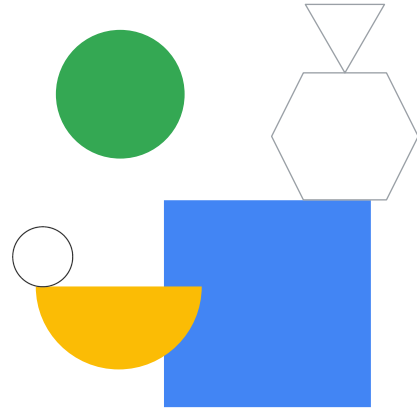


Introduction to Anthos



Welcome to Introduction to Anthos.



Today's agenda




- 01 Overview
- 02 Anthos technology stack
- 03 Anthos components
- 04 Billing

Google Cloud

Here is our agenda for the module.

We discuss Anthos' value proposition how it can help you manage hybrid- and multi-cloud environments with the same ease and operational excellence that you see in Google Cloud. You also learn about Anthos products and components and the billing model.



Today's agenda

01 [Overview](#)

02 Anthos technology stack

03 Anthos components

04 Billing

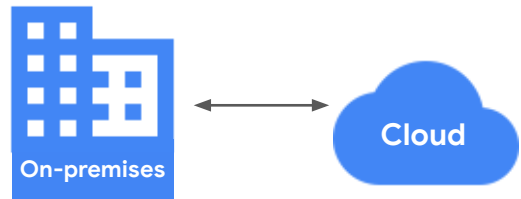


Google Cloud

Let's begin with a quick overview of the needs that you have in hybrid- and multi-cloud environments.

Hybrid needs

- The typical enterprise has a hybrid cloud strategy (82%).
- Enterprises cannot migrate the bulk of their existing software for reasons that include:
 - Compliance requirements
 - Long-term infrastructure contracts
 - Legacy applications support
 - Low-latency requirements in edge locations



Google Cloud

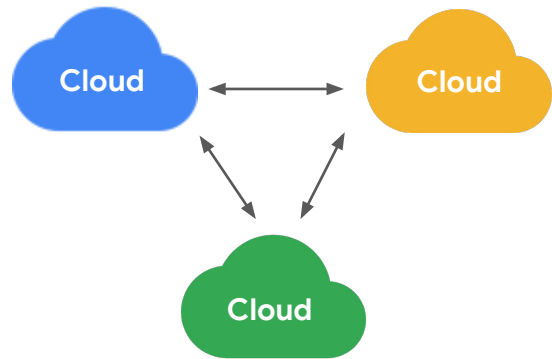
[According to a report from Flexera, 82% of the Enterprise has a hybrid cloud strategy.](#)

Although many companies want to operate completely in the cloud, there are many reasons why they cannot migrate the bulk of their existing software. For example:

- Compliance requirements force them to keep sensitive user data and encryption keys on their own data centers.
- Pre-existing long-term infrastructure contracts prevent them from migrating immediately to the cloud.
- Support must still be provided to legacy applications such as mainframes that cannot be easily migrated to the cloud.
- Some workloads need the lower latencies provided from deployments in edge locations, such as factories and other industrial settings.

Multi-cloud needs

- The typical enterprise has a multi-cloud strategy (92%).
- Enterprise customers use on average 2.6 cloud providers.
- Enterprise has multiple clouds for reasons that include:
 - Compliance requirements
 - Reduced risk and provider dependency
 - Additional resilience, availability, and disaster recovery
 - Company acquisitions with pre-existing commitments with another cloud provider



Google Cloud

According to the same Flexera study, the average [enterprise uses 2.6 cloud providers](#).

The reasons vary, but typically are due to the scale and complexity of enterprises. For instance:

- Compliance requirements require companies with customers in the public sector to have multiple providers.
- Internal policies and strategies to reduce risk promote having multiple providers to increase negotiation power on prices.
- Additional resilience is needed in case a provider cannot fulfill their availability guarantees or a major disaster recovery is needed.
- Companies may have acquisitions with pre-existing commitments with another cloud.

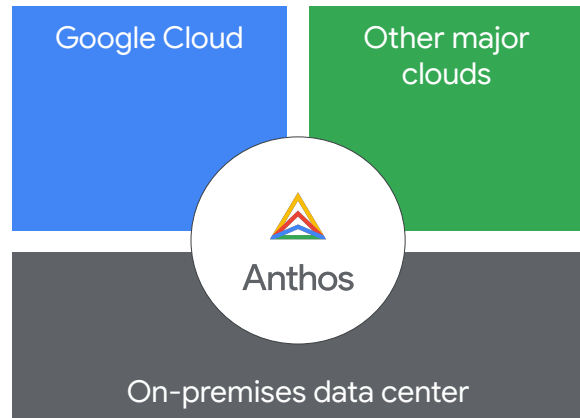
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Instructor examples:

Twitter just signed a [huge renewal](#) with Google Cloud. Twitter ALSO signed a [huge deal with AWS](#) late last year. Snap was born in Google Cloud, and is easily spending [billions of dollars there](#); but hold on, don't they also [spend a billion in AWS](#)? Uber is an [AWS shop](#), but wait, what's this about [tens of millions on Google Cloud](#)? Waze decided to run on both even though Google bought them. Even Netflix, the canonical AWS poster-child, uses Google Cloud if "only" for backups and experiments.

Introducing Google Cloud's Anthos

- Anthos lets you build and manage modern hybrid- and multi-cloud applications without infrastructure lock-in.
- Build once, to run anywhere, across your existing on-premises infrastructure and all major public cloud providers.



Google Cloud

Until now, there were only two viable ways: lift and shift or rewriting the software.

Anthos allows you to build and manage your applications in hybrid- and multi-cloud environments.

There are three common trade-offs – security vs. agility, reliability vs. cost, and portability vs. consistency – that keep IT from giving the business what it wants. Everyone in IT is familiar with these trade-offs because they have been making them for decades. Anthos is a different kind of hybrid-cloud software that overcomes some of these trade-offs so you don't have to compromise between agility and reliability or between choice and consistency. With Anthos, you can manage applications across on-premises and cloud providers – without lock-in – and build applications once that can run anywhere.

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Additional information re trade-offs:

Security vs. agility:

Agility is what everyone wants, but making lots of changes rapidly is a breeding ground for security issues. IT often is pinched between helping the business move quickly and making sure that the changes they are making have passed security audits. IT needs to make sure they have evaluated, tested, and researched fully to

avoid making a fast change that can come with a painful surprise. In most cases, security trumps agility and organizations are left moving slower.

Reliability vs. cost:

You've heard it for years, you have to pay for more reliability. Buying more expensive hardware with lower failure rates, purchasing redundant systems that sit idle to protect from failovers. IT is constantly balancing the cost of more reliable systems with the need for greater uptime.

Portability vs. consistency:

Every big company offers some version of "better together". That consistency and reduction of complexity is compelling. It often comes as the cost of vendor lock-in (i.e., removing portability). Customers have to choose between picking separate tools that increase complexity but are more portable and can avoid lock-in, or choosing a single vendor who can make integration much easier but often makes them locked in to proprietary solutions that will be there for decades (WebSphere anyone?)

Anthos is a **managed platform** that extends
Google Cloud **services and engineering practices** to
your **environments** so you can **modernize apps faster**
and establish **operational consistency** across them.

Google Cloud

Anthos is a managed platform that extends Google Cloud services and engineering practices to your environments so you can modernize apps faster and establish operational consistency across them.

SaaS-like model with
updates provided by
Google



Anthos is a **managed platform** that extends
Google Cloud **services and engineering practices** to
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and establish **operational consistency** across them.

Google Cloud

It's a managed platform, which means that Google provides the updates, manages the stack, and delivers the OS updates. The Kubernetes components and the platform itself are mostly self-operational.

SaaS-like model with updates provided by Google

Get integrated technologies (like Kubernetes, Knative, Istio), access to our public cloud services, and codified DORA/SRE principles

Anthos is a **managed platform** that extends Google Cloud **services and engineering practices** to your **environments** so you can **modernize apps faster** and establish **operational consistency** across them.

Google Cloud

The real value of Anthos comes from the fact that it's not just Kubernetes.

Yes, Kubernetes is at its core, but it incorporates different Google Cloud services and engineering practices.

Anthos consists of open source software we've created, like Istio and Knative and Tekton and others.

We've codified Site Reliability Engineering best practices, such as creating SLOs, into the platform to make it simpler for you.

SaaS-like model with updates provided by Google

Get integrated technologies (like Kubernetes, Knative, Istio), access to our public cloud services, and codified DORA/SRE principles

Anthos is a **managed platform** that extends Google Cloud **services and engineering practices** to your **environments** so you can **modernize apps faster** and establish **operational consistency** across them.

See consistency, security, and cost-effective computing for hybrid- and multi-cloud scenarios

Google Cloud

Turning all that into one platform that you can put wherever you want.

You get to choose where you want to run, whether in one environment or multiple, and Anthos is there to support you.

This is a single experience for developers and operators, regardless of where it is.

SaaS-like model with updates provided by Google

Get integrated technologies (like Kubernetes, Knative, Istio), access to our public cloud services, and codified DORA/SRE principles

Tools included to perform VM-to-container migration

Anthos is a **managed platform** that extends Google Cloud **services and engineering practices** to your **environments** so you can **modernize apps faster** and establish **operational consistency** across them.

See consistency, security, and cost-effective computing for hybrid and multi-cloud scenarios

Google Cloud

That really enables you to modernize faster. There is no new stack to learn and no ramp-up time on every provider and new environment.

You can build better systems and get greater visibility.

Modernization with Anthos and Google Cloud is not just some toolkits.

It includes technology to help you migrate from VMs to Containers, or migrate from Cloud Foundry to Kubernetes and Anthos, and cloud code integration to help your developers complete tasks more quickly.

So, it is an active approach and partnership.

SaaS-like model with updates provided by Google

Get integrated technologies (like Kubernetes, Knative, Istio), access to our public cloud services, and codified DORA/SRE principles

Tools included to perform VM-to-container migration

Anthos is a **managed platform** that extends Google Cloud **services and engineering practices** to your **environments** so you can **modernize apps faster** and establish **operational consistency** across them.

See consistency, security, and cost-effective computing for hybrid and multi-cloud scenarios

Define declarative policies that apply secure standards to all environments

Google Cloud

This all falls apart if this is more work. Yes, of course, there is **some** additional work.

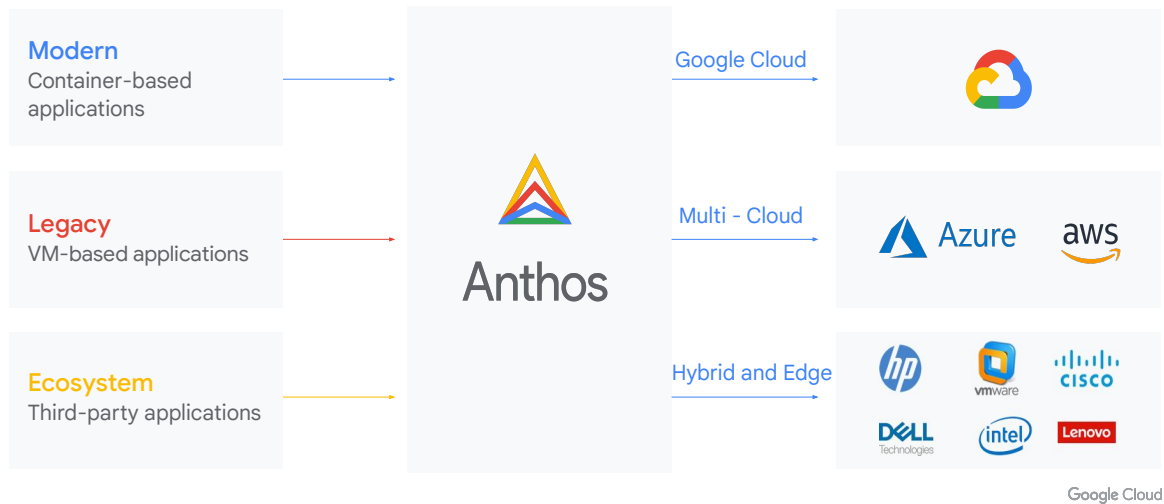
But if you think that the future is a scale problem, how do you make sure that is not also a linear scaling of operations investment.

How do you reduce or manage the operational cost by creating consistency across your fleet? But also, how can you have consistency when you're running in all these environments?

This is where Anthos really supports you with the services we'll discuss.

So, you can have this control plane that will allow you to run the platform everywhere, and you can manage it consistently while maintaining your shipping velocity for software.

Introducing Google Cloud's Anthos



Anthos is a platform that allows you to modernize existing applications, that can interact with legacy systems, and that can provide consistency across a variety of platforms in both the cloud and hybrid environments.

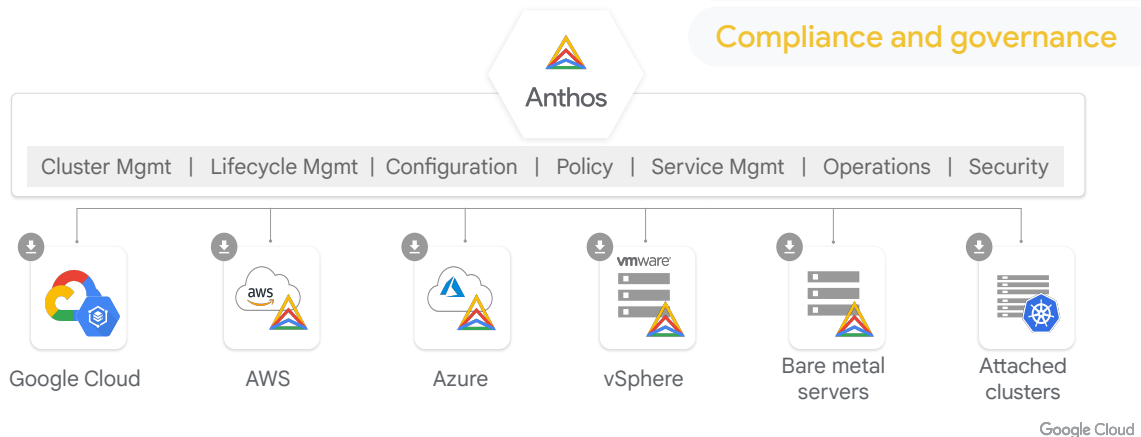
Anthos is a **Kubernetes-based platform** that **runs everywhere** you do, with a cloud-backed control plane for **centralized management**.

Application management


Infrastructure automation

End-to-end observability

Compliance and governance



With Anthos, you can centrally manage your Kubernetes-based applications and infrastructure with end-to-end observability and also configuration and policy management to assure compliance and governance. All that, across different environments in the cloud such as in Google Cloud, AWS, or Azure, and on-premises environments such as vSphere or bare metal.



Today's agenda

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03 Anthos components

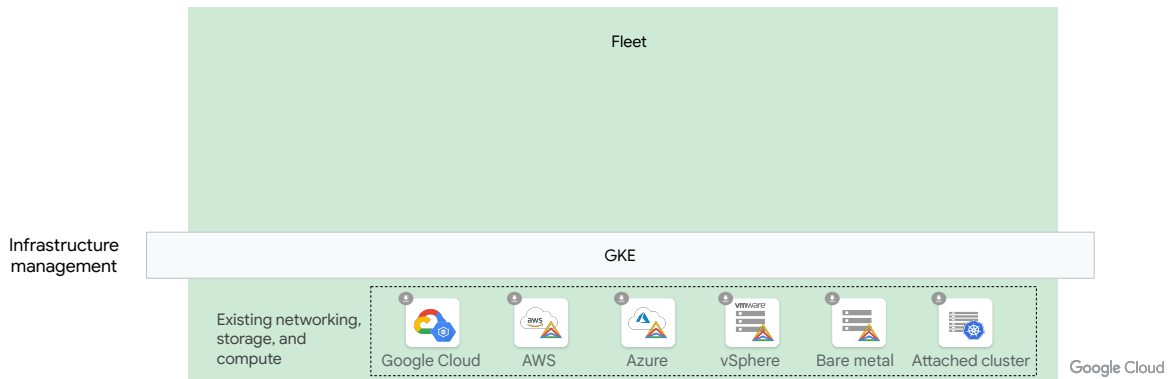
04 Billing



Google Cloud

Let's look at the layers of the Anthos Technology Stack.

Anthos technical overview

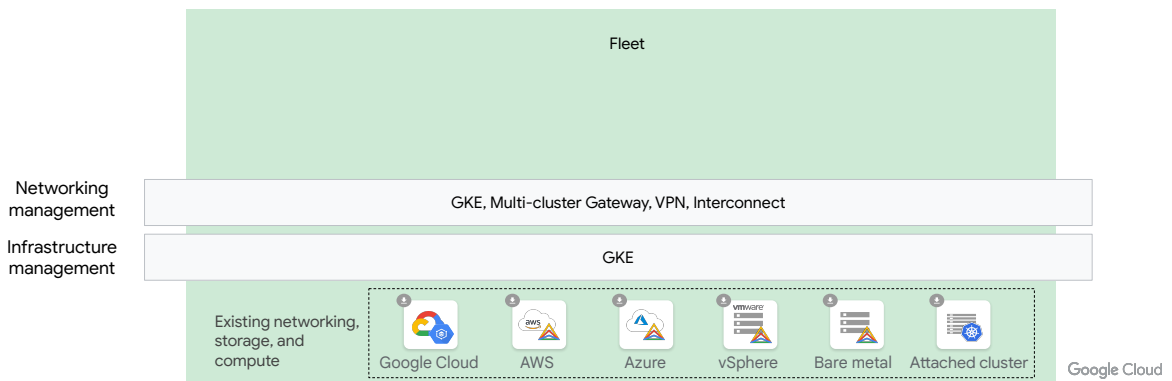


The first layer is Infrastructure Management.

Anthos leverages your current investments in infrastructure and allows you to expand to new platforms with a consistent approach. Anthos bundles upstream Kubernetes releases and provides management capabilities for creating, scaling, and upgrading conformant Kubernetes clusters. With Kubernetes installed and running, you have access to a common orchestration layer that manages application deployment, configuration, upgrade, and scaling.

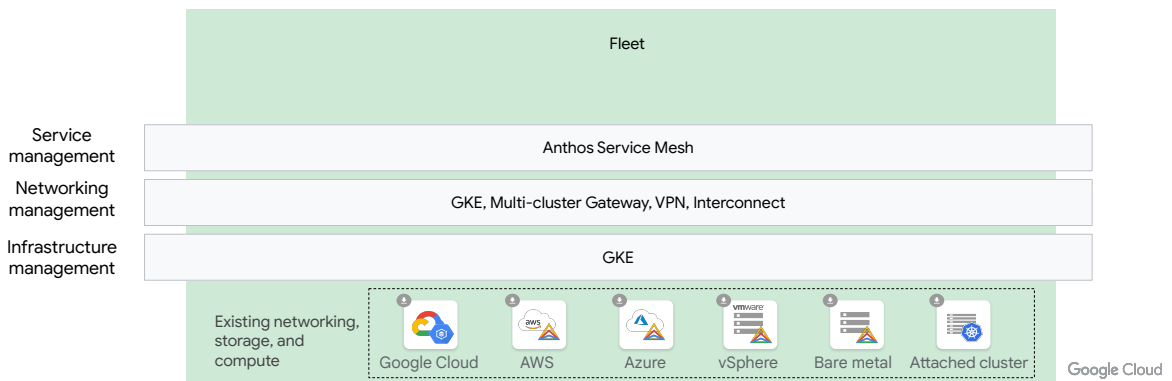
Anthos also benefits from technologies specific to each platform. For instance, in Google Cloud, Anthos will work seamlessly with Google's Global HTTPs Load Balancer, while in AWS, it will leverage the AWS Application Load Balancer, or ALB, or on-premises you will be able to use third-party Load Balancers such as F5.

Anthos technical overview



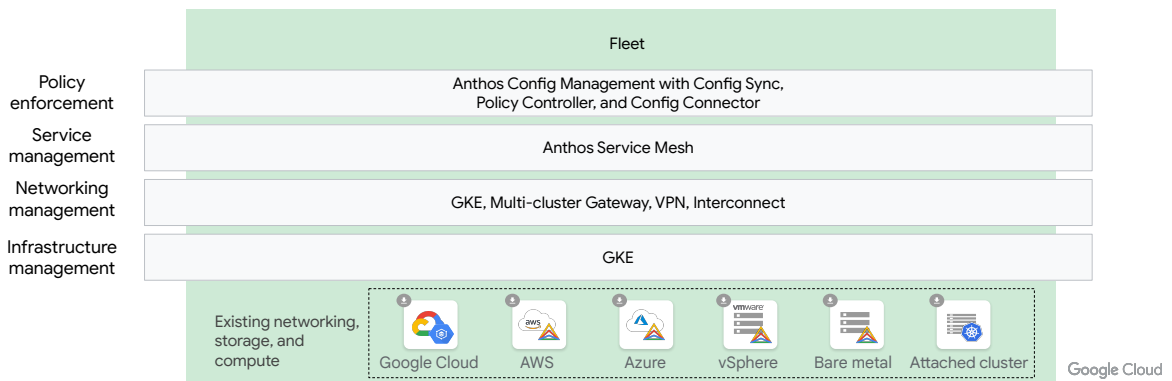
Anthos provides a networking layer to be able to ingress and communicate across platforms. With Multi-cluster Gateway, you can expose services to the internet. If you want to communicate cross-platform, you can connect your on-premises data centers, multi-cloud locations, and attached clusters in various ways. The easiest way to start is by implementing a site-to-site VPN between the environments using [Cloud VPN](#). If you have more stringent latency and throughput requirements, you can choose between [Dedicated Interconnect](#) and [Partner Interconnect](#).

Anthos technical overview



To better control your services communication in a way that offers the maximum visibility, security, and routing capabilities, Google offers Anthos Service Mesh. It's a managed service mesh, based on open-source Istio, with a simplified installation, upgrading process, and configuration, so that you can better manage your most complex distributed microservice applications. With Anthos Service Mesh, you can achieve multi-cluster networking easily, so that your developers don't have to worry about where services are deployed.

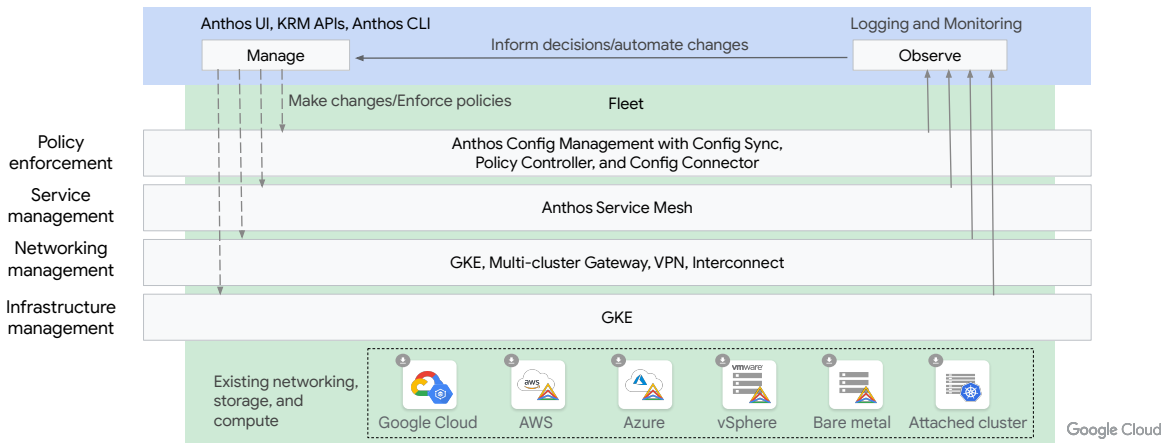
Anthos technical overview



Spanning multiple environments adds complexity in terms of resource management and consistency. Anthos provides a unified declarative model for computing, networking, and even service management across clouds and data centers.

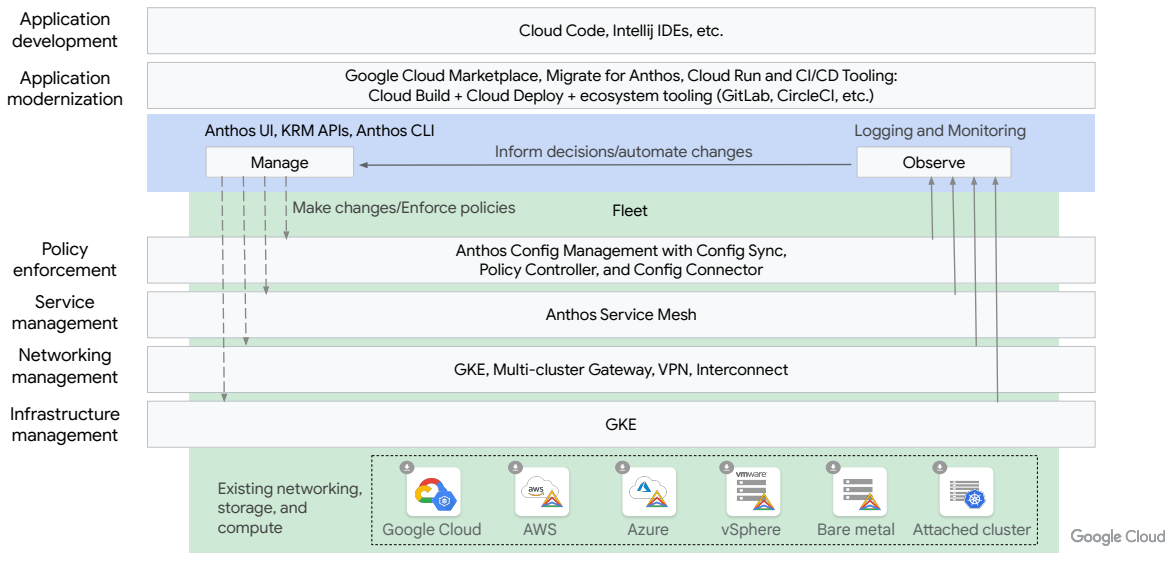
Configuration as data is one common approach to managing this complexity that allows you to store the desired state of your hybrid environment under version control and apply it directly with repeatable results. Anthos makes this possible with [Anthos Config Management](#), which integrates with Anthos clusters on-premises or in the cloud and lets you deploy and monitor configuration changes stored in a central Git repository.

Anthos technical overview



The Anthos dashboard in the Google Cloud Console provides you with a secure, unified user interface to view and manage your applications, including an out-of-the-box structured view of all your Anthos resources. The dashboard landing page gives you a runtime status summary for all your services and clusters and a quick “getting started” experience for first-time users. To view clusters on the Anthos cluster management view, you can register them with Connect to your Google Cloud project fleet. A fleet provides a unified way to view and manage your clusters and their workloads as part of Anthos, including clusters outside Google Cloud. If you are using the Anthos Service Mesh, you will have access to additional observability into the health and performance of your services. Metrics and logs from your Anthos clusters are uploaded to Cloud Monitoring and Cloud Logging to empower service operators to troubleshoot, maintain, and optimize their applications.


Anthos technical overview



For developers, Anthos provides a state-of-the-art container management platform based on Kubernetes. Developers can use this platform to quickly and easily build and deploy existing container-based applications and microservices-based architectures.

Key benefits include:

- Google Cloud Marketplace to quickly and easily drop off-the-shelf products into clusters
- Migrate for Anthos to modernize in place by converting VMs into Containers
- Cloud Run for Anthos to abstract away the complexity of Kubernetes and have a serverless developer experience on top of your own infrastructure
- GitOps approach to configuration management with Anthos Config Management and CI/CD workflows with Cloud Build and Cloud Deploy



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Google Cloud

Let's take a closer look at the Anthos components.

Anthos components overview

- Anthos is a modern application management platform that provides a unified model for computing, networking, and even service management across clouds and data centers.
- The technology stack is built on a consistent set of APIs based on open source technologies that empowers developers and operators with a single methodology that applies to on-premises, Google Cloud, and other cloud providers.



Anthos is a platform, a collection of Google Cloud products and features, that makes it easier to deploy and manage applications across operating environments in a consistent manner.

Do you know where the Anthos name comes from? It means “flower” in Greek. Flowers grow on-premises, but they need rain from the clouds (Google Cloud) to flourish.

Google builds Anthos atop open-source technologies that can run on-premises, on Google Cloud, and with other cloud providers. The Google Cloud implementations of these technologies include Google Kubernetes Engine, Anthos Service Mesh, and Anthos Config Management,.

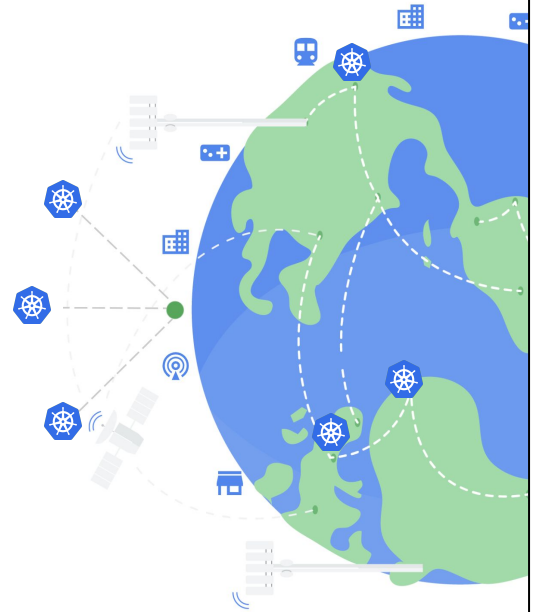
Let’s look at some these technologies.



Best-in-class Kubernetes

Google Kubernetes Engine (GKE) provides the best Kubernetes experience on the planet.

- Record-breaking 15K node scalability for a single cluster.
- **Autoscaling, auto-repairs, and auto-upgrades** keep clusters healthy and hyper-responsive to massive resource spikes.
- World-class GPU/TPU integration.
- Dozens of unique security features (e.g., eBPF).



Google Cloud

Google Kubernetes Engine, or GKE, provides the best Kubernetes experience on the planet. With over 15 years of experience in Kubernetes, Google provides a seamless managed experience that you can run at scale.

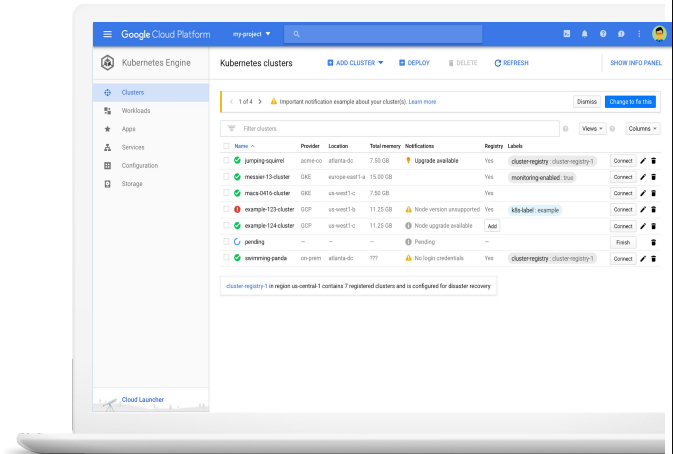
Deploy rich heterogeneous workloads, such as Windows or machine learning applications, that can benefit from a dynamic autoscaling, auto-repairing and auto-upgrading platform with advanced feature support such as GPU and TPUs. All that together with unique security features such as eBPF.



Unified management hub

Single interface across Google Cloud and on-premises and other public clouds

- 01 Orchestrate and manage on-premises containers just like GKE in the cloud.
- 02 Consistent operating model with access to Google Cloud services across hybrid environments.
- 03 Single pane of glass for multiple Kubernetes clusters, no matter where.



Google Cloud

Bring the power of Google Kubernetes Engine to on-premises and other cloud providers while continuing to enjoy the same consistent, single-pane-of-glass experience to manage Kubernetes clusters.



Serverless anywhere

Cloud Run for Anthos is a managed serverless product that:

- Rapidly scales containerized applications from zero to *N*.
- Supports HTTP and gRPC protocols.
- Natively handles private DNS resolution.
- Runs absolutely anywhere Anthos runs.



Google Cloud

Run workloads serverless anywhere. With Cloud Run for Anthos, developers can run their stateless containerized applications on an Anthos cluster of their choice, without the need to learn all the Kubernetes constructs such as Services, Deployments, and HorizontalPodAutoscalers. Developers can focus on building applications and leverage automations including:

- Autoscaling from zero instances until clusters are fully used
- Support for HTTP and gRPC protocols
- Native support for private DNS resolution

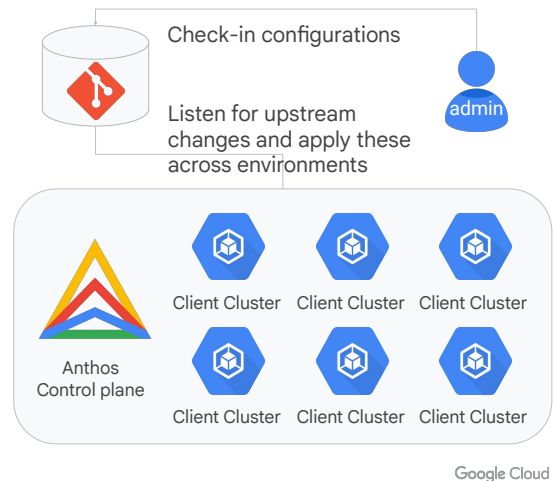
Cloud Run for Anthos offers the same kind of managed experience that developers are used to from Google Cloud, but running on infrastructure on your own premises or other cloud providers.



GitOps at scale

Anthos Config Management (ACM) is a GitOps automation suite that provides policy and configuration at scale.

- Synchronizes configuration for any cluster, either on-premises or in the cloud.
- Continuously enforces compliance policies.
- Enables end-to-end auditability and CI peer review through policy-as-code.
- Can **manage all your cloud infrastructure**, not just your Kubernetes apps.



[Anthos Config Management](#) is a multi-cluster configuration manager that helps you have consistent policies across your clusters, whether they're on-premises or in the cloud.

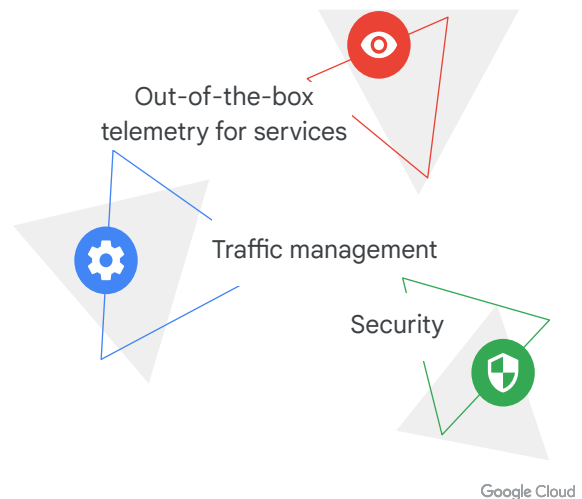
- **It's declarative and continuous:** After you declare new desired state, it continuously checks for changes that go against state.
- **It uses a** Central Git repository to manage access control policies, resource quotas, and namespaces, with end-to-end auditability and Continuous Integration peer-review through policy-as-code.
- **Uses YAML or JSON**, so no rewriting of existing Kubernetes configs is required, and the configuration management can extend to the rest of your infrastructure.



Zero trust networking

Anthos Service Mesh provides service management and a single pane of glass to manage:

- Enhanced observability with tracing, logging, metrics, and SLO monitoring.
- Zero trust networking with service identity, AuthN/Z, and encryption.
- Traffic management capabilities with routing and load balancing.



Anthos Service Mesh offers a solution to manage networking and distributed services across clusters so that they are most visible, secure, reliable, and routable.

Anthos Service Mesh offers features such as:

- Service telemetry collection, ingestion, and display in automatically generated Anthos Service Mesh dashboards. View network topology with real-time latencies and breakouts by service, and set up service level objectives to make sure any possible network degradation doesn't go unnoticed.
- Service-to-service security with mutual TLS encryption and authentication backed by a managed certificate authority called Mesh CA.
- Routing policies that allow you to create your deployment strategies such as Blue-Green deployments, Canary deployments, or A/B testing.



Operational efficiency

Logging

Collect logs from platforms, apps, and services.

- Log search/view/filter
- Error reporting and dashboard
- Log metrics
- Log router for easy export

Monitoring

Monitor metrics from platforms, app, services, and microservices.

- Dashboards
- Metrics explorer/custom metrics
- Uptime checks
- Service monitoring
- Alert management

APM

Monitor and troubleshoot application performance.

- Trace: Latency analysis across distributed apps
- Profiler: CPU and memory profiling
- Debugger: In-production debug and conditional snapshots

Google Cloud

If you can't measure it, you can't improve it.

Anthos integrates with Google Cloud's operations suite to offer integrated monitoring, logging, and trace managed services for applications and systems running on all Anthos platforms, spanning across clouds and on-premises environments.

As part of the installation, Anthos installs agents in your clusters to collect and send metrics, logs, and traces to Google Cloud.

After the information is collected, you can use Google Cloud's operations suite dashboards to gain visibility into the performance, availability, and health of your applications and infrastructure.

- Cloud Logging offers advanced search capabilities to view, filter, and investigate both information logs and errors. You can also generate metrics from logs and export your logs to other long-term backends such as Cloud Storage, BigQuery, or Splunk.
- Cloud Monitoring provides visibility into the performance, uptime, and overall health of your applications. Visualize this data on charts and dashboards and create alerts so you are notified when metrics are outside of expected ranges.
- Application Performance Management, or APM, combines the monitoring and troubleshooting capabilities of Cloud Logging and Cloud Monitoring with Cloud Trace, Cloud Debugger, and Cloud Profiler to help you reduce latency and cost so you can run more efficient applications. With Anthos Service Mesh,

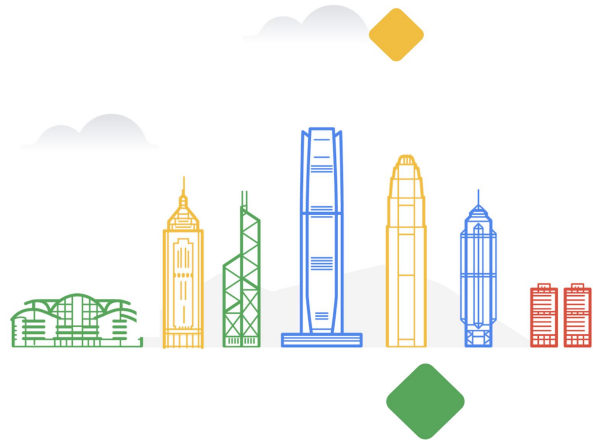
- tracing data is collected automatically so that you can deep dive on your requests and identify which services are causing bottlenecks.



One-click ecosystem

Marketplace for Anthos lets you centrally manage production-grade third-party software and data in a completely self-service manner.

- Single bill for Google Cloud and third-party services
- Built-in support for negotiating bespoke vendor quotes
- 'Click to deploy' pre-integrated Kubernetes applications anywhere that Anthos runs
- Managed updates



Google Cloud

Marketplace for Anthos provides a secure supply chain of production-grade third-party software and data, which has been tested and verified by Google, in a completely self-service manner. You can benefit from industry innovation with a centrally managed solution for all your vendors that provides a single bill at the end of the month.

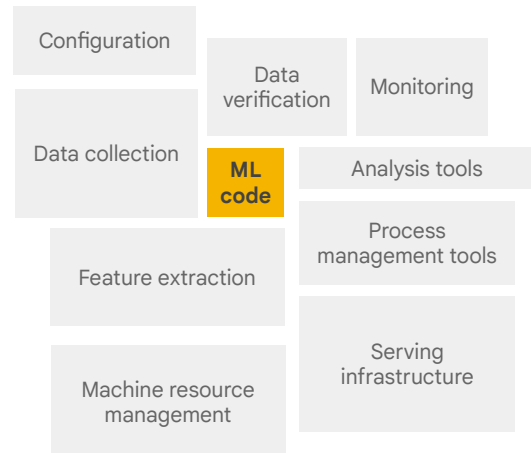
It provides a "Click to deploy" experience that works on all Kubernetes-based Anthos clusters and managed updates so that your third-party software benefits from the latest features and security updates.



Ubiquitous Google AI

Hybrid AI for Anthos provides unrivaled hybrid-cloud AI/ML training and inferencing capabilities.

- One-click deployment of pre-trained AI models, created by teams of Google PhDs, into any Anthos environment via the Anthos Marketplace
- Enterprise support for custom AI model training and MLOps lifecycle management using virtually any deep-learning framework



Google Cloud

Whether it's image recognition, pattern detection, conversational chatbots, or any number of other emerging use cases for artificial intelligence, or AI, organizations are eager to incorporate AI functionality into their offerings.

AI models require a lot of data, which more often than not resides in an organization's data center—not in the cloud. Further, many organizations' data is sensitive and must stay on-premises. As a result, you're often forced to rely on fragmented solutions across on-premises and cloud deployments or to minimize your use of AI entirely. With Anthos, you don't have to make those types of compromises.

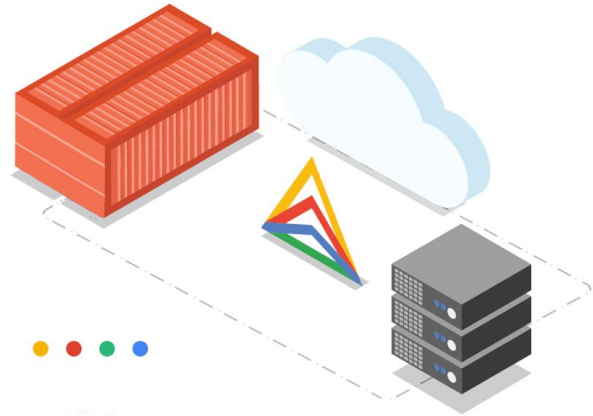
Google Marketplace allows you to deploy your AI models on Anthos clusters so that you can benefit from the power of AI while fulfilling the data residency and compliance requirements, all from within your own data center.



One-click VM migration

Migrate for Anthos brings the power of containerization to existing workloads.

- Migrate VMs running on VMware, AWS, or Azure into containers managed by Anthos/GKE in real time.
- Capitalize on increased resource utilization, unified logging and monitoring, and modern application lifecycle management tools.
- Migrate for Anthos supports both legacy Linux and Windows VM applications.




Google Cloud

Migrate for [Anthos](#) makes it fast and easy to modernize traditional applications away from virtual machines and into native containers.

You can migrate VMs running on VMware, AWS, or Azure into containers managed by Anthos/GKE in real time.

That way, you can benefit from a unified continuous integration and continuous deployment pipeline and a single way of logging and monitoring your applications and also get more resource use because you can increase the density of your workloads running on the same infrastructure.

Migrate for Anthos is available for both legacy Linux and Windows VMs and works well with both stateless and stateful workloads.



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Google Cloud

Those were some of the key components that are part of Anthos. Finally, let's take a look at the billing model for Anthos.

Anthos pricing

Two models: pay-as-you-go and subscriptions, which provide a discounted price for a committed term:

	Pay-as-you-go (hourly)	Pay-as-you-go (monthly)	Subscription (monthly)
Anthos (Google Cloud)	\$0.01096 / vCPU	\$8 / vCPU	\$6 / vCPU
Anthos (AWS)	\$0.01096 / vCPU	\$8 / vCPU	\$6 / vCPU
Anthos (attached clusters – multi-cloud)	\$0.01096 / vCPU	\$8 / vCPU	\$6 / vCPU
Anthos (VMware and bare metal)	\$0.03288 / vCPU	\$24 / vCPU	\$18 / vCPU

- Includes collection and storage of system logs in Cloud Logging for the default retention period of 30 days
- Free tier: \$800 worth of usage, or for a maximum of 30 days

Google Cloud

Anthos is offered in two distinct billing models:

- Pay-as-you-go, with no long-term commitments and a flexible pay-per-use model, is ideal for environments with dynamic changes, such as those enabled by autoscaling.
- Subscription, with flexible monthly installments, offers you a more attractive pricing and is ideal for predictable environments such as on-premises locations where infrastructure changes are less dynamic because you might be leveraging your CAPEX investments. Any extra usage not covered by the subscription will be billed at the pay-as-you-go rates.

Charges apply to all clusters under management, including Anthos GKE, Anthos on AWS, Anthos on-premises, and Attached Clusters.

Anthos pricing includes collection and storage of system logs in Cloud Logging and all Anthos components such as Service Mesh, Config Management, and Migrate for Anthos.

Anthos pricing does not include charges for:

- Google Cloud resources such as Compute Engine, Cloud Load Balancing, and Cloud Storage
- AWS resources such as EC2, ELB, and S3
- Azure resources such as Azure VMs or Storage

If you are a new Anthos customer, you can try Anthos on Google Cloud for free up to \$800 worth of usage or for a maximum of 30 days, whichever comes earlier. During the trial, you are billed for the applicable fees and then credited at the same time for those fees, up to \$800. You are still billed for applicable infrastructure usage during the trial.

Anthos components pricing

- All components are included in the Anthos license.
- Each component can be used independently also, without the Anthos license.
- When components are used independently, you can use pay-as-you-go or buy a subscription.
- Components that can be purchased independently include:
 - Anthos Service Mesh
 - Anthos Config Management
 - VM Migration

Google Cloud

As we just said, components such as Anthos Service Mesh, Anthos Config Management, or VM Migration are included in the Anthos bundle pricing. However, you can also purchase them independently both in pay-as-you-go and subscription billing models. This offers the flexibility for companies running on Google Cloud that might want to start testing individual services to improve their security, resilience, and observability postures.