CloudBase with Red Hat Cloud Suite

Ultimate workload portability with cloud-native technologies

PENGUIN COMPUTING

Contents

Features

- Tightly integrated components that act in concert to provide an open hybrid cloud.
- A single management framework across infrastructure and application development layers.
- Complete operation and lifecycle management with proactive risk mitigation.
- Flexible container-based application development abilities via OpenShift Enterprise.
- Red Hat's open API exposure allows customers to enhance or replace existing components with their choice of existing technologies.

Benefits

- Achieve cloud-native workload portability.
- Build true hybrid clouds across private and public domains.
- Administer cloud infrastructure and app development workloads with a unified management framework.
- Modernize and deploy apps faster.
- Integrate and deploy apps in containers and virtual machines.
- Create a private cloud with public cloud-like scalability.
- Improve the performance, adaptability, and accessibility of your data platforms.

Cloud Challenges

Technology advances daily, but the move of compute environments to the Cloud is one of the biggest changes of the last decade. The belief was that the cloud would be easier and less expensive to use. In fact, most businesses moved to the Cloud to reduce total cost of ownership.

Cloud works extremely well for some, but not everyone fits into that category. A recently released survey by IDC reveals that 85% of respondents are now moving some or all of their compute environments away from the Cloud back to on-premises. Other surveys are showing similar results. Analysts predict that this "cloud repatriation" is expected to continue to grow.

The reasons that companies are repatriating some or all of their workloads from the cloud back to their core data centers can vary, but most often it is a result of workflow challenges, data gravity issues, workload mismatch and cost. This reality has produced a shift to a more inclusive definition of IT infrastructure that spans both on premises and cloud resources in a continuum that can be uniformly addressed with common tool sets.

In the end, Cloud computing turned out to be more costly for a lot of users than most originally thought. And not just in terms of dollars and cents:

Exponential Data Growth - Even though many businesses moved to the Cloud in order to reduce the costs of keeping data on-premises, as data grew, the costs increased as quickly as the data, The bandwidth to move data around is expensive and it is expensive to bring that data home. Data bottlenecks have also resulted in workload latency.

Loss of Expertise - Over time, as companies moved to the Cloud, they lost in-house expertise. Now, when they are moving back to core, they are challenged to find HPC and cloud-native technology experts. Engineers with the experience that they need are expensive and often hard to find.

Rapidly Changing Technology - Cloud vendors often restrict customers into using a preferred technology stack and cluster management tools with few, if any, options.

Security - Security is always a consideration when deciding where the data should reside and how it should be accessed. While many of the security considerations that companies had with Cloud services have been addressed, there remains highly confidential information that can never be placed in the cloud. Many companies have both confidential and not-so-confidential information that they must keep on-premises.

Enter what we at Penguin Computing call "Cloud 2.0", a cloud-appropriate rather than cloud-first approach. For many, as reflected in the surveys, this will involve repatriation -- bringing some of the compute capability and the data home. Whether repatriating from the cloud, or building a new private or hybrid cloud, this can be a daunting task, both technically and organizationally.

Companies need a cloud-first approach to their infrastructure that allows them to prepare for hybrid and multi-cloud strategies. They need cloud-native solutions created and supported by experts that have the tools they need to create an on-premises or hybrid cloud that supports containerized or virtualized workloads.

Penguin Computing CloudBase

Penguin Computing CloudBase™ with Red Hat® Cloud Suite is built on our optimized server building blocks and cloud-native technologies to orchestrate an on-premises or hybrid cloud environment that enables workload portability and infrastructure flexibility for containerized and virtualized applications.

Red Hat OpenStack Platform gives enterprises an open foundation to deploy, scale, and manage a private cloud. It combines Red Hat Enterprise Linux® Server and Kernel-based Virtual Machine (KVM) into a secure infrastructure—a combination that allows users to run OpenStack nodes (such as compute, storage, and management) like a public cloud, but in a private environment.

Red Hat OpenShift Container Platform virtualization allows organizations to take advantage of the simplicity and speed of containers and Kubernetes while still benefiting from the applications and services that have been architected for virtual machines.

You can combine CloudBase with other Penguin Computing solutions for HPC, Data, Cloud, and AI/ Analytics. When you combine the benefits from these different technologies, you can easily build complex, high-performance environments across many facets of your IT infrastructure.

CloudBase includes:

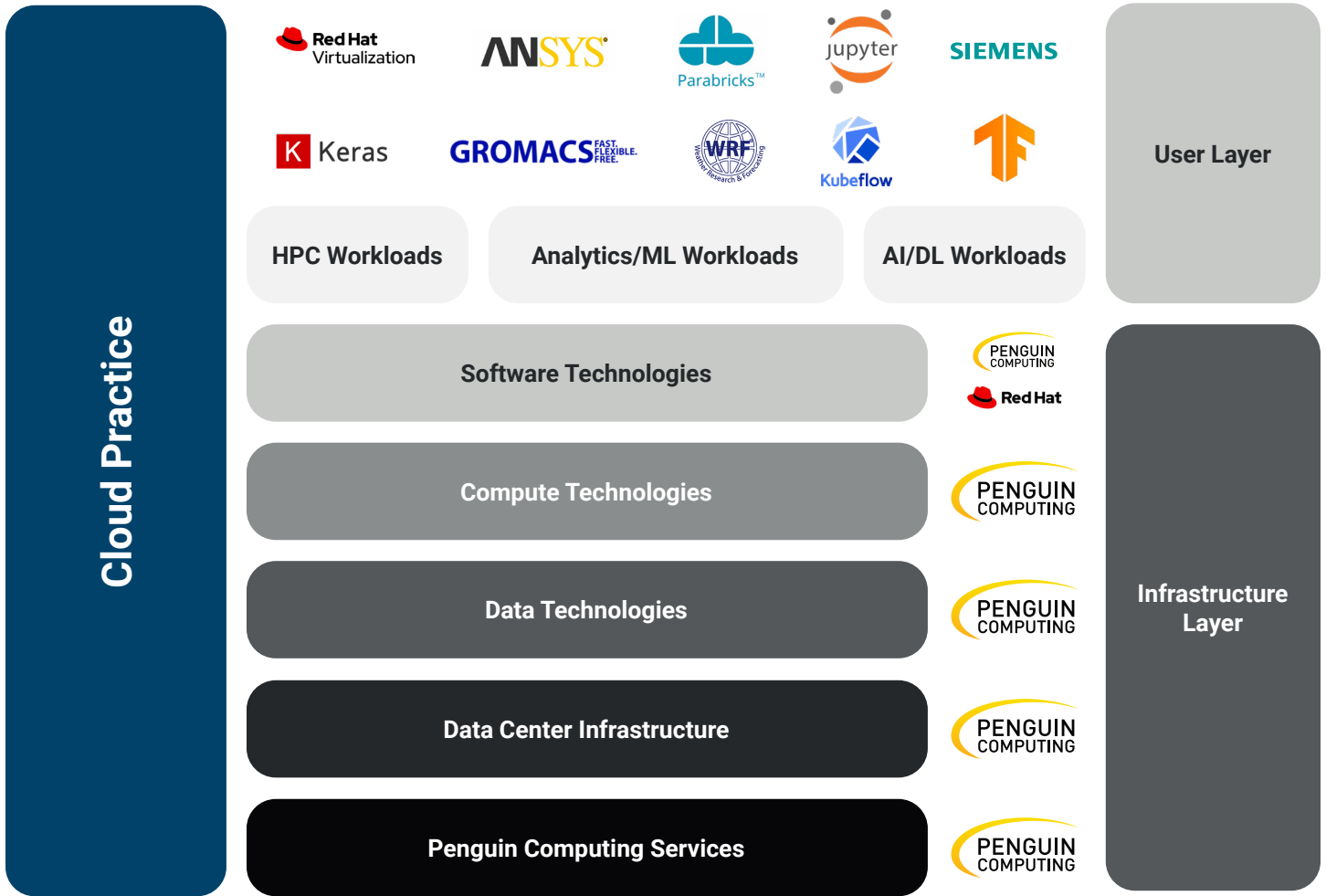**Software Technologies**

Compute Technologies

Data Technologies
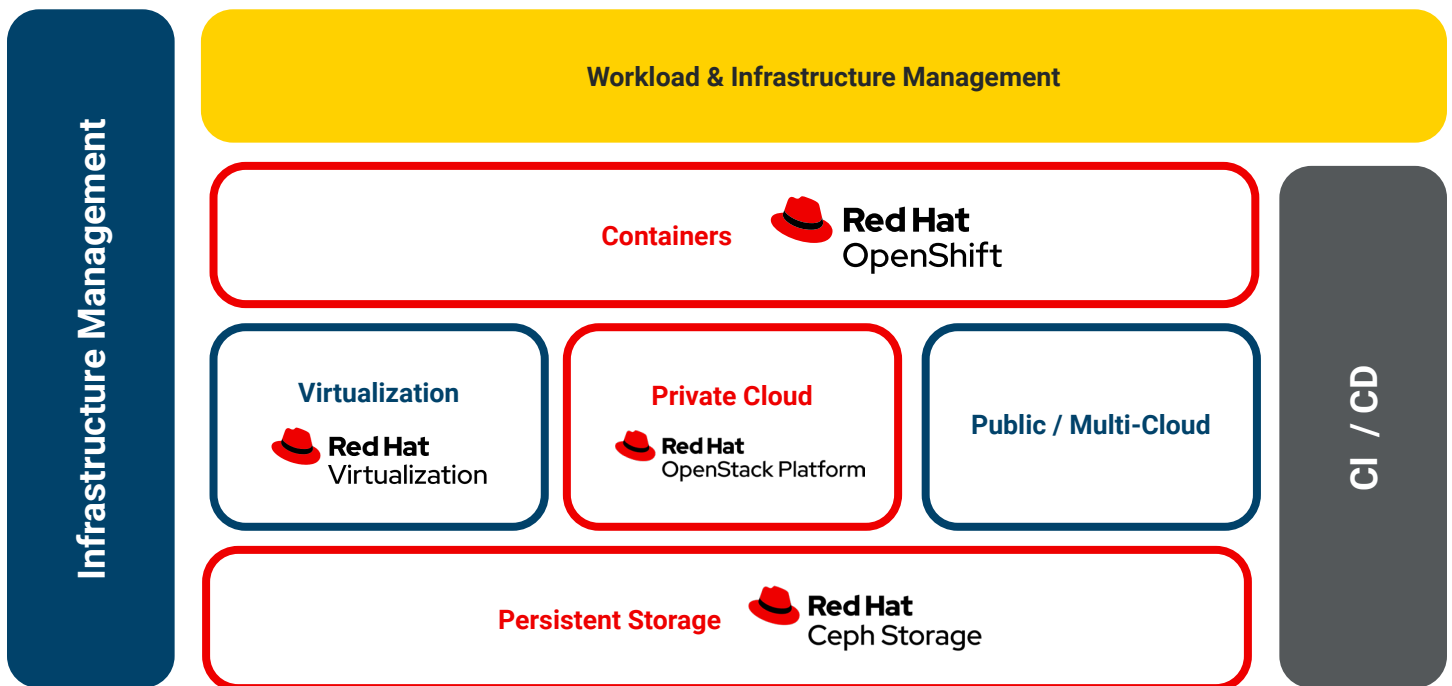
Data Center Infrastructure

Penguin Computing Services

Penguin Computing CloudBase Components

Cloud Practice

Red Hat Virtualization | ANSYS | Parabricks™ | jupyter | SIEMENS

K Keras | GROMACS FAST. FLEXIBLE. FREE. | WRF Weather Research & Forecasting | Kubeflow | TF

User Layer

| HPC Workloads | Analytics/ML Workloads | AI/DL Workloads |

Software Technologies — PENGUIN COMPUTING / Red Hat

Compute Technologies — PENGUIN COMPUTING

Data Technologies — PENGUIN COMPUTING

Data Center Infrastructure — PENGUIN COMPUTING

Penguin Computing Services — PENGUIN COMPUTING

Infrastructure Layer

Software Technologies

Red Hat Cloud Suite

CloudBase with Red Hat® Cloud Suite provides a container-based application development platform, built on massively scalable cloud native infrastructure, all managed through a common management framework. Customers can move existing workloads to scale-out cloud infrastructure and accelerate new cloud-based services for private cloud and application development. With CloudBase, an operations team can deliver public cloud-like services on premises to developers and business units while maintaining control and visibility. CloudBase enables a unified management framework to truly enable workload portability edge-to-core strategies to deliver the same user experiences on-premises or in public cloud environments.

Red Hat OpenStack and OpenShift

At its infrastructure foundation, CloudBase leverages Red Hat Cloud Suite to build a private cloud based either on Red Hat OpenStack® Platform with public cloud-like scalability, or Red Hat Enterprise Virtualization, based on high-performance virtualization. Both underlying choices provide secure, scalable foundations for hosting the Openshift Container Platform. OpenShift automates the development and administration of container-based applications.

Red Hat CloudForms, Satellite, and Insights

This marriage of infrastructure and application development is seamlessly administered by a unified, single management framework offered by Red Hat CloudForms and complemented by powerful lifecycle management from Red Hat Satellite. The solution also leverages a Solution-as-a-Service (SaaS)-based risk management tool, Red Hat Insights, that collects infrastructure analytics, allowing customers to quickly and proactively manage technical risks before they impact operations.

Red Hat Ceph Storage

CloudBase users can also make use of Red Hat Ceph Storage, an open, massively scalable, highly flexible software-defined storage system that is now bundled with Red Hat OpenStack Platform. Red Hat Ceph Storage is expertly architected and integrated into complete turnkey solutions on optimized Penguin hardware. Red Hat Ceph Storage is overwhelmingly preferred by OpenStack users because of its seamless integration with OpenStack's modular architecture and storage components.

Containerized, Cloud-Native Workload Portability

As cloud-native technologies like containers and Kubernetes mature rapidly, they are quickly becoming the preferred way to build new software experiences and modernize existing applications, workloads, and workflows at scale and across on premises to public clouds and multi-cloud. Creating value depends on the ability to deliver applications and workloads faster. This is being driven by the explosion of data-driven workloads in AI/ML, Analytics, IoT, and other emerging technologies. Cloud-native technologies are driving this innovation culture. Enterprise customers now seek container development platforms that accelerate and simplify

the development and operations (DevOps) of cloud-native apps wherever and however firms build and deploy them. CloudBase not only provides comprehensive container infrastructure lifecycle operations from the data center to the cloud to the edge, it also helps developers modernize apps and innovate workloads with integrated service catalogs and microservices, service mesh, and serverless features.

CloudBase powered by the Red Hat OpenShift Container Platform delivers a balanced blend of development and operations features that:

- **Simplify cloud-native app development with rich development services** — CloudBase draws developers in and jump-starts both development and app modernization with microservices frameworks, serverless support, continuous integration and delivery (CI/CD) integrations, dependency management, and app lifecycle management features like code quality checks and vulnerability scanning. CloudBase helps developers focus on business logic with comprehensive service catalogs and prebuilt DevOps automations and integration.

- **Enable distributed infrastructure operations from data center to cloud to edge** — Data-driven workloads are increasingly distributed and hybrid. CloudBase offers model-driven configuration, monitoring, security, and cluster lifecycle features for unified multi-cloud cluster operations. CloudBase extends operational control to the edge and supports thousands of clusters.

Customer Benefits

CloudBase with Red Hat Cloud Suite provides a common interface and technology stack for operations, IT administration, development, and lines of business. CloudBase includes a management framework across application development and infrastructure layers, along with complete operation and lifecycle management as well as proactive risk mitigation. Developers use CloudBase to gain rapid access to compute power and to continuously integrate and deploy applications across a broad range of languages and frameworks. Operators can simultaneously monitor and govern these services and applications across a hybrid infrastructure, from development to production. CIOs can now align better with business requirements, meeting market needs and customer requirements.

Key product advantages include:

- **Integrated components** — Tightly integrated, fully supported components that act in concert to provide an open hybrid cloud.
- **Unified management** — A single management framework across infrastructure and application development layers, plus complete operation and lifecycle management with proactive risk mitigation.
- **Full-featured application development and containers** — Flexible container-based application development abilities via OpenShift Enterprise.
- **Open and interoperable** — Leveraging Red Hat's open API exposure, CloudBase allows customers to enhance or replace existing components with their choice of existing technologies, enabling a true open technology approach.
- **Massive ecosystem** — It's easy to add networking, storage, and other cloud-native solutions, including Penguin Computing, Red Hat, and third-party products. In addition, leveraging Penguin engineered and optimized hardware to deliver a complete solution, CloudBase integrates into your on-premises environment and monitors activity in public clouds.
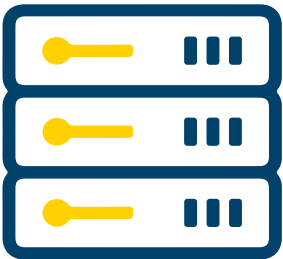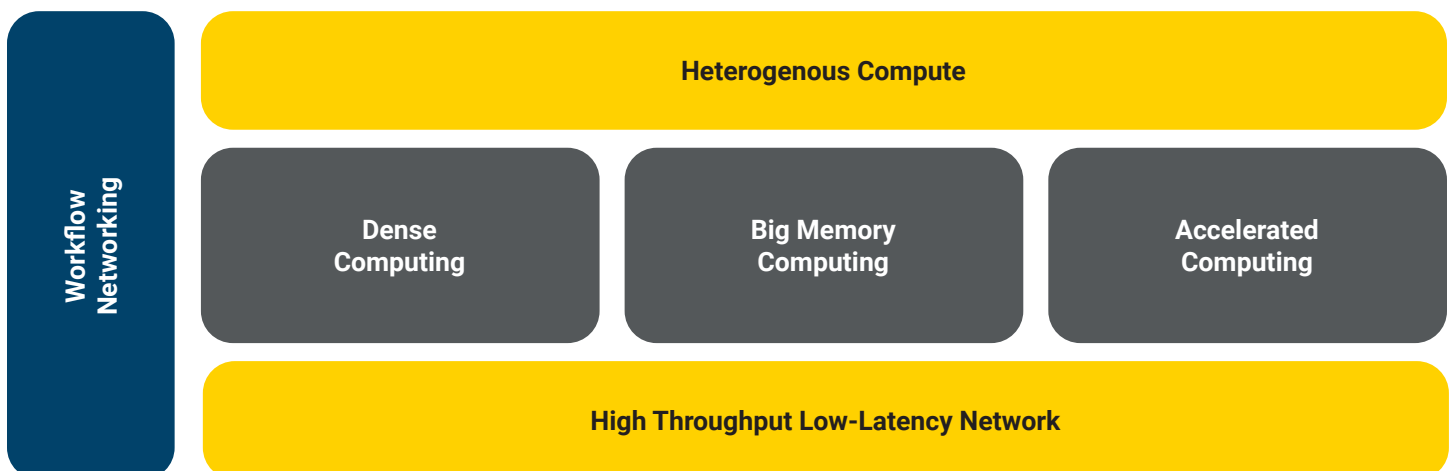
Compute Technologies

Heterogeneous Compute

CloudBase leverages industry-leading technologies from Intel, AMD, NVIDIA, and other technology providers to enable a complete technology ecosystem supporting many different workloads. HPC workloads often require high core count, high clock speed, high memory bandwidth, low latency communication, and/or accelerated computing using GPUs, FPGAs, and ASICs. CloudBase supports heterogeneous computing environments using workload-optimized server building blocks for many types of high-performance workloads.

Workflow Networking	Heterogenous Compute		
	Dense Computing	Big Memory Computing	Accelerated Computing
	High Throughput Low-Latency Network		

Workload-Optimized Servers

HPC workloads typically require a large number of cores and high core clock speeds to achieve the best performance possible. These workloads also require high-performance interconnects, because many HPC workloads span multiple servers, requiring constant node-to-node communication that benefits from high-throughput and low-latency network technologies. Optimized server building blocks for HPC workloads need to provide many cores with high clock speeds and low-latency, high-throughput interconnects to provide the best application performance possible.

Memory-centric workloads call for additional server memory resources to support applications that require extreme read and write performance and extremely low latency. Optimized server building blocks for big memory computing require as much memory bandwidth, capacity, and clock speed as possible to provide the best application performance.

Accelerated computing workloads require enterprise accelerators, such as GPUs, FPGAs, and ASICs to drastically improve the performance of certain applications. Optimized server building blocks for accelerated computing require in-system device-to-device communication optimizations to ensure that accelerators can communicate with CPUs, SSDs, NICs, and other accelerators without communication bottlenecks in order to provide the best application performance possible.
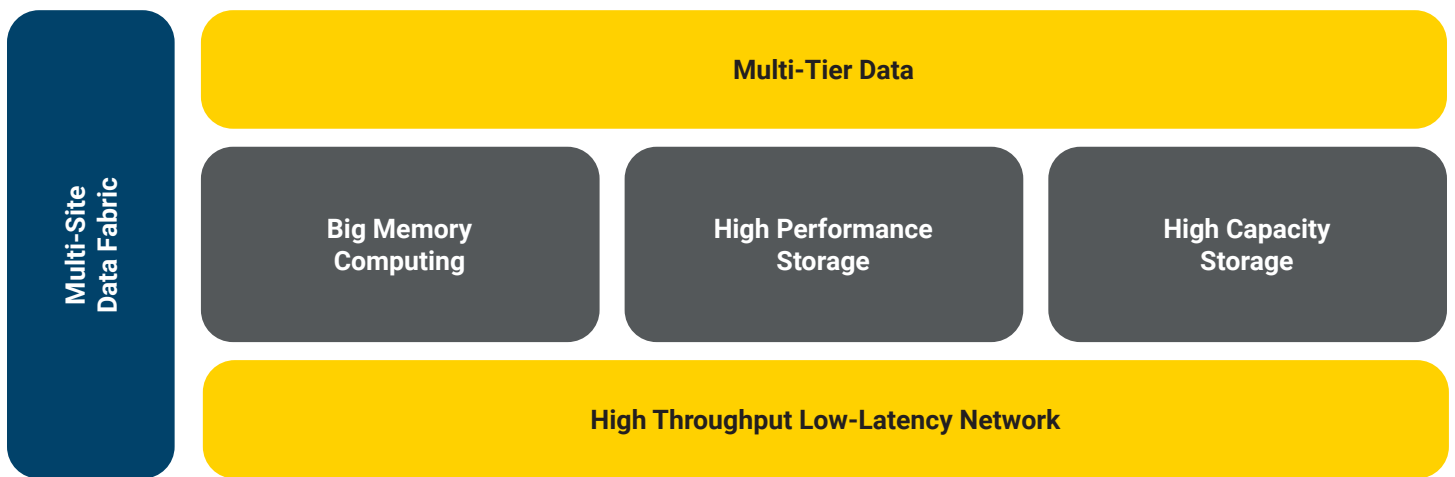
High Speed Low-Latency Interconnects

The CloudBase solution supports several high-throughput, low-latency networking interconnects that help maximize the performance of an HPC cluster for certain workloads.

Data Technologies

HPC is moving toward data-driven workloads that consume and generate large amounts of data. This data growth drives the need for data solutions that can scale to exabyte capacities. HPC environments have data requirements that create data workflow and infrastructure challenges related to management and orchestration.

Data I/O requirements weigh heavily on the overall success of an HPC solution. I/O patterns and performance vary across different tiers of storage in the environment — from memory, to flash, to cold storage. CloudBase integrates with the data solutions in Penguin Computing's Data Practice, which cover the entire spectrum of I/O — from memory, to flash, to cold storage — to support the entire data lifecycle.

Multi-Tier Data		
Big Memory Computing	High Performance Storage	High Capacity Storage
High Throughput Low-Latency Network		

Multi-Site Data Fabric

Big Memory Computing

Some HPC workloads can require massive memory storage or memory performance. By utilizing the LiveData™ solution, CloudBase can support memory-centric workloads that require high memory capacity, persistent memory, and high memory tier performance.

High Performance Storage

HPC workloads require high performance storage that can fulfill the ingest needs of high performance workloads. CloudBase can be paired with the ActiveData™ solution to provide high-performance storage for data-heavy computing workloads. Just as with CloudBase, the ActiveData solution can leverage the industry-leading technologies that are best suited for general or specific customer workloads.

High Capacity Storage

HPC workloads often ingest or output massive amounts of data that must be kept in a general purpose storage environment when not being used for computing. CloudBase can be paired with the DeepData™ solution to provide scale-out, capacity-optimized storage best suited for storing long-term data.

Multi-Site Data Fabric

Some HPC environments require connectivity to the cloud or another site. Some workloads might require cross organizational collaboration on datasets that span multiple locations. CloudBase can access data sets across the world as if they were local using the DataNexus™ solution.
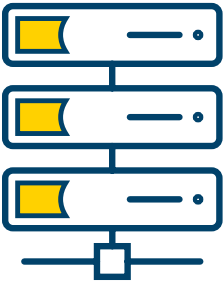
Data Center Infrastructure

CloudBase can be built using both a traditional 19" rack platform and a modern 21" OCP (Open Compute Project) platform. Traditional 19" rack infrastructures are supported in almost every data center worldwide and in a variety of dimensions. Modern 21" OCP rack infrastructures require data centers that can support the most demanding physical and power densities. Penguin Computing has partnered with leading data center facility pioneers who can support the demanding characteristics of today's HPC platforms.
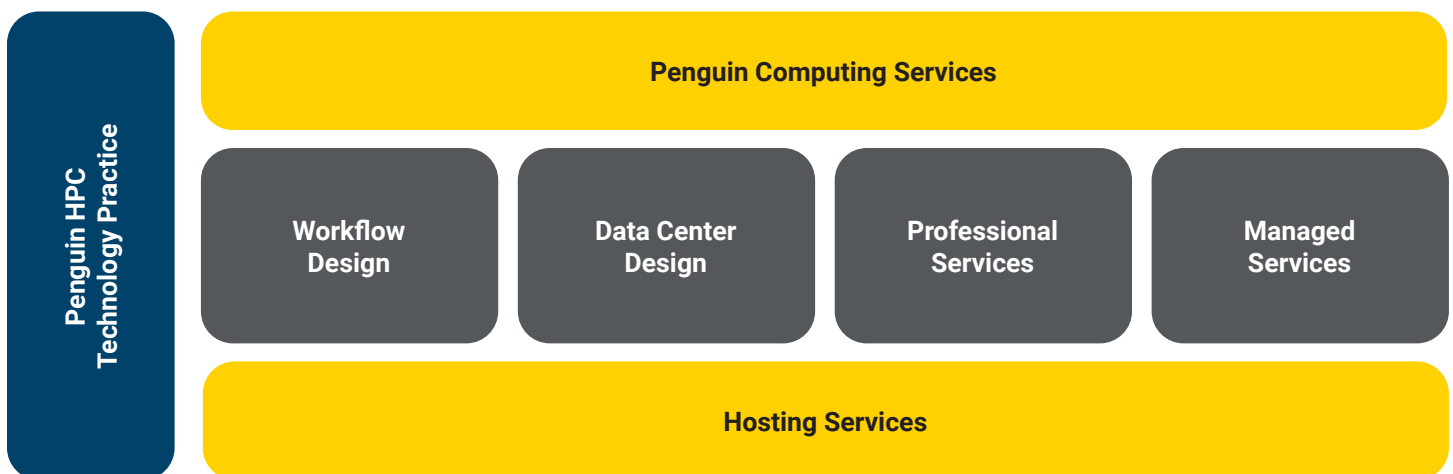
Power

CloudBase supports three-phase 50A or 60A, 208V, 277V, or 480V power options as well as A+B fully redundant power, or N+1 redundant power. 21" OCP also supports 12V or 48V power delivered directly to the servers, which enable much higher power density per rack.

Cooling

CloudBase can be air cooled with traditional HVAC equipment. Penguin Computing recommends using a combination of air cooling and liquid cooling when deploying CloudBase into a data center not designed for high-power equipment. Rear Door Heat Exchangers capture hot air exhaust at the rear of the rack, and can be deployed on most 19" and 21" rack infrastructures. CloudBase is also designed to integrate Direct-To-Chip cooling options that capture heat directly from the CPU block. This cooling solution removes 85% of server heat before it's transferred into the air, and can be used in select 21" infrastructures.

Penguin Computing Services

CloudBase is a comprehensive, end-to-end solution that organizations can leverage to jump-start their HPC initiatives. In some cases, the solution will directly meet the needs of the organization, right out of the box. However, most often there will be additional design, deployment, integration, and hosting considerations that need to be addressed.

Penguin HPC Technology Practice	Penguin Computing Services			
	Workflow Design	Data Center Design	Professional Services	Managed Services
	Hosting Services			

Penguin Computing provides services that consider rack and floor space, how to scale the environment, maximum rack power consumption, power phase balance, efficient heat removal, and the optimal networking topologies when using low-latency, high throughput interconnects.

CloudBase is supported by Penguin Computing engineering services, including Design Services, Professional Services, Managed Services, and Hosting Services.

Design Services

Workflow Design
- Software Orchestration
- Compute Performance
- Multi-Node Communication
- Data Storage and Data Tiering
- Data Ingest and Egest
- Environment Sizing

Data Center Design
- Rack and Floor Space
- Environment Scalability
- Maximum Power Consumption
- Power Phase Balance
- Efficient Cooling and Heat Removal
- Optimal Networking Topologies

Professional Services

Stand Up and Initialization
- System Burn-In Testing
- Racking and Cabling
- Software Installation & Tuning
- On-Site Deployment and Integration

Hosting Services

Data Center Hosting
- Penguin Data Center
- Customer Data Center
- Power, Space, and Cooling Management
- Monthly or Annual Billing (As-A-Service)

Managed Services

System Administration:
- Complete Hands-Off Experience
- Augment Existing IT Capabilities
- Collaborate with Penguin Support
- Tens to Thousands of Servers
- Terabytes to Exabytes of Data
- Multi Data Center Support

Data center hosting services are offered through Penguin Computing's strong partnerships with data center service providers. Our partners can provide the space, power, and cooling CloudBase needs — as a service.

Conclusion

CloudBase with Red Hat® Cloud Suite is built on our optimized server building blocks and cloud-native technologies to orchestrate an on-premises or hybrid cloud environment that enables workload portability and infrastructure flexibility for containerized and virtualized workloads.

CloudBase provides a single, secure, end-to-end solution for on-premises or hybrid cloud computing that includes a flexible, scalable, workload-optimized compute infrastructure and proven tools that unify your on-premises and cloud resources.

CloudBase frees organizations from having to focus valuable time and human resources on creating clouds from scratch, allowing them to lower TCO, reduce risk, and accelerate time-to-innovation.

Penguin Computing can apply our decades of experience to create quality, integrated solutions for our clients. We offer a wide range of professional and managed services that can quickly bring your HPC initiatives to production.

Contact Us

Use this **form** or call Penguin Computing today at 1-888-736-4846 to find out how you can use CloudBase to jump-start your on-premises or hybrid cloud with cloud-native workload portability.

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Expanding the world's vision of what is possible