

HPE GreenLake for Private Cloud Enterprise

Features, capabilities, and reference architecture



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Executive summary

HPE GreenLake for Private Cloud Enterprise reimagines the modern private cloud experience by providing an automated, flexible, scalable, and fully managed enterprise-grade private cloud. Built for both cloud-native and traditional applications, HPE GreenLake for Private Cloud Enterprise supports the self-service deployment of bare metal, virtual machine, and container services—optimized for price and performance.

This white paper introduces HPE GreenLake for Private Cloud Enterprise and reviews the solution's architecture, key features, and capabilities.

Target audience

The target audience for this paper includes enterprise cloud or tenant admins, cloud architects, IT directors, and other technical professionals who are planning or are involved with private cloud or hybrid cloud initiatives.

Solution overview

Many enterprises are embracing private clouds as part of hybrid and multicloud deployment models and data-first modernization initiatives. But traditional private cloud offerings are notoriously costly and complicated to design, deploy, operate, maintain, and scale. It takes months to plan and stand up a private cloud.

HPE GreenLake for Private Cloud Enterprise helps eliminate inherent complexities, inefficiencies, and cost constraints of conventional private cloud solutions. Designed, installed, operated, and maintained by HPE experts, this service brings a public cloud experience to a corporate data center or colocation facility while delivering the security, performance, and resiliency that enterprises demand.

HPE GreenLake for Private Cloud Enterprise accelerates time-to-value, slashing implementation timelines and speeding transformation initiatives. A pay-per-use¹ pricing model optimizes TCO by helping eliminate up-front capital equipment expenditures and tightly aligning ongoing operations expenses with evolving business demands. The solution supports a wide range of applications and workloads across industries.

With HPE GreenLake for Private Cloud Enterprise, you can:

- **Manage workloads, not infrastructure:** Hewlett Packard Enterprise takes full responsibility for managing your private cloud's underlying infrastructure, including system planning, installation, provisioning, hardware and software maintenance, operations, growth and capacity planning, and support.
- **Leverage a unified, open platform for both cloud-native and traditional applications:** Run traditional apps and cloud-native apps from a single fungible resource pool, at scale, with simplicity and speed. Bring all the benefits of the public cloud to traditional applications without the expense and complexity of refactoring applications.
- **Take full advantage of modern DevOps and automation:** Streamline application development and deployment. Infrastructure-as-code (IaC) configuration management, REST APIs, and cloud command shell make it easy to programmatically provision infrastructure and integrate with existing DevOps/CI toolchains.
- **Easily deploy and manage containerized applications across hybrid clouds:** Use the same container runtimes in public and private clouds for simple cloud-native workload portability and consistent manageability.
- **Achieve cost control and transparency:** Keep tabs on usage and spending with consumption analytics; view and optimize costs by service type, location, or business unit; and track capacity and aggregated usage.

HPE GreenLake for Private Cloud Enterprise services

Bare metal

With HPE GreenLake for Private Cloud Enterprise, you can provision bare-metal instances on-demand to support workloads that require the performance of a dedicated physical server. You can organize bare-metal instances into compute groups; define a unique set of resources for each group (compute instances, storage volumes, VLAN segments, IP pools, SSH keys, and more); and dedicate compute groups to specific applications, workloads, business units, or departments. Easily bring your sanctioned, hardened operating system images or your own virtualization or container technology stacks to HPE GreenLake for Private Cloud Enterprise to meet your corporate IT standards and versioning policies.

¹ May be subject to minimums or reserve capacity may apply



Virtual machines

You can provision virtual machines on-demand to support traditional virtualized workloads. Application blueprints (templates) and service catalogs, along with integration with leading change-management solutions such as ServiceNow, make it easy to deploy and manage VM-based applications.

The service supports the popular VMware ESXi™ hypervisor. You can choose from a variety of virtual machine instances with different compute instance types and sizes to meet the price-performance requirements of different workloads. In addition, HPE supports predefined VM instance families aligned to compute modules with various memory, storage, and CPU characteristics. You can also define and size your VM instances to address the specific requirements of any application.

HPE GreenLake for Private Cloud Enterprise includes VMware NSX-T network virtualization and security features. You can use these networks to connect VMs, segregate traffic, and instantiate virtual network functions such as firewalls, routers, and load balancers to secure infrastructure and optimize performance and resiliency.

Containers

You can provision Kubernetes clusters on-demand to deploy and scale containerized applications and cloud-native workloads. The default container service is built on the HPE Ezmeral Runtime Environment and based on CNCF-compliant Kubernetes. You can create container clusters using VMs and/or bare-metal compute instances to meet a range of performance requirements.

HPE GreenLake for Private Cloud Enterprise also supports select third-party container platforms such as Amazon Elastic Kubernetes (EKS), so you can leverage the same container runtimes in your public and private cloud. This approach streamlines workload portability and provides a consistent cloud-native experience across hybrid clouds for cloud or tenant admins (cloud system admins, DevOps admins, and more) and cloud consumers (developers, project contributors, and such).

Self-service cloud management

HPE GreenLake for Private Cloud Enterprise includes an intuitive browser-based console for configuring and provisioning cloud resources. Governed by role-based access controls (RBACs), the customizable, menu-based console allows users to configure resources and provision services without IT intervention. The console makes it fast and easy to perform routine operations such as creating and managing the lifecycle of bare-metal instances, virtual machine compute instances, and container clusters. In addition to providing a role-based overview of a customer's private cloud environments, it provides access to all the HPE GreenLake for Private Cloud Enterprise services.

Administration

The service includes administrative tools that let you manage user identities and access privileges, define roles and policies, track resource consumption, monitor and showback expenses, and define tags based on user roles or organization.

Identity and access management

HPE GreenLake for Private Cloud Enterprise supports granular RBACs that let you tightly govern which specific users, or groups of users, can access specific resources and platform functions. It helps you create custom roles or choose from many predefined role categories. For example, you can organize users into groups, assign roles to individual users, user groups or API clients, and then grant them access to a specific resource space.

The service also supports multifactor authentication (MFA) to tightly control access to private cloud resources and services. MFA mitigates credential phishing, password theft, and other threats by requiring multiple forms of identification (SMS code, hardware token, biometric identifier, and more) to confirm a user's identity. You can use MFA to authenticate cloud or tenant admins and cloud consumers.

Policies

HPE GreenLake for Private Cloud Enterprise supports granular, administratively defined policies that let you govern the actions of cloud or tenant admins and cloud consumers. You can enforce policies globally or for individual users, roles, groups, or clouds. For example, you could institute a tag policy to force users to assign a tag when provisioning a VM instance or establish a quota policy to set resource consumption limits on a specific project.

Resource tagging

You can tag resources for showback purposes, as well as for tracking and policy enforcement. For example, you could associate a VM with an individual business unit or department.



Consumption analytics

HPE GreenLake for Private Cloud Enterprise provides a consumption analytics dashboard and detailed reports that give cloud or tenant admins visibility into private and hybrid cloud usage and cost information. The tools deliver a unified view of historical accounting data for both HPE GreenLake for Private Cloud Enterprise resources and public cloud resources (AWS, Microsoft Azure, Google Cloud Platform™).

You can use consumption analytics to compare your private cloud spend with your public cloud spend or to break out spending per service type (compute, storage, and more), location, or business unit for chargeback or showback.

Figure 1 is an example of the consumption analytics cost overview dashboard.

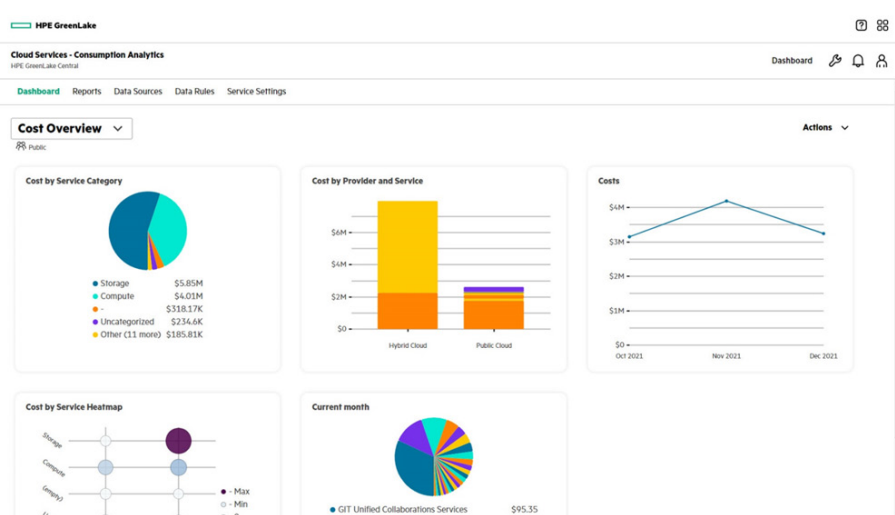


Figure 1. Consumption analytics cost overview dashboard

Capacity monitoring and management

Capacity planning functionality provides visibility into the utilization of compute, memory, and storage resources. Cloud or tenant admins can use it to track system capacity proactively and to identify trends and future requirements.

The functionality includes:

- Summary dashboards, meters, and bar charts that provide an at-a-glance visibility into resource utilization information
- Thresholds and alarms to notify you of capacity resource levels
- Detailed reports that let you track historical resource utilization data

Architectural overview

The solution is based on a scale-out design with standardized, modular hardware and software components for versatility and extensibility.

HPE GreenLake for Private Cloud Enterprise leverages cloud modules built with field-proven HPE technologies such as HPE ProLiant servers and HPE Alletra as an integrated system that delivers enterprise-grade performance and resiliency. Each of the compute and storage modules is presented as a compute instance type or a storage volume type that you choose to best suit your workload requirements.

HPE GreenLake for Private Cloud Enterprise provides various compute instances and storage volume types to satisfy a range of applications and workloads. The solution also includes comprehensive virtual networking functions to build, secure, and extend private cloud networks. Figure 2 depicts a single-rack HPE GreenLake for Private Cloud Enterprise configuration with the included cloud modules (compute, storage, and networking) and the control plane hardware components.



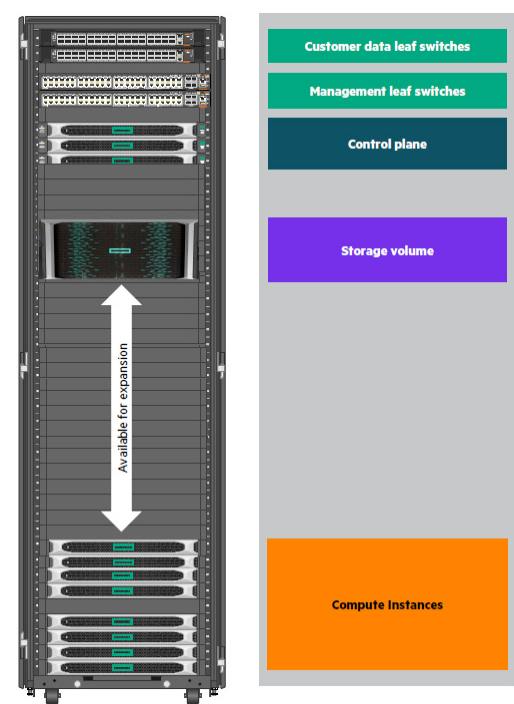


Figure 2. Single-rack deployment

Compute modules

Compute modules are designed for versatility, resiliency, and scalability. HPE GreenLake for Private Cloud Enterprise provides a variety of workload-optimized compute instance types (general purpose, compute optimized, memory optimized, and more) that support applications with varying compute and memory requirements. Table 1 provides examples of typical workloads supported by each instance type.

Table 1. Compute instance types and example workloads

Compute instance type family		Example workloads
General purpose		
For mainstream workloads	- Web and application servers - CI/CD pipelines (for example, Jenkins)	- ML Ops data preparation - EUC/VDI
Compute optimized		
For high-performance, compute-intensive workloads	- Container and VM orchestration - NoSQL databases	- Elasticsearch - CAE / EDA / molecular dynamics
Memory optimized		
For high-performance workloads with large datasets in memory	- In-memory databases - Analytics (Spark, Flink, and Presto)	- SAP S/4HANA® - Electronic health records (Epic)
Storage optimized		
For workloads with increased data storage performance and/or capacity requirements	- Splunk forward, index, and search - Splunk archive - Data lifecycle	- Traditional OLTP databases - Data lakehouse - Software-defined storage services



Storage modules

HPE GreenLake for Private Cloud Enterprise provides block storage options at various performance levels, as indicated in Table 2. Storage modules are available in one or more volume types ranging from 100 to 300 TB of usable capacity, designed to provide high availability and data durability with redundant critical components and advanced Triple+ Parity RAID technology.

Table 2. Storage volume types and example workloads

Storage volume type	Example workloads
Block storage—standard	
Cost-efficient flash storage for mainstream workloads	- Databases - Latency-sensitive applications - Web applications
Block storage—high performance	
Higher throughput and IOPS for performance-intensive workloads	- Highly transactional production databases - High-velocity streaming data

Networking

The service includes redundant high-performance 25/100GbE switches (leaf switches and spine switches) to accommodate intra-rack and inter-rack traffic, as well as redundant 1GbE switches to support out-of-band management traffic. The first rack of each multirack configuration includes a border-leaf switch that connects to the enterprise network. Networking modules are managed through Aruba Fabric Composer to enable software-defined networking.

Control plane

HPE GreenLake for Private Cloud Enterprise includes a control plane—a dedicated, redundant, dual-homed server cluster that performs internal system management, maintenance, and supervisory functions. The control plane is accessible and managed solely by HPE.

Scale-out architecture

HPE GreenLake for Private Cloud Enterprise expands to up to eight racks via a spine-leaf network architecture, as shown in Figure 3. Each rack can be configured with a different mix of compute and storage modules to support various use cases.

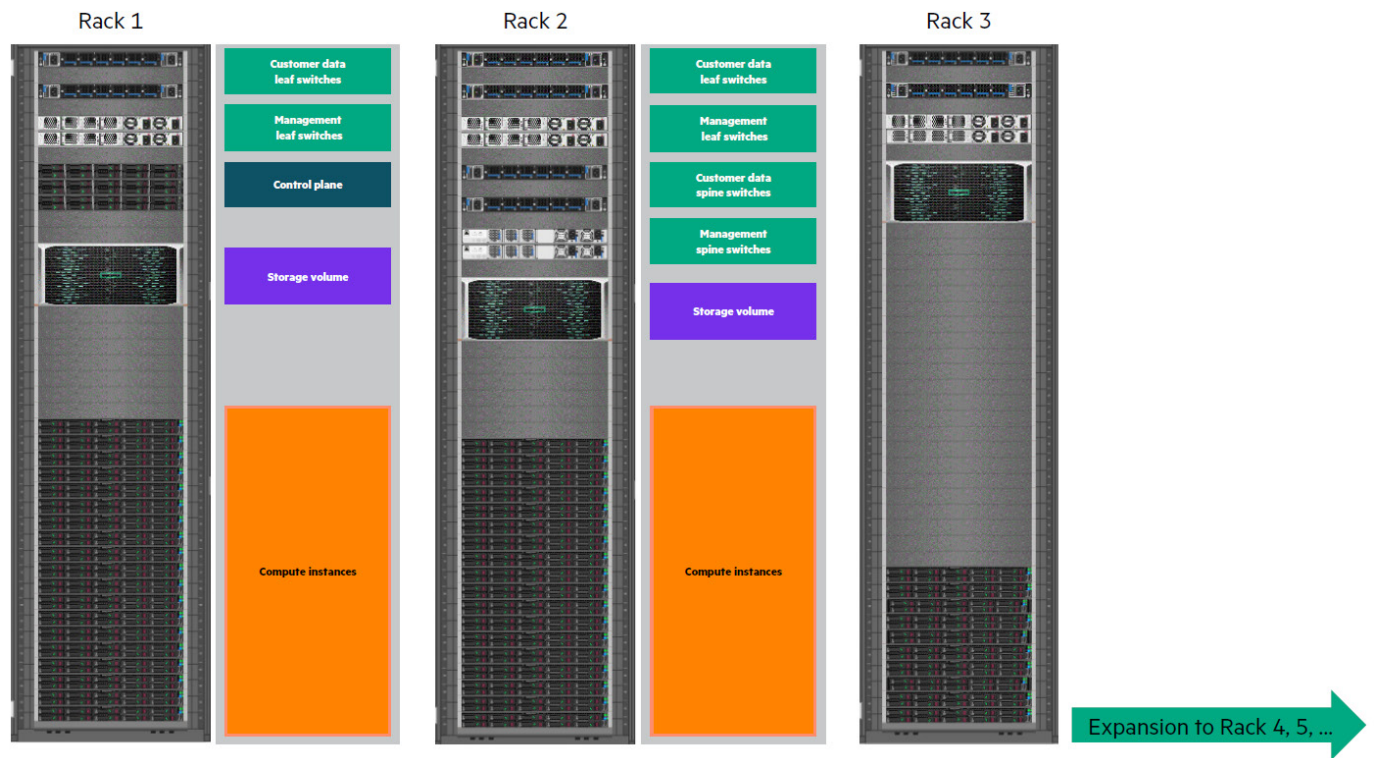


Figure 3. Multirack deployment



High-availability design

HPE GreenLake for Private Cloud Enterprise is designed to deliver high availability within a data center or a colocation facility. The solution includes:

- Redundant networking modules
- A resilient control plane cluster
- Resilient storage modules with redundant controllers and advanced RAID technology
- Dual-homed, workload compute modules

HPE GreenLake for Private Cloud Enterprise can be configured to support various metro area high-availability options for multisite deployments.

Multisite high availability for virtual machines

HPE GreenLake for Private Cloud Enterprise supports two options for enabling high availability across distributed data centers within a metro area.

- **VMware vSAN™ stretch cluster-based approach for virtual machines:** With this approach, you implement a VMware vSAN stretch cluster and replicate storage data across geographically distributed data centers. If a disaster or catastrophic failure occurs at one site, VMware vSphere® automatically restarts VM instances at the other site so you can recover applications with minimal service disruption.
- **VMware vSphere® Replication™-based approach for virtual machines:** With this approach, storage data is replicated across geographically distributed HPE GreenLake for Private Cloud Enterprise instances, VMware vSphere Replication is used to replicate virtual machines across sites, and VMware Site Recovery Manager™ is used to automatically orchestrate failovers, ensuring minimal downtime in case of a disaster.

Business continuity and disaster recovery options

HPE GreenLake for Private Cloud Enterprise can work with your existing backup or disaster recovery system, such as Veeam, Commvault, or Zerto, a Hewlett Packard Enterprise company. The HPE Pointnext Services team can assist with this integration.

Developer experience

Designed with a customer's DevOps and CI/CD frameworks in mind, the service includes various options for automated management and easy access to your private cloud resources, helping eliminate manually intensive and error-prone processes, and increasing agility.

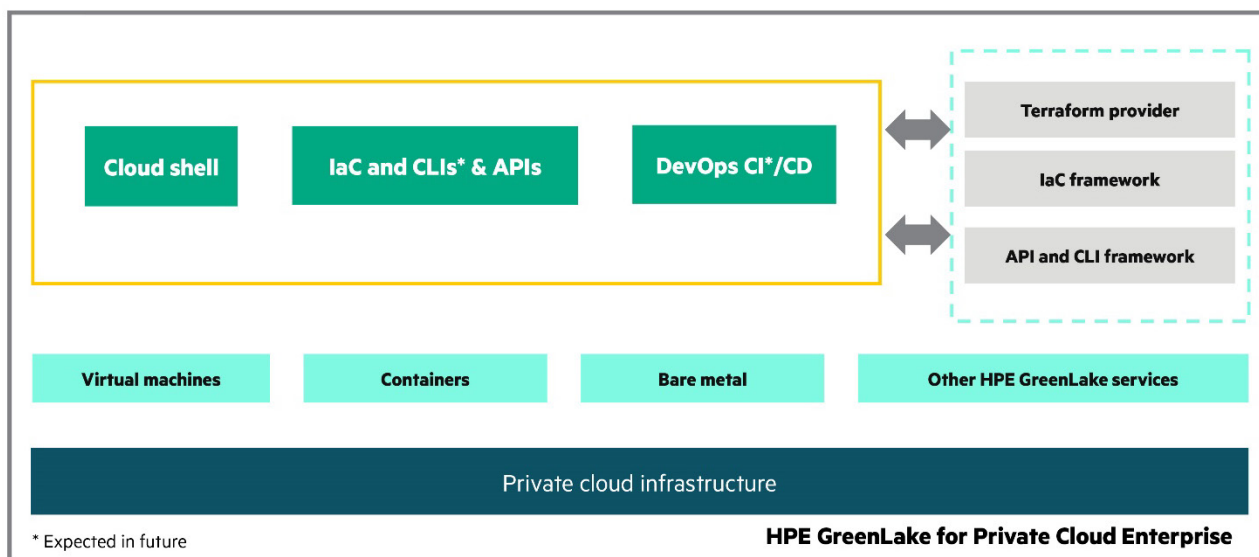


Figure 4. HPE GreenLake for Private Cloud Enterprise developer experience

REST Application Programming Interfaces

HPE GreenLake APIs provide a secure, standardized interface for automating common and repetitive tasks, programmatically configuring and provisioning services, and integrating applications with cloud services. The APIs are based on the OpenAPI specification and governed by administratively defined RBACs and strong authentication methods.

Infrastructure as code

Leverage IaC functionality offered by the HPE GreenLake Terraform Provider to provision and manage your private cloud resources. The Terraform Registry resources can be [downloaded from here](#).

Cloud shell CLI

Cloud shell as an interactive browser-based shell enables secure access to your HPE GreenLake for Private Cloud Enterprise resources. Development packages, orchestration tools and the latest IaC libraries are pre-installed as part of the cloud shell.

Additional configuration management tools

For the VM service, HPE GreenLake for Private Cloud Enterprise offers integrations with other popular configuration management platforms, including Ansible, Ansible Tower, Chef, and Puppet.

CI/CD pipeline integration

Integrate seamlessly with your existing CI/CD pipelines and processes using familiar tools and methodologies.

Cloud or tenant admins

- Set up and maintain the platform and initiate deployments
- Assign cloud resources
- Create and manage projects and deployment pipelines
- Manage user access to resources

Cloud consumers

- Access and leverage the platform and its resources
- Develop and deploy applications
- Enable and disable projects and deployment pipelines
- Monitor and manage the status of projects

As shown in Figure 5, cloud or tenant admins and cloud consumers can create DevOps projects—workspaces where authorized administrators and contributors can configure external connections such as GitHub, create and manage automated CD pipelines for external accounts, and associate Kubernetes container clusters with the deployment pipelines.

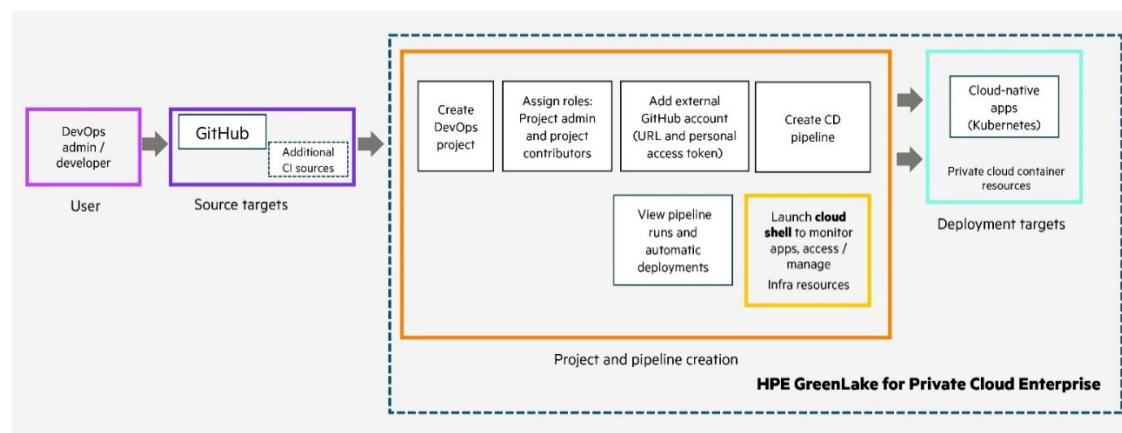


Figure 5. HPE GreenLake for Private Cloud Enterprise DevOps projects and pipelines

Managed service framework

HPE GreenLake for Private Cloud Enterprise is delivered as a managed service that HPE experts install and maintain, and govern through a shared responsibility model backed by enterprise-grade service level agreements.

Shared responsibility model

HPE GreenLake for Private Cloud Enterprise operates under a shared responsibility model.

HPE responsibilities include:

- Design, deployment, configuration, operation, monitoring, maintenance, and management of the physical compute, storage, networking, and control plane infrastructure
- Full lifecycle management for all underlying software (VMware ESXi, VMware NSX-T, Kubernetes, and others) and firmware (updates, patches, minor releases, and major releases)
- Implementation and software maintenance of all human and programmatic interfaces (GUIs, CLIs, and APIs)
- Implementation and software maintenance of supplemental administrative tools and services (consumption analytics and capacity monitoring)

Customer responsibilities include:

- Physical space, power, cooling, and physical security at a data center or colocation facility
- Internet uplinks and perimeter (network border) security
- Bare-metal host operating systems and technology stacks, VM guest operating systems, containers, workloads, and user and application data
- Application lifecycle management and configuration management
- Identity and access management (IAM) for cloud or tenant admins, cloud consumers, and applications

For additional information, see the [HPE GreenLake for Private Cloud Enterprise service data sheet](#).

Service-level agreements

HPE GreenLake for Private Cloud Enterprise is backed by the following service-level agreements (SLAs):

- For each bare-metal instance deployed in a single site, HPE guarantees a monthly uptime of at least 99%.
- For each VM instance deployed in a single-site high-availability cluster, HPE guarantees a monthly uptime of at least 99.5%.
- For each container cluster deployed with at least three Kubernetes control plane nodes in a single site, HPE guarantees a monthly cluster uptime of at least 99.9%.

See the [HPE GreenLake for Private Cloud Enterprise service data sheet](#) for additional information on SLA terminology, exclusions, credits, and claims.

Pay-per-use pricing model

HPE GreenLake for Private Cloud Enterprise features a simple pay-per-use pricing model that helps eliminate capital equipment expenditures, hidden fees, and surprise bills and closely aligns recurring operations expenses with fluctuating business demands.

The straightforward pricing structure includes two components:

- A fixed monthly cloud subscription fee based on installed capacity at customer premises, which can be used for running bare metal, virtual machines, and containers
- A variable monthly usage charge based on measured and metered bare metal, VM, container, and storage resource utilization



Additional resource

[HPE GreenLake for Private Cloud Enterprise service data sheet](#)

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