IBM Cloud

IBM Cloud Paks

An open, faster, more secure way to move core business applications to any cloud

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Introduction

Enterprises employ cloud technologies to deliver innovation at scale and at lower cost. New services are often built natively on cloud, but can also come with risk of “vendor lock-in” and escalating cost. Existing applications can be rewritten, but rewriting thousands (if not tens of thousands) of applications from the ground up is both cost and time prohibitive, so taking steps to modernize existing applications can be an attractive approach with faster time to value. Both strategies— building new cloud-native applications and modernizing existing applications to support cloud environments — need to be done in an open, portable manner that helps clients improve time to value while avoiding lock-in. Containers and Kubernetes enable this by providing portability and consistency in development and operations, but developers and administrators are still required to continuously connect component layers and verify interoperabilty. In addition, collecting, integrating and analyzing data enables data engineers and scientists to help application developers infuse AI into applications; but the trick is to do this without adding complexity and cost. And, then, once applications are built and connected to data, IT operations need them to run in an environment that is high performing, scalable and reliable. Today, around 80 percent of existing enterprise workloads have not yet moved to the cloud due to these challenges and enterprises struggle with movement, connectivity and management across clouds.

IBM Cloud Paks: To help clients move more workloads, faster, to cloud and AI

Last year, IBM announced a family of IBM Cloud Paks™ to give developers, data managers and administrators an open environment to quickly build new cloud-native applications, modernize/extend existing applications, and deploy middleware in a consistent manner across multiple clouds. The six IBM Cloud Paks include the IBM Cloud Pak® for Applications, IBM Cloud Pak® for Data, IBM Cloud Pak® for Integration, IBM Cloud Pak® for Multicloud Management, IBM Cloud Pak® for Automation and IBM Cloud Pak® for Security. They deliver IBM enterprise software and open source components in secure solutions that are easily consumable and can run anywhere.

IBM Cloud Paks provide:

- Containerized IBM middleware and open source components
- Consistent added capabilities for deployment, lifecycle management, and production quality of service – logging, monitoring, version upgrade and roll-back, vulnerability assessment and testing
- Certification by IBM to run on Red Hat OpenShift, providing full software stack support, and regular security, compliance and version compatibility updates

IBM Cloud Pak for Applications reduces development time to market by up to 84 percent by reducing the compute required and by accelerating throughput of the continuous integration continuous delivery (CI/CD) pipeline, and reduces operational expenses by up to 75 percent through increasing IT admin efficiency and reducing related labor costs.

(Source: https://www.ibm.com/downloads/cas/JXY5L6DR)

IBM is committed to delivering enterprise software from across its portfolio for modern cloud environments. IBM Cloud Paks provide enterprise container software that is pre-integrated for cloud use cases in production-ready configurations; they can be quickly and easily deployed to Kubernetes-based container orchestration platforms. In addition, these IBM Cloud Paks provide resiliency, scalability, and integration with core platform services, like monitoring or identity management.

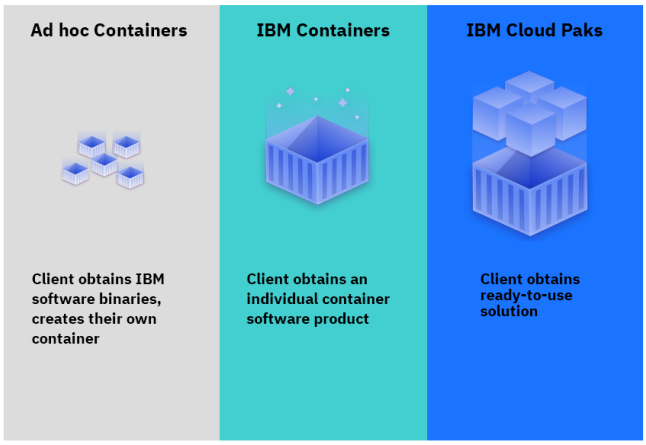

Figure 1. IBM software is supported and consumed as containers in 3 ways

IBM Cloud Paks enable you to easily deploy modern enterprise software either on-premises, in the cloud, or with pre-integrated systems and quickly bring workloads to production by seamlessly leveraging Kubernetes as the management framework supporting production-level qualities of service and end-to-end lifecycle management. This gives clients an open, faster, more secure way to move core business applications for any cloud, as shown in Figure 2.

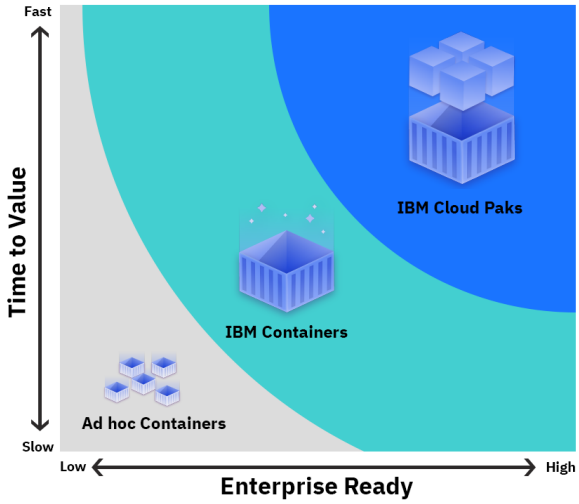

Figure 2. Time to Value and Enterprise Readiness of software

This paper describes IBM Cloud Paks in more detail, highlighting the additional value that this delivery model offers, with some background details on the underlying open technologies, for those who may be unfamiliar.

IBM Cloud Paks Simplify Enterprise-grade Deployment and Management for Software in Containers

Red Hat OpenShift Container Platform (OCP) builds on top of the open source Kubernetes orchestration technology. IBM is committed to delivering enterprise software designed for these modern container orchestration platforms and Red Hat OpenShift Container Platform.

Deploying complex software workloads in optimized and highly-available configurations can involve collecting or creating large numbers of disparate components, including the workload container images, configuration files, and assets for integrating with your chosen platforms or management tools.

IBM Cloud Paks bring together thoroughly-tested enterprise software container images using, Helm charts with intelligent defaults for simplified configuration and management and can include additional assets, such as Operators that intelligently manage software during runtime, in a single archive from a trusted source. As a result, you can quickly load software into your catalog, walk through a simple deployment experience, guided by logical defaults and helper text and easily deploy production-ready enterprise software onto IBM's container platforms, in the cloud or in your own data center.

Core Services

IBM Cloud Paks utilize a common set of operational services by default, such as security and identity services, logging, monitoring, auditing. For example, workloads can be monitored out of the box using the integrated monitoring service. Similarly, logs that are generated by each workload container are collected and correlated by a platform-provided logging service that includes a collection, search and dashboarding capabilities.

Containers Revisited

Containers give you the ability to run multiple software elements, isolated from each other, within the same operating system instance. Unlike a virtual machine, a container shares the operating system kernel with its underlying host and since system calls can be made directly, a container can be run more efficiently and be instantiated faster, as shown in Figure 3.

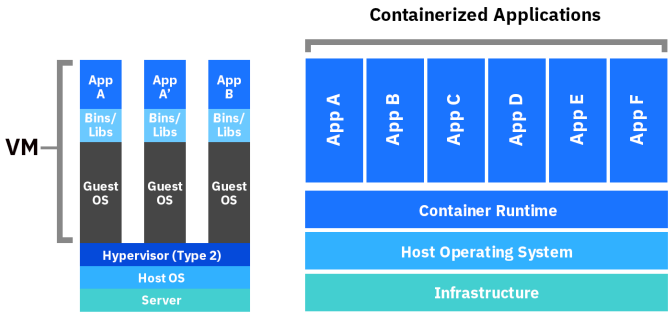

Figure 3. Virtual Machines compared to Containers

While containers are available in many forms and implementations, the Open Container Initiative (OCI) has emerged as the leading standard in the industry, defining open specifications for container images and container runtimes.

The fact that containers are lightweight and start quickly makes them ideal for hosting microservices, which are a key element of cloud-native application architectures. Traditional, more monolithic applications can also be run inside containers, but will benefit less from this technology. As always, keep in mind that a poorly architected and designed application is still a poorly architected and designed application when ran in a container.

Takeaway: Containers enable running software that is more lightweight and efficient than past runtime environments have provided. IBM's software offerings increasingly support containers as the standard runtime model and IBM Cloud Paks bring that software to market in a fully modular, easy to consume package.

Building production-ready images

All IBM container images in IBM Cloud Paks follow a set of well-defined best practices and guidelines, ensuring support for production use cases and consistency across the IBM software portfolio. IBM Cloud Paks support deployment to Red Hat OpenShift Container Platform using Red Hat Certified Containers.

One element that is especially important to IBM is support for multiple hardware architectures, including Linux on IBM Power and Linux on IBM LinuxOne, and providing images for the hardware platforms the respective IBM products support.

Management of security vulnerabilities is also critically important. IBM Cloud Paks are scanned regularly for known image vulnerabilities as part of the standard build procedures. As part of full software stack support and ongoing security, compliance and version compatibility, all IBM Cloud Paks must have a documented process for managing newly identified vulnerabilities. Additionally, IBM follows Secure Engineering Practices for development of software and maintains a Security Vulnerability Management process (PSIRT) for commercial software supported by IBM. IBM Software delivered as an IBM Cloud Pak inherently follows those corporate standards. IBM Cloud Paks delivered by partners must have a documented process for addressing security image vulnerabilities.

Kubernetes – a management environment for containers

Up to this point, we have discussed the basics of building, running and maintaining container images, which can be used to run containers in a standalone fashion. But containers alone do not provide a framework for implementing production-grade qualities of service like resilience, scalability or maintenance.

For example, software running inside a container may write data to a file. If the file exists within the container, deleting the container will also delete the file. If the software's state must be maintained, that state data should be written to a volume outside of the container. If the state needs to be consistent even with the failure of a host, then that volume should exist on storage that is accessible by multiple hosts, most likely over a network. To maintain availability of the application during the failure of a host, you would also need to run multiple instances of the container on multiple hosts and load balance incoming requests across those containers. This would require a reasonable amount of effort to manage manually, especially if you want to be able to seamlessly upgrade to newer versions of an application or build a continuous integration process.

Kubernetes is an open source orchestration platform for containers that solves these administrative challenges by providing a declarative framework for deploying, scaling, and managing container-based workloads. It is a popular choice for managing clusters of containers throughout the industry; RedHat OpenShift provides a common Kubernetes-based platform for IBM Cloud Paks on premises, on public cloud infrastructure, in pre-integrated environments like the IBM Cloud Pak System, and managed service via Red Hat OpenShift on IBM Cloud.

The declarative definition of abstract resources that influence how the cluster behaves and manages workloads is a key feature of Kubernetes and will be covered briefly below. IBM Cloud Paks are built for Kubernetes-based environments and include all the configuration artifacts you need to easily customize and deploy an enterprise-grade Kubernetes workload.

Takeaway: Kubernetes is a popular framework for running containers in a scalable, resilient, highly available fashion, supporting production use cases for enterprise applications. IBM has chosen Kubernetes as its container orchestration platform both on-premises and in the cloud, and IBM Cloud Paks are designed specifically for deployment to the Red Hat OpenShift Container Platform.

Kubernetes Resources

Kubernetes provides users with a set of defined resources including a way to describe how containers should run in the cluster, how the system reacts to events like failures, how to make containers accessible over the network and how and where to store data.

You can describe the provisioning and management of your application workload by defining the desired state of these resources using a YAML file and Kubernetes will manage the cluster environment accordingly.

Internally, Kubernetes delegates the management of the resource to its associated controller. A few of the most common Kubernetes resources are described briefly below.

Deployment
Describes the desired state of one or more Pods, which are collections of running containers.

StatefulSet
Similar to the Deployment resource mentioned above but describes containers that maintain state.

Service
Describes how pods that are part of a deployed workload (Deployment, StatefulSet, etc.) can be accessed from outside of the Kubernetes cluster. Gives clients a well-defined target address/port combination across multiple pods, including across restarts and recreations of these pods.

PersistentVolume / StorageClass
Enables you to define an allocation of storage that persists across the lifetime of the pods that use it. Pods can attach to a suitable volume by using a PersistentVolumeClaim. The StorageClass resource describes different qualities of service that are available for different types of storage that may be offered.

ConfigMap
Enables separating configuration data for a pod into a separate object.

Secret
Similar to ConfigMaps, Secrets contain sensitive data (for example, passwords or SSH keys) and are stored separately from container that use them.

This list barely scratches the surface of the resource types available in Kubernetes, which also supports defining custom resource types. For a more detailed description of Kubernetes resources, see the official documentation.

The resource definitions mentioned above contain configuration metadata that is critical in ensuring enterprise-grade qualities of service of the workloads running in Kubernetes. For example, you can define memory and CPU allocations for individual pods, ensuring that sufficient capacity is available when creating containers, while also ensuring that individual workloads cannot use more than their allocated resources, enabling effective sharing of hardware resources. As another example of the control afforded by Kubernetes, you can define affinity and anti-affinity rules that let you control which of your worker nodes certain pods run on.

Takeaway: Individual workloads, including IBM software content that runs in Red Hat Open Shift, are described using predefined Kubernetes resources. IBM Cloud Paks define Kubernetes resources for your workloads using intelligent defaults, and provide for easy customization during deployment.

Using Helm charts to orchestrate containerized workloads

As mentioned above, Kubernetes uses abstract resources to allow describing the desired target state of a workload, paired with controller implementations that enforce the defined target state.

Each application or service running in Kubernetes is represented by multiple resources, each of which is typically defined in its own YAML file. Each resource also carries several attributes with it, whose values may differ from deployment to deployment based on the specifics of the environment and the supported usage.

The Helm project aims to simplify the deployment and maintenance of complex workloads in Kubernetes environments. It provides a packaging format called a chart, which you can use to group together YAML templates that define related sets of Kubernetes resources. An instance of a Helm chart that has been installed into a target Kubernetes cluster is called a release. Helm not only simplifies orchestration of Kubernetes resources, it also simplifies the ongoing maintenance of your releases. This makes production-level operations like rolling upgrades more manageable and contributes to the overall availability and maintainability of your application.

IBM Cloud Paks use pre-built configurations that

describe runtime environments. These resource definitions can be easily customized during deployment, and upgrades can be easily rolled out or rolled back.

IBM Cloud Paks are certified by both IBM and Red Hat for the OpenShift Container Platform; the container images included in IBM Cloud Paks are required to complete Red Hat container certification, which is complementary to IBM's certification process.

Kubernetes Operators

Operators are flexible and powerful custom Kubernetes resource definitions that can be used for deploying and managing containerized workloads in a Kubernetes environment. They can also be used for packaging applications, in a manner similar to Helm charts, or they can be used together with Helm, in a complementary manner.

By building specific knowledge and best practices about deploying and managing a software product directly into an operator, a software provider can capture domain-specific expertise about operating the product, giving end-users powerful automated runtime and lifecycle management capabilities without requiring that same level of expertise from the end user.

For example, IBM Cloud Paks can utilize Operators to deliver IBM's expert knowledge about deploying and managing IBM enterprise software products in modern container orchestration environments as part of the software offering itself, transferring some of IBM's expertise to the customer automatically.

Takeaway: IBM Cloud Paks include Helm charts, which assemble all of the Kubernetes resource definitions related to a piece of IBM software, and provide for easy customization, deployment, and maintenance using Red Hat OpenShift, on premises or in the cloud, and can include Operators, which capture product-specific deployment and management expertise.

IBM Cloud Paks

IBM Cloud Pak for Applications

Businesses can no longer afford large, complex IT-centric application modernization projects. They not only need to achieve cost savings today, but they also need to extend the value of their existing application investments aligned to business priorities. Huge modernization programs are hard to greenlight and often fail to meet planned outcomes. A continuous application modernization approach enables application leaders to proactively manage costs and enhancements throughout the application life cycle.

IBM Cloud Pak for Applications helps you protect and optimize your current investments with flexible licensing and deployment options for immediate cost savings. It helps you unlock additional value from existing applications and develop new apps that unleash digital initiatives. With IBM Cloud Pak for Applications, application leaders can maximize ROI, balance business requirements and risk, and equip developers with tools to quickly deliver value to the market.

IBM Cloud Pak for Automation

Companies looking to transform, or just do business as usual, are facing bigger challenges – from volatile customer demand to remote employees struggling to get work done. Bigger challenges are creating big opportunities to build more resilient and adaptive business operations with intelligent automation at the core.

IBM Cloud Pak for Automation lets you quickly scale up or down to meet fluctuating customer demand, rapidly create new products and services to gain competitive advantage, and increase the productivity of remote

and onsite workers. It is a complete and flexible set of integrated automation software that can be deployed wherever you need it, on any cloud.

With IBM, you can shape and execute your automation vision. Our intelligent automation software platform, along with our global ecosystem of skilled business and IT consultants and deep industry expertise help you meet your most complex operational challenges.

IBM Cloud Pak for Data

As companies continue to harness the potential of AI, they need to use data from diverse sources, support best-in-class tools and frameworks, and run models across a variety of environments. With copious amounts of data recorded every day, business leaders are challenged to understand what's required for AI. And even if they did, much of data is either inaccessible, untrusted, or unanalyzed. Simply put, there's no AI without an information architecture.

IBM recognizes this challenge our clients are facing. As a result, IBM introduced the IBM Cloud Pak for Data with the goal of creating a prescriptive approach to accelerate the journey to AI: the AI Ladder, developed to help a client drive digital transformation in their business, no matter where they are on their journey. IBM Cloud Pak for Data brings together all the critical cloud, data and AI capabilities as containerized microservices to deliver the AI Ladder within one unified multicloud platform.

IBM Cloud Pak for Integration

Agile integration drives secure and timely access to data and applications at a lower cost.

Today, more than ever, organizations require integration to transform engagement models and optimize channels while still maintaining business continuity. Traditional integration is costly and can't keep up with escalating demand. Without a new approach, integration work will consume sigificant time and cost of digital initiatives.

To remedy this, your business needs a modern, agile approach to integration. One that empowers extended teams to create integrations, leverages a complete set of integration styles and capabilities and increases overall productivity.

IBM Cloud Pak for Integration is the platform for agile integration. We've seen companies significantly speed their integration development and reduce their costs of integration while increasing their overall operational agility.

IBM Cloud Pak for Multicloud Management

The escalating volume and complexity of enterprise applications has introduced unique challenges in maintaining visibility and control across the application landscape. As organizations expand their application portfolio, it's common that an ever-increasing proportion of these applications will span a hybrid cloud environment. Today's collection of point management solutions held together with custom code are not only inefficient, but vulnerable to data breaches.

Cloud native technologies are changing the way developers architect, code and deploy, necessitating a change in IT processes. A new application-centric approach to management is required to drive the automation and efficiency necessary to ensure continuity of business operations at a lower cost.

The IBM Cloud Pak for Multicloud Management is an application-centric, AI infused platform for IT automation designed to provide full visibility and control. With IBM Cloud Pak for Multicloud Management, you can achieve the level of automation required to achieve continuity of business operations while adapting quickly to changing demand.

IBM Cloud Pak for Security

As organizations move their business to the cloud, applications and data may be spread across multiple clouds and on-premises environments. Trying to secure this fragmented IT environment can be challenging. Security teams must undertake costly migration projects and complex integrations. In fact, more than half of the security teams surveyed struggle to integrate data with analytics tools and to combine data across their cloud environments to spot security threats.

IBM Cloud Pak for Security is a containerized software platform pre-integrated with Red Hat OpenShift. It connects to existing security data sources, enabling teams to search for indicators of compromise (IOC) across any cloud or on-premises location and uncover new threats. Once threats have been found, IBM Cloud Pak for Security allows teams to quickly orchestrate responses and automate actions from a unified interface.

Summary

IBM Cloud Paks provide an easy and powerful way to run high-quality, container-based enterprise software on a modern Kubernetes-based orchestration platform that enables high availability, scalability, and ongoing maintenance for enterprise applications, from a source you know and trust. They include container images that are built and tested by product teams, capturing product expertise and best practices in a form factor that is easy to consume and deploy in a location of your choice, on-premises, in the cloud, or with pre-integrated systems. Images provided by IBM are regularly scanned for known security vulnerabilities and follow a rigorous process for managing newly identified issues.

IBM Cloud Paks also include pre-configured Helm charts that describe runtime environments for IBM software products based on established best practices and can be easily customized during the deployment process. They may also include Operators that build product-specific deployment and lifecycle management expertise into the software. These capabilities combine to provide a first-class deployment experience, integration with core platform services, and production-ready qualities of service.

Certified Cloud Paks built with Red Hat Certified Containers build the combined expertise of IBM and Red Hat into trusted enterprise software solutions that combine fast, easy deployment with enterprise qualities of service and simplified, flexible pricing.

The new family of IBM Cloud Paks give customers fully modular and easy to consume capabilities they need to bring the next 80 percent of their workloads to modern, cloud-based environments.

Resources

IBM and Red Hat - Committed to Open Source
https://www.ibm.com/cloud/redhat

IBM Cloud Kubernetes Service
https://www.ibm.com/cloud/container-service

What is Docker?
https://www.ibm.com/cloud/blog/new-builders/kubernetes-vs-docker-its-not-an-either-or-question

What is Red Hat OpenShift?
https://www.openshift.com/learn/what-is-openshift

Microservices
https://www.ibm.com/cloud/blog/new-builders/video-what-are-microservices

Open Container Initiative
https://www.opencontainers.org/

Kubernetes Concepts
https://www.ibm.com/cloud/blog/new-builders/video-kubernetes-explained

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