Red Hat

Hybrid cloud and Kubernetes:

A guide to successful architecture

Table of contents

Executive summary

The goal of hybrid cloud is to ensure that you can emphatically answer "yes" to these three questions:

▶ **Can your software applications help you win against big and small threats that aim to upend your entire industry?**

▶ **Can your applications and infrastructure become a source of lasting competitive advantage?**

▶ **Can your people, processes, and culture adapt and use technology to truly transform your business for the long term?**

When you look across your ever-evolving application portfolio, you'll likely see a mix of architectures, technologies, and frameworks that have built up over time. Some of the changes were planned, some of them just happened by accident, and some of them were in response to new conditions and opportunities. Those applications are running across multiple infrastructures, spanning your datacenter, to one or more public clouds, and possibly out to the edge.

This hybrid mix of applications and infrastructure is the reality for most enterprise organizations today, and managing it all can be a major challenge.

Your hybrid cloud architecture can either be an anchor to the past—or a booster rocket to accelerate your innovation.

At Red Hat, for much of the past decade we've been talking about open hybrid cloud—a holistic view of hybrid cloud that also incorporates open practices—and have led the way in hybrid cloud, helping thousands of companies on their modernization journeys. This journey mirrors what we started with many of these same companies years ago when we helped them introduce Linux® and open source technologies into their organizations.

We've collected what we have learned from partnering with our customers and compiled the best practices in the following pages. I hope this e-book provides you with a better understanding of the current state of hybrid cloud—and how to gain the most value for your business.

Stu

Stu Miniman
Director of Market Insights | Cloud Platforms Business Unit, Red Hat

Frequently asked questions

Here are quick answers to some common questions about hybrid cloud.

What is a hybrid cloud?

The National Institute of Standards and Technology (NIST) defined hybrid cloud a decade ago as "*cloud infrastructure that is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).*"[1]

⊗ **Where we disagree:** For most organizations, the notion of unconstrained data and application portability or cloud bursting was never realistic. Much has changed in the last decade, and managing across these distributed environments is a significant challenge.

⊘ **Where we agree:** Organizations rely on a mix of datacenter, private cloud, and public cloud infrastructure environments to support an array of traditional and cloud–native applications and services to run their business.

Enabling these hybrid application deployments across a hybrid cloud infrastructure environment is a strategic imperative for organizations.

▸

Isn't everything just moving to the public cloud?

For most mid– to large–sized enterprise organizations, moving everything to the public cloud is not realistic. While public cloud adoption continues to grow, some enterprise applications and data aren't a good fit for the public cloud today. This challenge could be due to corporate governance, security, and compliance, application and data affinity, or simply having more comfort with certain information and applications remaining "in house," in your own datacenters.

We do, however, see customers using multiple clouds, deploying certain applications on different public cloud providers, driven by cost, capabilities, and a desire to reduce their dependence on a single cloud provider. Further, when you invest in edge deployments, you'll have your applications running closer to the source of the data. So a hybrid cloud approach that spans all of these environments is increasingly the reality for most enterprise organizations.

▸ **More on transforming infrastructure on page .**
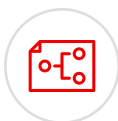
How do Linux, containers, and Kubernetes fit into the hybrid cloud discussion?

Linux, Linux containers, and Kubernetes serve as a common abstraction layer across a hybrid cloud environment. When an application is packaged and run as a virtual machine (VM), its packaging is specific to the VM hypervisor platform—i.e., vSphere, Kernel-based Virtual Machine (KVM), Hyper-V, etc.—that may be different depending on the environment. This limitation affects application portability. However, when an application is packaged as a Linux container, its only dependency is Linux itself, and Linux is widely available in the datacenter and is used in every public cloud and at the edge. The emergence of industry-standard Open Container Initiative (OCI) container image and runtime formats means that containers are packaged and run consistently across all environments. Likewise, the emergence of Kubernetes as an industry standard for container orchestration means that containers are orchestrated and managed consistently across environments. Therefore, Linux, Linux containers, and Kubernetes combine to enable a standardized way to package, run, orchestrate, and manage across a hybrid cloud environment.

▸ **More on .**

What is an open hybrid cloud?

Open hybrid cloud is Red Hat's recommended strategy for architecting, developing, and operating a hybrid mix of applications across a hybrid mix of infrastructure environments. This approach brings the interoperability, workload portability, and flexibility of open source software to enterprise environments.

Open hybrid cloud is about creating an abstraction layer that can help enterprises manage their diverse application portfolios across an increasingly diverse infrastructure environment. This approach brings a consistent interaction with any application in nearly any environment without retooling the app, retraining people, splitting management, or sacrificing security. And because it's all open source, your data will move with you—no matter where tomorrow takes you.

▶ **See page 25 to learn how Red Hat delivers solutions for hybrid cloud.**

Does a hybrid cloud strategy result in "least common denominator" cloud usage?

This concern existed before the emergence of containers and related open source cloud-native technologies. One of the primary reasons we see for the use of multiple clouds is to take advantage of the differentiated capabilities of each cloud provider. A hybrid cloud architecture built on Kubernetes will allow access to the best innovations from each cloud provider and the surrounding ecosystems. Other advantages of a hybrid or multicloud strategy include data locality, cost management, and the freedom to choose your cloud provider. The enterprise customers we work with have thousands of applications, some that are tied to the datacenter, others that are deployed across one or more public clouds, and many that rely on applications deployed at the edge.

By having a solid hybrid cloud strategy, you're able to reap the best benefits and value from each of the various infrastructures. With a platform like Red Hat® OpenShift®, our customers are able to deploy and run applications across all of these environments with a consistent experience that allows them to standardize development and operations—while choosing the best cloud for each application.

> "'Hybrid cloud' and 'multi cloud' are the same thing now. Converged management model, single management backplane. The choice going forward is between infrastructure and higher level managed services."[2]

RedMonk

James Governor
Analyst and Co-Founder

Hybrid for the next decade

Much has changed from the early days of cloud computing, and the cloud landscape continues to evolve.

Enterprise organizations have broadly adopted cloud computing over the past decade, and that adoption continues to grow unabated. As more organizations use public cloud services and adopt cloud-native application development practices, we have seen some clear trends emerge. First, although companies continue to build new cloud-native applications and modernize existing applications to cloud-native architectures, this approach still represents a small percentage of the total applications they rely on to run their business. Second, even as these organizations increasingly move applications to the public cloud, we see the majority of their existing applications still remaining in the datacenter, while many enterprises are also adopting multiple public cloud services. In addition, a growing number are planning to run applications at the edge.

Most enterprise organizations have application portfolios and infrastructure environments that are inherently hybrid. These organizations must manage an expansive application portfolio that spans a variety of technologies from different eras—and a number of different infrastructure footprints. Even though most customers aren't regularly moving applications between environments, their application portfolio does run across a mix of datacenter, cloud, and even edge environments. Meanwhile their application architectures are also evolving from traditional monolithic and n-tier applications to cloud-native[3] architectures, and they're making better use of data to provide greater intelligence to those applications.

> **"Our choice of Red Hat OpenShift is recognition of the importance of containers and the need to operate in a hybrid world. It provides workload mobility, so any app of our apps can run anywhere, regardless of the underlying architecture."[4]**

BlueCross BlueShield of North Carolina

Petar Bojovic
Director of Technology Infrastructure

---

3 *Cloud-native application development is an approach to build and run responsive, scalable, and fault-tolerant applications anywhere—be it in public, private, or hybrid clouds. Red Hat*

4 *Red Hat case study. "Insurance provider saves 70,000 work hours with Red Hat." May 13, 2020.*

Example of hybrid cloud in practice:

A large bank may have a mix of traditional Java™ and .NET applications running in their datacenter, some of which were built in-house and others that came in through acquisitions. These applications may even interface with older monolithic applications running on the mainframe. The bank may have modernized a portion of their application portfolio or built new applications using SpringBoot, Node.js, or other frameworks, and, in doing so, they also moved some of these applications to a public cloud. Perhaps the bank acquired a FinTech start-up a few years ago in an effort to respond to their need for a mobile banking app. The bank is also building new artificial intelligence (AI) capabilities to gain insights from their customer data and infuse more intelligence into their applications. Finally, the bank is planning new edge deployments to get closer to the sources of that data and closer to their customers.

Using our example, this bank didn't seek out a hybrid cloud strategy across both their applications and infrastructure—its IT environment is inherently hybrid in nature. While this example may not exactly describe your own IT environment or industry, you can see the reality that many organizations face.

The challenge for companies is to move from "*hybrid by accident*,"[5] to an approach that embraces the **hybrid requirements of applications, infrastructure, and skills.**

As we look back 10 years, we've seen the incredible pace of change in the IT landscape since the early days of the cloud. As we look ahead to the next 10 years, we see continued evolution and competitive advantages emerging when organizations embrace a hybrid architecture and mindset.
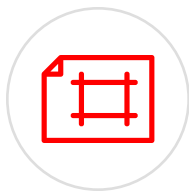
We've defined three pillars that determine hybrid cloud success for organizations.

Pillar 1. Transform your applications

Software applications are transforming businesses in every industry. Whether it's to create new commercial products and services, find new ways to understand and engage with customers, stave off competitive threats, or even manage unprecedented global events, organizations will continue to demand new applications. As a result, development teams must keep pace and identify new ways to build those applications and deploy them faster.

Your current application portfolio may consist of a hybrid mix of architectures and technologies that have evolved alongside the organization. This portfolio likely spans traditional, monolithic,[6] and n-tier[7] applications to cloud-native applications built on newer microservices architectures and application programming interfaces (APIs). Perhaps you're even adding more intelligence into applications with data analytics and artificial intelligence and machine learning (AI/ML). In addition to custom application development, you also likely rely on independent software vendors (ISV) or Software-as-a-Service (SaaS) providers for packaged solutions, which may include enterprise resource planning (ERP), customer relationship management (CRM), or other technology or vertical-specific packaged applications and services. These prebuilt applications provide out-of-the-box solutions to many common business problems. Most organizations will integrate and extend these purchased applications with their own applications, resulting in a blend of custom and ISV solutions.

Reconciling the application estate

Some of your existing applications may be decades old, but they're still critical to your business. These enterprise applications tend to be Enterprise Java, Microsoft .NET, C/C++, and even mainframe-based systems. They provide the foundation that you rely on, and that reliance will continue well into the future—even if those applications need to be augmented with new services to address more contemporary customer demands.

---

6   *A monolithic application is self-contained and independent from other computing applications." –Wikipedia*

7   *"A client–server architecture in which presentation, application processing and data management functions are physically separated." –Wikipedia*

Ultimately, you'll need to assess your existing applications to determine whether to rehost, refactor, replatform, or just leave them as is.

Rehosting, to simply lift and shift applications to the public cloud, may seem appealing, but it's rarely that simple. Typically, traditional applications may not be well suited to a cloud environment, and the operational expenses can cost more than the value of moving them out of the previous environment.

Refactoring applications to cloud-native architectures can provide many benefits, but this process could involve a significant amount of effort. Modernization likely won't be feasible for all of your existing applications. You may need to take an incremental approach to break down some of your existing monoliths and decide which ones to leave alone.

Replatforming applications from virtual machine or bare-metal environments to containers can be a middle ground to bring the benefits of container portability, immutability, and automation, while limiting the cost of a full application refactoring effort. This approach can help you abstract those applications from the underlying infrastructure and enable them to be cloud ready.

We see customers undertake a mix of these approaches as they determine the best way to maintain their application estate.

"Our developers can work faster and smarter to build more applications for our customers, instead of spending time on infrastructure. ... With Red Hat OpenShift's automation capabilities and a continuous delivery approach, we're seeing features and applications getting to market five times faster."[8]

Boehringer Ingelheim

Clemens Utschig-Utschig

Head of IT Technology Strategy & CTO

8 *Red Hat case study. "Top-20 pharmaceutical company delivers services 5 times faster with containers." Jan. 15, 2021.*

Injecting intelligence in those applications

To make cloud-native applications built with microservices even more intelligent, add data analytics, AI/ML, and event-driven architectures. Technologies like cloud-native storage, NoSQL databases, and Apache Kafka can help manage the large amounts of data you're gathering. More intelligent applications can turn insights into actionable decisions by mining and considering more data. Data analytics and AI/ML use is more pervasive and useful than the hyperbolic examples shown in popular television shows and movies. Your organization is creating and collecting exponentially more data than ever before—but how can you make sense of it all in microseconds and derive business value? We have found that AI/ML can be very effective.

You'll find the greatest data benefits as you move from seeing *what did happen*, to predicting *what will happen*. Then, you can accentuate the good, avoid the bad, fix the unintended, and create more advantages as you lower your risks. That can only happen with the help of data analytics and AI/ML to ingest, process, analyze, and make those data-driven decisions and recommendations.

"Our old approach involved several teams and lots of rounds of approvals, and we'd need sometimes as long as six weeks to develop an application. Today, with Red Hat OpenShift, we can have a prototype available within hours."[9]

PORSCHE
INFORMATIK

Simon Waldner
System Engineer
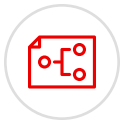
Enabling serverless and event-driven architectures

Serverless is the umbrella term for the deployment model focused on the developer experience. Serverless allows your developers to build, deploy, run, and manage applications without requiring deep insight into the underlying infrastructure.

The serverless capabilities in Red Hat OpenShift are based on the Knative open source community project, which enables developers to build, deploy, run, and manage event-driven applications. These applications will start based on an event trigger, scale up resources as needed, then scale to zero—across a hybrid cloud environment.

Function-as-a-Service (FaaS) is a subset of serverless solutions and a way to implement serverless computing to provide an event-driven execution model. Those functions manage server-side logic and state through the use of containers or by calling cloud provider services.

FaaS offerings like AWS Lambda, Google Cloud Functions, and Microsoft Azure Functions enable FaaS in the public cloud.

The hybrid application advantage

Your development resources are valuable and finite.

Applications must be able to be created and updated to meet the needs of the business. Linux, Linux containers, and Kubernetes allow the application activity to be independent from the underlying infrastructure. A hybrid architecture that supports a broad spectrum of application types with consistent tooling and processes can significantly increase overall development productivity.

This brings us to our second pillar of a hybrid cloud strategy: Transform your infrastructure.

Pillar 2. Transform your infrastructure

Diverse enterprise applications run across a hybrid infrastructure environment. And while most large enterprise organizations have started to deploy applications to the public cloud, few, if any, have been able to completely eliminate their datacenters. As the migration of applications to the cloud grows, so does an organization's tendency to adopt multiple public cloud services. Finally, new application requirements for data access and latency are also leading the emergence of edge deployments. Expecting to rely on a single infrastructure platform is not only futile, but it also limits future innovation and agility. However, embracing differing infrastructures for those applications can provide an advantage for your organization. Many organizations find themselves with a hybrid cloud approach before any official strategy is determined. Company acquisitions that bring together disparate IT environments can contribute to this situation, as does "shadow IT" where developers start using public cloud instances for projects with the swipe of a credit card.

Abstracting applications from infrastructure

Being "hybrid by design" allows your teams to unlock the distinct innovation from different environments and their respective ecosystems, without having to create customized processes and teams for each area. When your infrastructure footprints are isolated due to disparate tooling and skill requirements, you're incurring additional management costs without gaining the full benefits of hybrid cloud. To be successful, you need to abstract applications from the underlying infrastructure and provide a consistent operating environment—regardless of where those applications run.

> "With Red Hat, we can now share hardware resources easily without buying additional servers, antivirus software, networking components, or other software licenses."[10]

ALLIANCE BANK

Lee Choo Yee
Head of Digital Innovation & Design

10   Red Hat case study. *"Malaysian banking group modernizes branch banking with tablet-based experience." Feb. 4, 2021.*

Linux containers and Kubernetes provide a consistent abstraction layer for microservices across any environment. When applications are packaged as Linux containers, their only dependency is Linux itself, and Linux is pervasive across datacenters, public clouds, and edge environments. Kubernetes is the industry standard for orchestrating and managing containers on Linux across those environments. It provides the platform for an effective hybrid cloud infrastructure architecture where your application portfolio can be packaged, deployed, orchestrated, and managed consistently in any environment for developers, operators, and security teams.

> "Red Hat helped us modernize our technologies, which is not easy in a highly regulated industry, and in doing so, helped us offer our customers more innovative and competitive solutions."[11]

EMPLOYERS®

Jeff Shaw
Exeutive Vice President and Chief Information Officer

Operating at the edge

The term "edge computing" is thrown around quite a bit these days as an amorphous technology buzzword—but it's so much more. Edge computing offers two main benefits:

01 It allows applications that process data to run closer to the source of where the data is being created or collected. This ability is why we see an intersection between the growth of AI and edge deployments.

02 It supports applications that need to run closer to customers or to critical infrastructure, which is a key enabler for telecommunications service providers deploying 5G services.

When processing data, if anomaly detection and decision making can't wait, edge is the likely solution. Because of latency, datacenters and public clouds are simply too far for some applications to be effective. With edge computing, instead of bringing the data to the analytics or AI/ML software, you bring the software to the data. Microsecond decision making in autonomous cars is one example, but use cases

span all industries including manufacturing, retail, finance, and healthcare. Edge computing is just another example of a hybrid cloud infrastructure footprint. Its many use cases put to rest any doubt that environments will be hybrid and dispersed for the foreseeable future.

The hybrid architecture advantage

When your application portfolio can run consistently across your entire infrastructure environment, you're starting to unlock a key advantage of a deliberate hybrid cloud architecture.

As your evolution continues on multiple infrastructures, you'll want simplicity and control for your operations team, with contemporary tooling for your developers. This consistency for developers, operators, and security teams is vital—and a key benefit of doing hybrid cloud exceptionally well.

"Insights and innovations are happening at a rate that we've never seen before. It's an exciting time at UPS, and Red Hat is a significant partner in that transformation."[12]

Nick Costides

President, Information Technology

Pillar 3. Transform your people, process, and culture

Your organization will ultimately need to manage applications and infrastructure across all of your IT environments. Your IT team, like the applications and infrastructure they are responsible for, will consist of a hybrid mix of experience, skills, and processes, from long-established practices to more modern approaches. Just as your technology must evolve and work together, so too must your organization. While the first two of our pillars are about the technology, this final pillar is about how you make it all work. It describes the concurrent transformation of organizational processes, people, and culture that is required for successful digital transformation efforts.

In a cloud-native world, proper execution makes all the difference. According to Harvard Business Review, 63% of global executives rank cultural challenges as the biggest impediments to transformation efforts.[13] Building an innovative culture not only creates a competitive advantage—it also sustains it. Individuals seek out companies that empower them, provide the latest tools, and offer the support to succeed. If your organization does this well, you'll be recognized as the workplace that retains and hires the best talent.

63% of global executives rank cultural challenges as the biggest impediments to transformation efforts.[13]

Harvard Business Review

"We used to compare ourselves to what other banks were doing. Now, we no longer care, because we have the platform we need to choose our own path. We can innovate, fail fast, embrace new technologies, and find our own way in this new era of banking."[14]
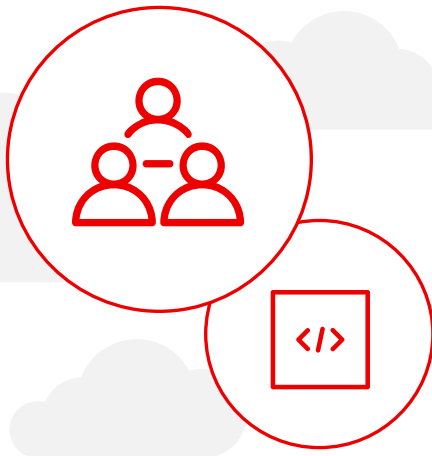
bank hapoalim

Dani Sela
Tech Transformation Lead

---

13 Harvard Business Review. "Rethinking digital transformation." A pulse survey sponsored by Red Hat, 2020.

14 Red Hat case study. "Israel's largest bank builds app platform on Red Hat OpenShift." Dec. 7, 2020.

The vision: Hybrid operations + hybrid development

No lasting cultural change in an organization takes place overnight, which is why we repeat our mantra that enterprise digital transformation is an evolution, not a revolution. Development and operations teams represent one example of this philosophy in practice.

Hybrid operations

Your IT operations team widens their aperture from managing infrastructure in traditional datacenters to also managing services in public clouds.

Their focus shifts to managing services, not just servers, and they have a desire to automate everything.

Regardless of where your developers want to build, deploy, and run apps, your operations team must be armed with the tools and skills to meet those needs.

This is hybrid operations.
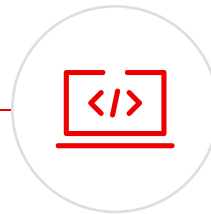
Hybrid development

Your global team of developers evolve their skills, tools, and processes to embrace the cloud-native development model.

They focus on how to use cloud-native architectures to gain agility and get apps to production faster, while also making better use of data to inject more intelligence into their applications.

While growing those skills, they're also maintaining the estate of traditional applications to keep your business operating.

This is hybrid development.

Bridging dev and ops with automation

When your teams work together (instead of in disparate environments), you'll find that your organization increases the quantity and quality of software releases and gains better end results, no matter where that product is deployed. New processes like agile methodologies and continuous integration/continuous delivery (CI/CD) will take hold and displace waterfall development and manual deployment processes. DevOps initiatives and culture will promote greater collaboration and efficiencies between your developer and operations teams.

DevOps works by creating a team structure that brings together developers and operations under a shared framework and philosophy. Both teams actively collaborate on work, and then they automate processes. The result is that as developers build new applications, operations can immediately put those applications into production and better manage the life cycle of that application.

Automation is the key to transforming DevOps. CI solutions automate application build processes, allowing developers to work independently while continuously integrating and testing their code, along with code from fellow developers, in a shared and automated build environment. CD solutions take that a step further by creating deployment pipelines that allow those applications to be automatically promoted from test environments to staging and production environments with little or no human intervention. GitOps helps deliver quality code by using Git and its established workflows to power CD pipelines. With Git as your single source of truth, infrastructure, deployments, configurations, and CI/CD infrastructure can be treated as code across hybrid environments. This automation helps developers and operations teams standardize their deployment processes and add security by identifying issues earlier in the development process. This practice is known as "shift left."

IT automation shouldn't be limited to development and deployment processes. It should be applied everywhere. Automating the provisioning and configuration of new infrastructure, including compute, networking, and storage, is critical to gaining agility and reducing costs—whether you're running in the datacenter, public cloud, or edge locations. Automation is also key to detecting and resolving security issues before they threaten your business.

Making hybrid your organizational advantage

Ultimately, automation connects the business to the underlying technology.

Done well, a hybrid cloud environment combined with automation, and an architectural plan including tools and processes, will accelerate your activities. Done poorly, you can strain your resources and impede progress.

Your hybrid cloud advantages translate to overall organizational competitiveness in the market. Since your organization's future (not just your digital future) hinges on doing hybrid cloud well, you can't leave it to chance. With thousands of enterprises in production across all industries and geographies, Red Hat is the market leader in hybrid cloud.[15]

"The Red Hat solutions we have deployed are key to modernising our infrastructure and to implementing the DevOps strategy that will determine our digital future."[16]

David Brupbacher
Head Global IT Operations

15 *Red Hat OpenShift customer success stories.*
16 *Red Hat press release. "SIX Selects Red Hat to Help Modernise Its IT Infrastructure and Innovate Faster." Sept. 11, 2017.*

How Red Hat enables a hybrid cloud approach

An open hybrid cloud strategy helps organizations evolve and manage their hybrid landscape of applications, infrastructure, and processes to support digital transformation.

A foundation of Linux everywhere

We start with Linux as our foundation and build from there. Linux is the core that underpins many of your critical enterprise applications, and Red Hat Enterprise Linux provides a solid, trusted foundation that lets you focus on those applications that power your business. Linux has a proven history in the datacenter and broad adoption in all major public clouds and for edge deployments. It also underlies innovations like Kubernetes, AI/ML, and more.

Red Hat Enterprise Linux provides a consistent foundation for your applications across all infrastructure footprints, including bare metal, virtualization, private cloud, public cloud, and edge environments. Red Hat Enterprise Linux is also the foundation for Red Hat OpenStack® Platform for customers looking to build a fully open, scaled out, private cloud environment. OpenStack is a key enabler for telecommunications providers, providing a base for network function virtualization (NFV) deployments. Many global enterprises have used Red Hat OpenStack Platform to build private cloud environments and to provide a programmable infrastructure for Red Hat OpenShift.

By choosing Red Hat Enterprise Linux, you've selected the world's leading enterprise Linux platform.[17] Red Hat Enterprise Linux is trusted by enterprises across every industry vertical. Linux is at the heart of the cloud, and Red Hat Enterprise Linux is the leading hybrid and multicloud operating system.[18]

Kubernetes, the hybrid cloud engine

Kubernetes depends on Linux to deploy and run Linux containers. Kubernetes plus Linux is the engine that powers hybrid cloud today. Red Hat is a recognized leader in

both the Linux[19] and Kubernetes[20] open source communities. Red Hat OpenShift is Red Hat's commercial Kubernetes platform that brings Kubernetes to the enterprise, as either a fully managed cloud service or a self-managed software solution.

Red Hat OpenShift is Kubernetes at its core and is certified by the Cloud Native Computing Foundation (CNCF) as both a Kubernetes Distribution and Kubernetes Hosted Service. Red Hat OpenShift Kubernetes Engine also includes Red Hat Enterprise Linux CoreOS, which is Red Hat Enterprise Linux delivered as an immutable host image and optimized for running containers. It includes critical Kubernetes infrastructure components that are required for your applications, including monitoring, logging, networking, ingress, and more. Red Hat OpenShift Kubernetes Engine also provides the core of all OpenShift offerings including Red Hat OpenShift Container Platform and Red Hat OpenShift Platform Plus for self-managed customer deployments and Red Hat OpenShift Dedicated, Microsoft Azure Red Hat OpenShift, Red Hat OpenShift Service on AWS and Red Hat OpenShift on IBM Cloud for fully managed cloud services. Whether you are using Red Hat OpenShift managed services or deploying Red Hat OpenShift yourself, Red Hat OpenShift delivers a comprehensive and more secure Kubernetes platform.

A hybrid cloud application platform

Enterprises need an application platform that can help them build and deploy new cloud-native applications, while also modernizing and managing their existing application estate. Red Hat OpenShift delivers a complete application platform that can support both traditional applications and cloud-native microservices, while also helping you take advantage of data and AI/ML to build new intelligent application services.

Red Hat OpenShift lets developers build applications in any programming language or framework, while also providing integrated platform services for building CI/CD pipelines, enabling GitOps-based deployments, providing service mesh capabilities, running serverless functions, and more. Red Hat OpenShift also offers a broad ecosystem to support your preferred DevOps tools-including over 4,000 certified containers and 200 certified operators available through the Red Hat Marketplace. It allows your developers, operators, and security teams to consistently manage ever-expanding and changing distributed environments.

19   The Linux Foundation. "*2020 Linux Kernel History Report*." Aug. 2020

20   Kubernetes project community dashboard. "*Community sizing and health assessment / Companies table*." Accessed Apr. 20, 2021.

Red Hat OpenShift portfolio
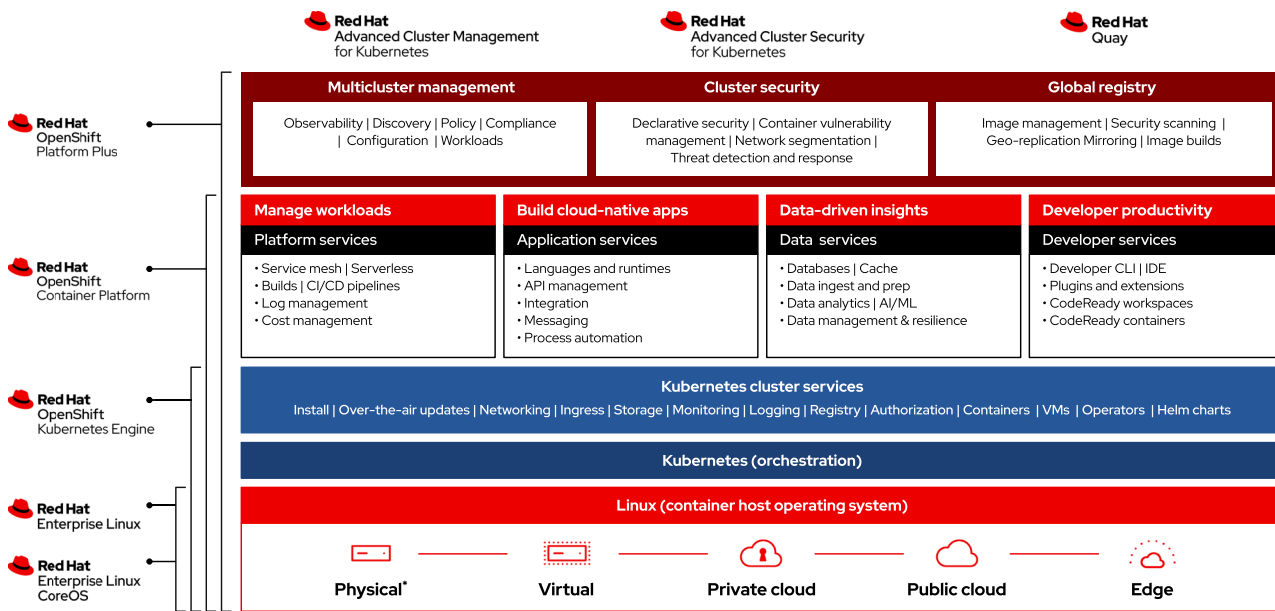
Red Hat OpenShift includes supported runtimes for popular languages/frameworks/databases.
Additional capabilities listed are from the Red Hat Application Services and Red Hat Data Services portfolios.

Red Hat Consulting services can help organizations accelerate their application modernization efforts, adopt containers, and embrace agile and DevOps practices. Red Hat Open Innovation Labs provides a residency-based program, to help you speed the delivery of your most innovative ideas and create infectious enthusiasm for building applications the open source way.

> "Participating in Red Hat Open Innovation Labs and adopting technology like Red Hat OpenShift has demonstrated our commitment to exploring new ideas. We aim to attract passionate professionals, and we can't do that if we're working with proprietary, closed source technology using traditional methods."[21]

Joaquín Moraga Gallego
Head of Architecture

Security and management of a hybrid cloud environment

Managing applications securely across a hybrid and multicloud environment is a major challenge that many enterprises face. When you are running those applications in Kubernetes, there are three main areas that must be secured—the software supply chain for building your application container images, the Kubernetes infrastructure platform that runs your applications, and the containers that make up your application services.

Red Hat OpenShift's security is now enhanced with Red Hat Advanced Cluster Security for Kubernetes, via the 2021 acquisition of StackRox, a leader in Kubernetes-native security. Red Hat Advanced Cluster Security scans for container vulnerabilities and automates DevSecOps processes to protect the software supply chain. It ensures the underlying Kubernetes platform is configured with security and compliance, and it helps defend workloads at runtime against misconfigurations and threats.

Red Hat Advanced Cluster Management for Kubernetes extends management across all of your Kubernetes clusters. It allows you to view, deploy, and upgrade Red Hat OpenShift clusters through a single integrated console, deploy applications across those clusters, apply policies to govern application and cluster deployments, and monitor your entire fleet of Kubernetes clusters. Red Hat Quay can be used to store and manage container images across all of those clusters, and it combines with Red Hat Advanced Cluster Management and Red Hat Advanced Cluster Security to help you manage your hybrid cloud environment with security.

Automate and scale

Managing at scale across a hybrid and multicloud environment requires automation. That's why automation is no longer just a tactical solution—it is a strategic priority for IT and the business. Red Hat Ansible® Automation Platform lets you automate across your organization to help you scale. While Red Hat OpenShift lets you automate the deployment of containerized applications, you can use Ansible Automation Platform to automate infrastructure and application service deployments across your organization and enable automated remediation. It includes compute automation for Linux- and Windows-based systems, networking, security, and other cloud and datacenter services. Ansible Automation Platform includes all the tools needed to implement enterprise-wide automation.

Application and data services

Cloud platforms exist to support applications and the underlying data. Red Hat's product portfolio includes software and services to enable developers to build, deploy, run, and manage enterprise environments that range from traditional to cloud-native application and data services.

The Red Hat Application Services portfolio gives developers, architects, and IT leaders the ability to create, integrate, and automate applications at scale seamlessly across datacenter, public cloud, and edge environments. The portfolio includes comprehensive frameworks, integration solutions, process automation, runtimes, and development tools to take advantage of cloud-native modalities such as API and event-driven architecture, microservices, and serverless computing.

Red Hat Runtimes includes powerful open source application runtimes such as Red Hat JBoss® Enterprise Application Platform, the open source standard for enterprise Java developers building Java EE applications, and Quarkus (which is also included with Red Hat OpenShift), a Kubernetes-native Java stack for building fast, lightweight microservices and serverless applications. Red Hat Integration provides a comprehensive set of integration, messaging, and API solutions, including Red Hat Fuse, Red Hat AMQ, and Red Hat 3Scale API Management. Red Hat Process Automation includes business process management (BPM), business rules management (BRM), business resource optimization, and complex event processing (CEP)

Red Hat Data Services allows customers to manage their application data across a hybrid environment. Red Hat OpenShift Data Foundation provides data protection, availability, and portability for traditional application workloads, as well as emerging application workloads requiring static and dynamic data. Application teams can dynamically provision persistent volumes with a consistent experience, and dynamic scale across hybrid cloud environments. Red Hat Ceph® Storage provides an open, massively scalable, simplified storage solution for modern data pipelines. It is engineered for data analytics, AI/ML, and emerging workloads.

Red Hat has also expanded our hybrid cloud portfolio with new managed cloud application and data services. Red Hat OpenShift API Management, Red Hat OpenShift Streams for Apache Kafka and Red Hat OpenShift Data Science are designed to deliver a fully managed and streamlined user experience as organizations build, deploy, manage, and scale cloud-native applications across hybrid environments.

Your open hybrid cloud architectural advantage

According to The Forrester Wave™: Multicloud Container Development Platforms Q3 2020 report, *"OpenShift is the most widely deployed multicloud container platform and boasts powerful development and unified operations experiences across many public and on-premises platforms."*[22]

Red Hat can help you realize your open hybrid cloud vision.

Manage your evolving applications landscape by modernizing existing apps and developing new, more intelligent cloud-native applications.

Red Hat created Red Hat OpenShift to be the broadest cloud-native development and deployment platform for your containerized applications. Red Hat OpenShift and our open hybrid cloud solutions portfolio can help you accelerate the creation and modernization of applications, without leaving environments behind. Your organization can move as fast as you want, with the security and stability you require.

Transform your infrastructure to meet the needs of those applications.

Red Hat OpenShift and Red Hat Enterprise Linux work seamlessly across traditional virtual and physical infrastructures, including innovations in cloud ecosystems. Build once, run anywhere so your applications run on your choice of infrastructure. For your latency-sensitive or disconnected workloads, we help you unlock opportunities at the edge so data can be processed and acted upon where it's created.

Evolve people and processes to create value with an agile and innovative culture.

Transformation takes practice and the right skills. Red Hat Training and Certification provides hands-on training to maximize your team's skills and increase the impact of your organization's technology investments. Red Hat Open Innovation Labs helps you translate ideas into innovation by incorporating open processes, culture, and technology to make disparate teams stronger, more connected, and better positioned to speed innovation and iterate on their projects faster.

Red Hat...

...can support your changing needs.

We have a wide-ranging portfolio to help you achieve your goals. Whether you are modernizing your applications, building out a hybrid infrastructure, want to evolve your storage and data services, introduce more automation, or simplify your management, we have the products and services to help.

...plays an active role in the open source community.

Red Hat's commitment to the open source community is substantial.
We actively participate in working groups and engage with numerous related CNCF community projects. Our own OpenShift Commons, which has over 500 member organizations, is where Red Hat OpenShift users, partners, and contributors from related communities go to collaborate and work together.

...is here to stay.

Red Hat is now part of IBM, one of the industry's most established names. Red Hat's open hybrid cloud technologies are now paired with the scale and depth of IBM's innovation and industry expertise—and sales leadership in more than 175 countries. IBM and Red Hat are better together.

Get started today

▸ Find out more about Red Hat OpenShift: openshift.com

▸ Try Red Hat OpenShift for free: openshift.com/try

▸ Speak to a Red Hatter: redhat.com/contact

▸ Learn more about Kubernetes and Red Hat OpenShift:

Red Hat OpenShift and Kubernetes . . . what's the difference?

About Red Hat

Red Hat is the world's leading provider of enterprise open source software solutions, using a community-powered approach to deliver reliable and high-performing Linux, hybrid cloud, container and Kubernetes technologies. Red Hat helps customers develop cloud-native applications, integrate existing and new IT applications, and automate and manage complex environments. A trusted adviser to the Fortune 500, Red Hat provides award-winning support, training and consulting services that bring the benefits of open innovation to any industry. Red Hat is a connective hub in a global network of enterprises, partners and communities, helping organizations grow, transform and prepare for the digital future.