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Container Management 2.0

Next-Gen Platforms Package Management, Orchestration, and Services for a Streamlined User Experience

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Introduction[1]

As enterprises execute their hybrid cloud strategies, they are looking to simplify critical functions, such as:

- moving applications across various infrastructures
- optimizing legacy applications
- introducing new functionality and services to legacy and cloud applications

Increasingly, they are choosing to build and deploy applications in containers, rather than virtual machines (VMs). Containers package all the code and dependencies needed to run a workload (including microservices, data, runtime environment, and system tools and settings) into a single, self-contained image. By abstracting the application from the underlying infrastructure, containers can be easily moved across infrastructures. Containers are also lightweight, consuming less of the server's processing capacity than a VM.

As container usage has grown, so has the complexity associated with orchestrating, provisioning, and managing container clusters. Scaling production workloads, ensuring consistent security profiles across clusters, and managing networking and storage can be difficult for users. And the most popular container management service, open-source Kubernetes, can actually make it more difficult to manage containers. In answer to user challenges, IBM recently launched an enterprise-ready container platform to simplify container deployment and management leveraging Red Hat OpenShift.

In this report, we will examine the need for improved container management. We will also look at the new Cloud Paks introduced by IBM.

The Draw of Containers

Containers are all the rage for technology vendors and enterprise developers alike. But what are containers, and why all the buzz?

Containers use operating system (OS) or kernel-based virtualization to share an OS among application instances. Containers package an application's code and dependencies into a lightweight unit containing its own dedicated CPU, RAM, file system, and storage resources while sharing the host OS. Essentially, containers are self-contained application "packages" that can be built and easily deployed across a variety of infrastructures. Containers are designed to virtualize a single application, creating an isolation boundary at the application level rather than at the server level. So, if anything becomes corrupted in a single container, it only affects that individual application instead of an entire VM or server.

[1] In preparing this report, Frost & Sullivan conducted interviews with representatives of IBM.

The primary advantage of containers over their traditional counterparts—VMs—is efficiency: containers are lighter weight and use fewer server resources, so more of them can fit on a single physical server. Containers are also very agile: because everything the application needs is defined in the container, it can be easily moved to any infrastructure that has the appropriate operating system. Figure 1 gives a more in-depth comparison of containers versus VMs.

Figure 1: Comparing Containers with VMs

Features	Containers	VMs
Virtualization	Containers use OS or kernel virtualization that enables them to share the host OS. Each container is a self-contained application package consisting of dedicated RAM, CPU, storage, and system files. The host OS is shared, making it lightweight in terms of resource consumption.	VMs use hardware virtualization, wherein a hypervisor enables emulation of the hardware resources on VMs. Each VM or guest OS runs a copy of the host OS, thus increasing overall resource consumption.
Deployment Speed	Containers can be started in seconds (sometimes less than a second) due to their lightweight nature.	VMs can take several minutes to start, as they need to emulate the entire copy of the host OS on the guest OS.
Portability	Containers can be easily ported across environments.	VMs can be ported across different Linux or Windows servers, but it is a cumbersome process.
Operating System	Each container supports a single OS, and a single application. For example, a Linux-based host OS *cannot* support Windows containers. Linux is the most commonly used OS for containers.	VMs can support multiple OSes. The guest OS on VM can be different from that of the host OS. For example, a Windows-based server OS can support Linux OS on its VMs.
Isolation	Containers lack isolation at the hardware level, as they share the host OS, hence potentially more prone to security breaches.	Isolation is built into the VMs due to hardware virtualization.
Resource Utilization	Multiple containers can be run on a single host due to their lightweight nature, which enhances resource utilization.	Compared to containers, fewer VMs may be supported using hardware virtualization due to the heavy nature of VMs.

Source: Frost & Sullivan

Managing Containers

Many businesses have standardized on Kubernetes to manage their growing number of containers.

Kubernetes is an open-source system to manage Linux containers across public, private, and hybrid cloud environments. It can manage microservices and can be deployed on most cloud infrastructures.

Kubernetes uses a master node—the control plane—and worker nodes, which are infrastructure where the container is to be deployed. Each node requires multiple components to operate. The master node uses a scheduler, an API server, controller-manager, and a configuration store housing configuration data. The worker nodes each require a runtime, a "kubelet" that relays information to and from the control plane, and a kube proxy that handles load balancing and other networking tasks.

Other open-source container management platforms—such as Red Hat OpenShift, Docker Swarm, and Cloud Foundry Diego—introduce similar challenges. Development on open-source projects happens quickly, and new versions come out frequently. Storage is also managed separately and requires separate deployment, configuration, management, backup and recovery, and security policies.

All of this requires constant updates and configuration changes to the enterprise container clusters, and can make it hard to run earlier versions.

If you think this sounds complex, you're right. While Kubernetes and similar services do a good job of orchestrating containers, they can be challenging to manage at scale. So, adding a layer to the orchestration platform that removes complexity and makes management easier is much needed in the container market.

New Offerings Ease Management Burdens: IBM Cloud Pak® Solutions

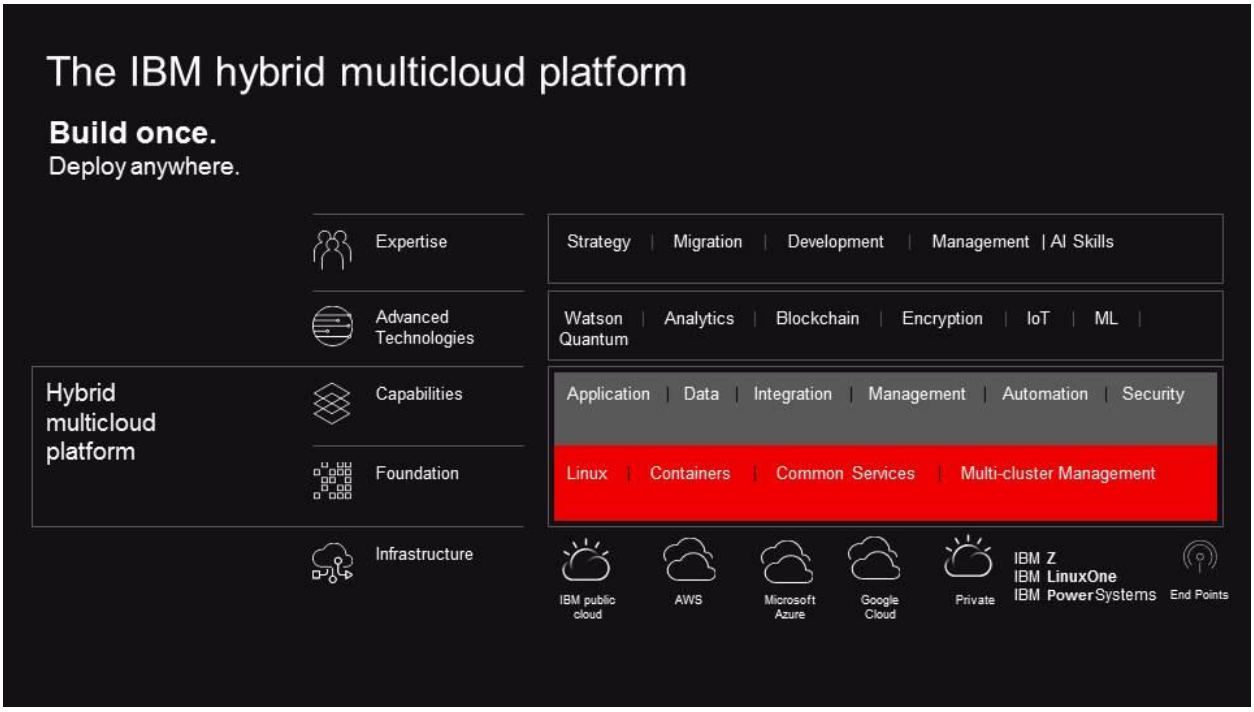
In response to the complexities of managing containers, IBM is seeking to ease the container deployment and management burden for businesses.

On August 1, 2019, IBM launched its Cloud Paks offerings, a key component in the company's hybrid multicloud platform. IBM's platform promises to ease container management and offers a path to application modernization. The foundation of IBM's hybrid multicloud platform is Red Hat's Kubernetes-based OpenShift Container Platform, running on Red Hat Enterprise Linux (RHEL). IBM Cloud Paks integrate a variety of use-case specific "connecting" services to allow businesses to deploy containers on a variety of infrastructures.

To understand the unique value provided by IBM's Cloud Paks for container management, it's helpful to look at the entire software stack.

IBM Cloud Paks are containerized software solutions built to run anywhere; they are underpinned by Red Hat OpenShift. Each Cloud Pak integrates management of Linux and containers with common services, and allows customers to manage multiple public and private clouds within a single pane of glass. Figure 2 shows the architecture of IBM hybrid multicloud platform.

Figure 2: IBM Hybrid Multicloud Platform



Source: IBM, 2020

Why Red Hat OpenShift is the Optimal Foundation for Container Management

The foundation for IBM Cloud Paks is Red Hat OpenShift, the open-source Kubernetes application platform for hybrid clouds. In contrast to other community-driven open-source Kubernetes distributions, OpenShift is enterprise-grade; that is, it is "hardened" (not subject to continual community-provided updates). Furthermore, OpenShift is fully supported by Red Hat to run in any infrastructure environment, from mainframes to private cloud to any commercial public cloud. As such, OpenShift is uniquely capable of supporting the hybrid and multicloud deployments that enterprises increasingly rely on.

While nearly every public cloud vendor offers a version of Kubernetes for container management and orchestration on their unique cloud, most of their deployments add proprietary enhancements or limit orchestration to their public cloud or distributed, on-premises solutions, thus making it difficult or impossible to migrate or manage workloads across a mix of public clouds, private clouds or traditional IT. In contrast, Red Hat OpenShift offers flexibility for enterprises to easily self-manage their container clusters anywhere, and to leverage the IBM public cloud and IBM expertise via fully managed IBM Cloud Paks.

IBM Cloud Paks Provide Enterprise-Ready Containerized Software Solutions

The unique attribute of Cloud Paks is its variety of pre-packaged containerized middleware solutions and user-specific software services that run anywhere, and support development/deployment of containers for various hybrid, multicloud use cases. Current Cloud Paks include:

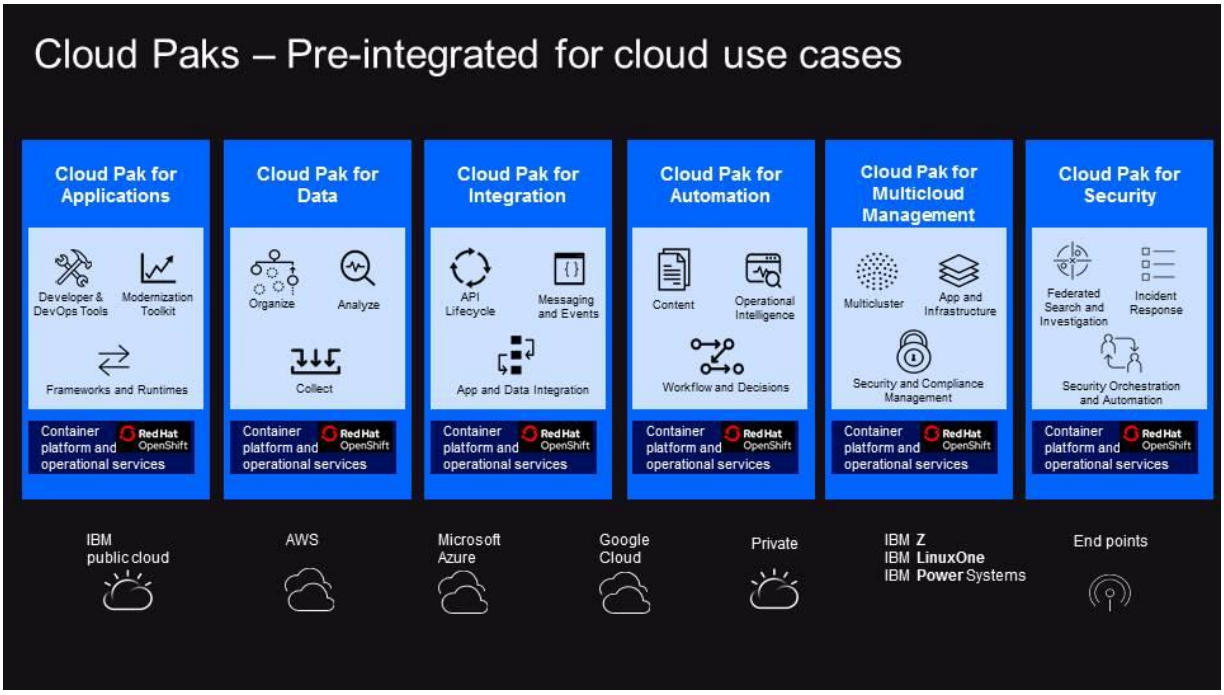
- **IBM Cloud Pak for Applications**, designed to help application developers build, deploy and run applications in a modern, microservices framework.
- **IBM Cloud Pak for Automation**, designed to help automate business processes and streamline operations.
- **IBM Cloud Pak for Data**, designed to help data scientists collect, organize, and analyze data, as well as accelerate the shift toward artificial intelligence (AI) usage.
- **IBM Cloud Pak for Integration**, designed to help integration specialists and developers more easily integrate applications, data, cloud services, and APIs.
- **IBM Cloud Pak for Multicloud Management**, designed to help IT or data center managers increase visibility across cloud infrastructures, and apply consistent governance and automation across multiple infrastructures.
- **IBM Cloud Pak for Security**, designed to help more quickly integrate existing security tools to generate deeper insights into threats across hybrid, multicloud environments.

The use-case-aligned Cloud Paks allow organizations to solve persona-specific challenges in consistent and repeatable ways, regardless of underlying infrastructure choices. IBM has launched Cloud Paks for developers, data scientists, integration specialists, IT administrators, and even business process transformation teams. Having services specific to role reduces time to value, because everything users need is packaged in a use-case-specific platform.

IBM Cloud Paks are based on open standards, and are able to run on the premises, at edge locations, and on private or hybrid clouds (such as IBM Cloud, AWS, Microsoft Azure, Google Cloud Platform, and Alibaba Cloud). Cloud Paks are also available on pre-integrated hyperconverged hardware appliances, and the IBM Cloud Pak System.

Figure 3 illustrates the different IBM Cloud Paks running on Red Hat OpenShift.

Figure 3: IBM Cloud Paks



Source: IBM, 2020

Enterprise Benefits of IBM Cloud Paks

Regardless of the specific IBM Cloud Pak deployed, the platform enables greater portability and faster, easier application modernization through integration of new services, such as analytics, AI, and machine learning. Cloud Paks also streamline container management, enabling both legacy and cloud-native applications to be orchestrated using the same container platform. They also enable portability across disparate infrastructures and easier modernization of legacy applications. But, each type of Cloud Pak has its own benefits. Figure 4 outlines the benefits of each specific IBM Cloud Pak.

Figure 4: IBM Cloud Pak Benefits

IBM Cloud Paks for:	Benefits
Applications	• Allows application and data portability in hybrid environment • Enables modernization of legacy applications without significant re-factoring • Simplifies development of cloud-native applications with open-source standards, common services, and integrated DevOps toolsets • Leverages data insights and analytics to appropriately optimize resources and costs, and reduce complexity

Data	• Connects all application data to self-service analytics that are integrated directly into the Cloud Paks platform • Collects data from anywhere within a hybrid environment • Allows deployment and use of AI with transparency • Streamlines the building and deployment of cloud-native data and AI workloads
Integration	• Integrates cloud and SaaS applications (e.g., connect a payroll system to Workday) • Creates secure API portals for clients and partners • Offers broad integration capabilities between applications and cloud services • Provides an enterprise-grade, certified platform that is highly scalable and secure
Automation	• Helps transform business processes based on analytic-driven insights • Improves productivity by intelligently automating workflows and decisions (both routine and more complex) • Collects and analyzes business data to help show where business process improvements can be made
Multicloud Management	• Manages both container and VM deployment, orchestration, upgrades, security, and compliance across hybrid resources in a consistent way • Ensures application uptime and value through constant monitoring and dynamic problem resolution • Is platform-agnostic • Builds on open-source software and standards • Supports all major flavors of Kubernetes, like OpenShift, EKS, AKS, IKS, GKE
Security	• Runs anywhere, connects security openly, installs easily in any environment—on a customer's premises, private cloud, or public cloud • Provides security insights without moving data: IBM can connect all data sources to help uncover hidden threats and make better risk-based decisions, while leaving the data where it resides. • Allows for faster response to security incidents with automation that connects workflows to a unified interface.

Source: Frost & Sullivan

Frost & Sullivan
The Last Word

Answering the enterprise need to manage containers faster, more easily, and more consistently, providers like IBM and Red Hat are launching the next generation of container management platforms with solutions that are built on proven open-source technologies such as Kubernetes and OpenShift. Such platforms enable the enterprise to leverage containers to create truly portable applications that can move across hybrid infrastructures, modernize legacy applications with cloud benefits, and integrate new technologies and services into mission-critical applications. **These platforms streamline container deployment and management, and enable portability and consistent governance across infrastructures.**

Frost & Sullivan expects that more vendors will follow suit. **Simplifying container deployment and management will provide significant value as enterprises execute their cloud strategies for cloud-native and legacy applications.**

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