, that runs both on GCP and on-premises.

Data is the lifeblood of a SaaS application. When you built your first-generation application, you made the best choice available at the time. When you create your next-generation SaaS application, you should do the same thing. For most organizations, that means choosing a managed cloud data service. With Spanner and other options, GCP provides an unmatched set of services for operational data.

Integrating Data Analytics

Collecting historical data about your users and the work they do is important. It lets you better understand your customers over time, which can help you decide what features to build next. But analyzing what your users are doing as quickly as possible — in seconds, not days — can also be important. This kind of integrated data analytics can let you change the offers you show customers as they browse your site, analyze performance of a web-based marketing campaign in real time, and more.

Doing these things in a SaaS application requires using the data analytics technologies that your cloud platform provides. When you're creating a next-generation SaaS application, this means that the quality of a cloud platform's analytics offerings is fundamentally important. This is another area where Google has uniquely powerful offerings.

GCP's flagship data analytics service is BigQuery. This managed data warehousing service works with relational and other data, and it deserves its name: BigQuery provides excellent performance even on petabytes of data. In fact, *Gartner's 2019 Critical Capabilities for Data Management Solutions for Analytics* states that "reference clients praised the ease of use and performance of BigQuery".

Along with BigQuery, GCP provides other managed services for data analytics, including:

- Cloud Dataproc, a service for running Spark and Hadoop clusters in the cloud. (It's worth noting that the open source Hadoop is also based on technologies originally created by Google.)

- Cloud Dataflow, a service for processing streaming data and more.
- Cloud Data Fusion, a service for graphically creating extract/transform/load (ETL) and ELT pipelines for your data warehouse.

Well-designed data analytics are an essential part of a next-generation SaaS application. And even if you don't think you need the massive scale that BigQuery and the other GCP services provide, you're still better off building on a platform that can handle it. Everybody always has more data than they expect.

Adding Intelligence With Machine Learning

Machine learning lets you analyze training data to generate models. Those models can then be used to answer questions like "Is this transaction fraudulent?" or "Is this a picture of a cat?"

Google's lead in ML technologies is widely acknowledged today, due in no small part to global press coverage of things such as our world-champion Go software. And here's Gartner again, from its *2019 Magic Quadrant for Cloud Infrastructure as a Service*, Worldwide: "Google has differentiated technologies on the forward edge of IT, specifically in analytics and machine learning."

Machine learning is important today for any organization creating a next-generation SaaS application, and it's going to be even more important tomorrow. To please your customers and beat your competitors, you'll want the strongest possible offerings in this area. In other words, you want GCP.

One aspect of our strength in this area is illustrated by what we've contributed to the open source community. Examples include TensorFlow, a widely used deep learning framework, and Kubeflow, a technology for easily deploying models in the cloud and on-premises. Another way to understand GCP's benefits is to look at the breadth of our ML offerings. The range includes:

- Infrastructure components, such as our unique tensor processing units (TPUs) that provide cost and speed advantages over our competitors.
- Flexible low-level tools for data scientists, such as AI Platform. This suite of tools includes support for deep learning, distributed model training, and model hosting.

- Tools that let non-data scientists generate models, democratizing access to machine learning. Cloud AutoML is a primary example, but it's not the only option. GCP also lets you create models directly in BigQuery using extended SQL. Tools like these let your organization get the benefits of machine learning without hiring scarce and expensive ML experts.

- APIs for accessing pre-trained models addressing many common problems. These models include vision, speech-to-text and text-to-speech, translation, and many more.

Other cloud platforms also offer a range of ML services. Why are GCP's offerings superior? The answers include the following:

- GCP's speech-to-text and text-to-speech models support 120 language variants, many more than our cloud platform competitors. This lets your next-generation SaaS application be global from day one.

- GCP's AutoML functions work with both unstructured data, such as images, and structured data, such as tables. Competitive offerings support only unstructured data, which makes it harder to create models using tabular business data.

- GCP's pre-trained models are commonly more accurate than those offered by other cloud platforms. For example, *The Forrester New Wave™: Computer Vision Platforms, Q4 2019* shows Google as the overall leader in computer vision. This advantage lets you create applications that more effectively recognize things in the real world, such as machine parts, wetlands, and people.

Even if you're not using machine learning today, you should expect to incorporate this technology into your applications soon. Our goal is to give you the most capable ML services, helping you create the best possible next-generation SaaS application.

Google as a Business Partner

You want to choose the cloud platform that offers the best technology to build on. But the decision isn't solely about technology; you also want to choose a great cloud company to partner with. We know this, and it's why we offer a broad range of advantages as a business partner.

For example, rearchitecting your existing application into containers (and perhaps microservices) can be daunting. We can connect you with multiple GCP partners that have done this many times. We can also help you do this ourselves via Google's Professional Services Organization. GCP also provides an Anthos Migrate offering that helps you containerize your monolithic applications.

Another challenge facing every SaaS vendor is keeping their application available. Google is second to none in our knowledge in this area, and we're happy to share. SaaS partners on GCP have access to our Customer Reliability Engineering (CRE) programs, which are designed to teach you how to achieve the highest reliability at the lowest cost.

We also help you market and sell your SaaS offerings. You can list your application in our Google Marketplace, for example, making it globally visible. For more on the Google partner advantage, go here.

Making a Choice

Creating a next-generation SaaS application requires effort. Yet the rewards, including improving your customer experience and keeping pace with your competitors, are substantial. If you're like most SaaS companies, you don't really have a choice — you need to make this change.

And given the effort involved, creating a next-generation SaaS application also gives you the chance to re-think your cloud platform choice. Rather than choosing among the limited options available years ago, you can pick the cloud platform that offers the best technology today.

Google Cloud Platform is likely to be your best choice. For each of the four aspects of next-generation SaaS, we offer unmatched advantages:

- **Rearchitecting logic with containers:** We created Kubernetes, which is why we now offer the most mature Kubernetes environment. GCP also provides Anthos, a uniquely software-only approach for multi-cloud support.

- **Modernizing data with managed services:** GCP provides Spanner, the only massive scale managed relational database service with SQL semantics and ACID transactions, along with BigTable and other managed NoSQL services. We also support open source database technologies both directly and through partners, letting you minimize platform lock-in if you

choose to.

- **Integrating data analytics:** BigQuery offers industry-leading speed and scale in multiple analytics use cases. This cloud data warehouse service is also part of a broad ecosystem of other GCP data analytics tools.

- **Adding intelligence with machine learning:** We are the acknowledged leader in machine learning today. As part of this, we provide ML services for both data scientists and less specialized people, along with the broadest natural language support and the most accurate models for computer vision and other services.

Finally, Google is a first-class partner, offering real benefits that can help you grow your business.

The truth is evident. Before you create a next-generation version of your SaaS application, you need to take a close look at GCP.


Google Cloud