IBM Cloud Pak for Data on the AWS Marketplace

Deployment Guide

December 2022

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Overview

This deployment guide provides step-by-step instructions for deploying IBM Cloud Pak for Data on a Red Hat OpenShift Container Platform cluster on the AWS Cloud. You can automatically deploy a multi-master, production instance of Cloud Pak for Data.

IBM Cloud Pak for Data enables enterprise users to connect, catalog, govern, transform, and analyze the data regardless of where the data is.

Cloud Pak for Data on AWS

Cloud Pak for Data is an analytics platform that helps prepare data for artificial intelligence (AI). It enables data engineers, data stewards, data scientists, and business analysts to collaborate using an integrated multiple-cloud platform.

Cloud Pak for Data uses IBM's deep analytics portfolio to help organizations meet data and analytics challenges. The required building blocks (collect, organize, analyze, infuse) for information architecture are available using Cloud Pak for Data on AWS.

Cloud Pak for Data uses AWS services and features, including virtual private clouds (VPCs), Availability Zones, security groups, Elastic Block Storage, and Elastic Load Balancing to build a reliable and scalable cloud platform.

This reference deployment provides AWS CloudFormation templates to deploy Cloud Pak for Data on a new OpenShift cluster. This cluster includes:

- A Red Hat OpenShift Container Platform cluster created in a new or existing VPC on Red Hat CoreOS (RHCOS) instances, using the <u>Redhat OpenShift Installer Provisioned Infrastructure</u>. See the <u>OpenShift Container Platform Installation overview</u> for details about the underlying OpenShift deployment architecture.
- A highly available storage infrastructure with Redhat OpenShift Container Storage.
- Scalable OpenShift compute nodes running Cloud Pak for Data services.

For more information about Cloud Pak for Data, see the IBM Knowledge Center.

This product requires an internet connection to deploy properly. The following packages are downloaded on deployment:

git, wget httpd-tools, python3, python3-pip, jq, unzip, podman, terraform, awscliv2, openshift-client-linux-4.10.37

Git repo: https://github.com/IBM/cp4d-deployment/

Cost and licenses

The Cloud Pak for Data environment is deployed by using AWS CloudFormation template. You are responsible for the cost of the AWS services used for the infrastructure.

The AWS CloudFormation template for this deployment includes configuration parameters that you can customize. You can use it to build a new VPC for your Cloud Pak for Data on AWS cluster or deploy on an existing AWS VPC. Some of these settings, such as instance type, will affect the cost of deployment. For cost estimates, see the pricing pages for each AWS service you will be using. Prices are subject to change.

For more information about licensing terms, see the Cloud Pak for Data software license agreement.

Upgrading to the latest version of Cloud Pak for Data indicates your acceptance of any new terms that may be applicable for the new version. To determine if new terms apply and to review them, please visit <u>https://www-03.ibm.com/software/sla/sladb.nsf/search?OpenForm</u>, execute a search for LI documents, and locate the LI applicable for the version you wish to upgrade to. To locate the LI for the Cloud Pak for Data Standard edition, type, 'IBM Cloud Pak for Data Standard Edition' and for the Enterprise edition type, 'IBM Cloud Pak for Data Enterprise Edition.'

In the event there are no results for the version you are upgrading to, review the LI associated to the previous version which would apply in this scenario (for example, if you are upgrading to version 4.0.1 and there is no LI for this version, you will need to review the LI for version 4.0)

Architecture

Deploying the <u>AWS Marketplace</u> template for a new VPC with **default parameters** builds the following Cloud Pak for Data environment in the AWS Cloud.



Figure 2: Deployment architecture for Cloud Pak for Data on AWS

The Cloud Formation Stack sets up the following:

- A highly available architecture that spans one or three Availability Zones.*
- A VPC configured with public and private subnets according to AWS best practices, to provide you with your own virtual network on AWS. *
- In the public subnets:
 - Managed network address translation (NAT) gateways to allow outbound internet access for resources in the private subnets.*
 - A boot node Amazon Elastic Compute Cloud (Amazon EC2) instance that also serves as a bastion host to allow inbound Secure Shell (SSH) access to EC2 instances in private subnets.
- In the private subnets:
 - OCP master instances up to three Availability Zones
 - OpenShift Container Platform (OCP) compute nodes that combined, contain Cloud Pak for Data Collect, Organize, and Analyze services.
 - Elastic Block Storage disks that are mounted on the compute nodes for container persistent data



- A Classic Load Balancer spanning the public subnets for accessing Cloud Pak for Data from a web browser.
- A Classic Load Balancer spanning the public subnets for accessing the OCP master instances.
- A Network Load Balancer spanning the private subnets for routing internal OpenShift application programming interface (API) traffic to the OCP master instances.
- Amazon Route 53 as your public Domain Name System (DNS) for resolving domain names of the IBM Cloud Pak for Data web console and applications deployed on the cluster.

* The template that deploys into an existing VPC skips the components marked by asterisks and prompts you for your existing VPC configuration.

Cloud Pak for Data microservices are preconfigured on compute nodes. The following diagram shows the platform architecture.



Figure 3: Cloud Pak for Data services

Planning the deployment

Specialized knowledge

This deployment assumes basic familiarity with Cloud Pak for Data components and services. If you're new to Cloud Pak for Data and Red Hat OpenShift, see the <u>Additional resources</u> section. This deployment also assumes familiarity with the OpenShift command line interface and Linux, in addition to a moderate level of familiarity with AWS services.



Technical requirements

For Cloud Pak for Data requirements, see <u>System requirements for Cloud Pak for Data</u>. <u>Red Hat Enterprise Linux CoreOS (RHCOS)</u> is used for the OpenShift compute node instances in this deployment. Before you launch the template, your account must have resource quotas as specified in the following table.

<u>Resources</u>	If necessary, request <u>service quota increases</u> for the following resources. You might need to do this if an existing deployment uses these resources, and you might exceed the default quotas with this deployment. The <u>Service Quotas console</u> displays your usage and quotas for some aspects of some services. For more information, see the <u>AWS documentation</u> .		
	Resource	This deployment uses	
	VPCs	1	
	Elastic IP addresses	3	
	Network Load Balancers	1	
	Classic Load Balancers	2	
	i3.large instances	1	
	m5.xlarge instances	3	
	m5.4xlarge instances	3	
	m4.4xlarge instances	3(OCS)	
Regions	This deployment includes 3 Availability Zones, which isn't currently supported in all AWS Regions. For a current list of supported Regions, see <u>Service Endpoints and Quotas</u> in the AWS documentation.		
<u>Key pair</u>	Make sure that at least one Amazon EC2 key pair exists in your AWS account in the Region where you are planning to deploy the template. Make note of the key pair name. You'll be prompted for this information during deployment. To create a key pair, follow the <u>instructions in the AWS documentation</u> . If you're deploying for testing or proof-of-concept purposes, we recommend that you create a new key pair instead of specifying a key pair that's already being used by a production instance.		

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IAM permissions	To deploy the template, you must log in to the AWS Management Console with AWS Identity and Access Management (IAM) permissions for the resources and actions the templates will deploy. The <i>AdministratorAccess</i> managed policy within IAM provides sufficient permissions.
	The AdministratorAccess is required for the creation of openshift cluster. The info is present under the section creating an IAM user in the below link, Please review: <u>https://docs.openshift.com/container-platform/4.10/installing/installing_aws/installing_aws/installing_aws-account.html</u>

Deployment options

This template provides the following deployment options:

- **Deploy Cloud Pak for Data into a new VPC** (end-to-end deployment). This option builds a new AWS environment consisting of the VPC, subnets, NAT gateways, security groups, bastion hosts, and other infrastructure components, and then deploys Cloud Pak for Data into this new VPC.
- **Deploy Cloud Pak for Data into an existing VPC**. This option provisions Cloud Pak for Data in your existing VPC infrastructure.

The template also lets you configure CIDR blocks, instance types, and Cloud Pak for Data settings, as discussed later in this guide.

Pre-requisites

Ensure the following subscriptions are in place with your existing Cloud Pak for Data entitlements or obtained from <u>AWS Marketplace</u>

Step 1. IBM Cloud Pak for Data Subscription

When you purchase Cloud Pak for Data from Marketplace, you will get the Cloud Pak for Data entitlement Username and API Key. You should keep it handy as it's a required parameter in the Cloud Formation Template

Step 2. Red Hat Subscription

Ensure that you have the Red Hat <u>OpenShift pull secret</u> with your purchase. It should be uploaded to an S3 bucket. The Cloud Formation Template will pull this secret file from the specified S3 bucket location to provision the cluster.

Step 3. Sign in to your AWS account

Notes:

The customers should consider deploying their product to new AWS accounts because the permissions allow your application to create Administrative roles as well as it utilizes a long-term access key and secret key.

- Sign in to your AWS account at <u>https://aws.amazon.com</u> with an AWS Identity and Access Management (IAM) user role that has the necessary permissions. For details, see <u>Planning the</u> <u>deployment</u>, earlier in this guide.
- 2. Make sure that your AWS account is configured correctly, as discussed in <u>Technical</u> requirements, earlier in this guide.
- 3. Use the Region selector in the navigation bar to choose the AWS Region where you want to deploy Cloud Pak for Data on AWS. An IBM Pak for Data high availability deployment is restricted to AWS Regions with at least three Availability Zones.
- 4. The following resources should be made available for Cloud Pak for Data deployment
 - A key pair to SSH to the cluster nodes. In the navigation pane of the <u>Amazon EC2 console</u>, choose **Key Pairs**, and then choose your key pair from the list.
 - A new or an existing S3 Bucket location with Red Hat pull secret
 - A new or an existing <u>Route 53</u> domain and a Hosted Zone Id which will be used for adding DNS records for Cloud Pak for Data applications.
 - An existing S3 Bucket to store deployment log files.

Step 4. Launch the Deployment

Notes The instructions in this section reflect the current version of the AWS CloudFormation console. If you're using the redesigned console, some of the user interface elements might be different.

You are responsible for the cost of the AWS services used while running this deployment. For full details, see the pricing pages for each AWS service you will be using for this deployment. Prices are subject to change.

1. Launch the AWS CloudFormation template into your AWS account from the AWS Marketplace directly or you can download the template and launch it separately from your account.

A Cloud Pak for Data standard deployment takes about 3 hours, and a high availability (HA) deployment takes about 4 hours to complete.

- 2. Check the Region that's displayed in the upper-right corner of the navigation bar and change it if necessary. This is where the network infrastructure for Cloud Pak for Data will be built. The template is launched in the US East (N. Virginia) Region by default.
- 3. On the Create stack page, keep the default setting for the template URL, and then choose Next.
- 4. On the **Specify stack details** page, change the stack name if needed. Review the parameters for the template. Provide values for the parameters that require input. For all other parameters, review the default settings and customize them as necessary.

In the following tables, parameters are listed by category and described separately for these deployment options:

- Parameters for deploying Cloud Pak for Data into a new VPC
 - o <u>Cloud Pak for Data Base Services</u>
 - <u>Cloud Pak for Data Cartridges</u>
- Parameters for deploying Cloud Pak for Data into an existing VPC
 - o <u>Cloud Pak for Data Base Services</u>
 - <u>Cloud Pak for Data Cartridges</u>

When you finish reviewing and customizing the parameters, choose Next.

OPTION 1: PARAMETERS FOR DEPLOYING CLOUD PAK FOR DATA INTO A NEW VPC

VPC network configuration:

Parameter label (name)	Default	Description
Number of Availability Zones (NumberOfAZs)	3	The number of Availability Zones to be used for the deployment. Keep in mind that some Regions may be limited to two Availability Zones. For a single IBM Cloud Pak for Data cluster to be highly available, three Availability Zones are needed to avoid a single point of failure when using three, five, or seven master nodes or etcd nodes. With fewer than three Availability Zones, one of the Availability Zones will have more master nodes (or etcd nodes) than can be lost without losing a majority of the etcd instances. Allowed values: 1, 3
Availability Zones (AvailabilityZones)	Requires input	The list of Availability Zones to use for the subnets in the VPC. The template uses one or three Availability Zones and preserves the logical order you specify.
VPC CIDR (VPCCIDR)	10.0.0/16	The CIDR block for the VPC to be created.
Private subnet 1 CIDR (PrivateSubnet1CIDR)	10.0.0.0/19	The CIDR block for the private subnet located in Availability Zone 1.
Private subnet 2 CIDR (PrivateSubnet2 CIDR)	10.0.32.0/19	The CIDR block for the private subnet located in Availability Zone 2.
<pre>Private subnet 3 CIDR (PrivateSubnet3CIDR)</pre>	10.0.64.0/19	The CIDR block for the private subnet located in Availability Zone 3.
Public subnet 1 CIDR (PublicSubnet1CIDR)	10.0.128.0/20	The CIDR block for the public subnet located in Availability Zone 1.
Public subnet 2 CIDR (PublicSubnet2CIDR)	10.0.144.0/20	The CIDR block for the public subnet located in Availability Zone 2
Public subnet 3 CIDR (PublicSubnet3CIDR)	10.0.160.0/20	The CIDR block for the public subnet located in Availability Zone 3.
BootNodeAccessCIDR (BootNodeAccessCIDR)	Requires input	The CIDR IP range that is permitted to access the Boot Node instance. We recommend that you set this value to a trusted IP range. The value `0.0.0.0/0` permits all IP addresses to access. Additional values can be added post-deployment from the Amazon EC2 console.
Cluster Network CIDR (ClusterNetworkCIDR)	Requires input	The Cluster Network CIDR IP range that is used as IP address pools for pods.

DNS configuration:

Parameter label (name)	Default	Description
Domain name	Requires input	The domain name configured for the cluster.
(DomainName)		

Parameter label (name)	Default	Description
Key pair name (KeyPairName)	Requires input	The name of an existing public/private key pair, which allows you to securely connect to your instance after it launches.

Amazon EC2 configuration:

OpenShift hosts configuration:

Parameter label (name)	Default	Description
Number of master nodes (NumberOfMaster)	3	The desired capacity for the OpenShift master instances. Must be an odd number. For a development deployment, 1 is sufficient; for production deployments, a minimum of 3 is required.
Number of compute nodes (NumberOfNodes)	3	The desired capacity for the OpenShift node instances. Minimum of 3 nodes required. Warning If the number of node instances exceeds your Red Hat entitlement limits or AWS instance quotas, the stack will fail. Choose a number that is within your limits.
Master instance type (MasterInstanceType)	m5.xlarge	The EC2 instance type for the OpenShift master instances.
Compute instance type (NodesInstanceType)	m5.4xlarge	The EC2 instance type for the OpenShift node instances.
Cluster name (ClusterName)	Requires input	Custom cluster name for kubernetes.io/cluster/tags. If left blank, will use the stack name suffixed with the AWS Region.
Enable Fips (EnableFips)	false	Enable Fips for OpenShift
Publish (PrivateCluster)	false	To Deploy a Private cluster select true and false for Public cluster
Choose OpenShift Version (OpenShiftVersion)	4.10.37	Choose a <u>supported OpenShift Version</u> .
Choose username to login to OpenShift Console (OpenShiftUser)	ocsadmin	Username to be used to login to OpenShift Console.
Choose password to login to OpenShift and Cloud Pak for Data consoles (OpenShiftUser)	Requires input	Password to be used to login to OpenShift Console.

Storage Configuration:

Parameter label (name)	Default	Description
Storage type for Cluster (StorageType)	efs-ebs	efs, efs-ebs, ocs storage are available.
OCS instance type (OCSInstanceType)	m4.4xlarge	Update this value if Storage type selected is OCS. The EC2 instance type for the OpenShift Container Storage instances.
Number of OCS nodes (NumberOfOCS)	3	Update this value if Storage type selected is OCS. The desired capacity for the OpenShift container storage instances. Minimum of 3 is required.

Red Hat subscription information:

Parameter label (name)	Default	Description
RedHat subscription pull secret. (RedhatPullSecret)	Requires input	S3 path of OpenShift Installer Provisioned Infrastructure pull secret(e.g., s3://my-bucket/path/to/pull-secret).

IBM Cloud Pak for Data configuration:

Parameter label (name)	Default	Description
IBM Cloud Pak for Data version (ICPDVersion)	4.6.0	The version of Cloud Pak for Data to be deployed
IBM Cloud Pak for Data Entitled Registry User (APIUsername)	ср	Enter the IBM Cloud Pak for Data Username value to access IBM Container Registry.
IBM Cloud Pak for Data Entitled Registry API key Value (APIKey)	_	Enter the IBM Cloud Pak for Data API key to access IBM Container Registry
License agreement (LicenseAgreement)	_	I have read and agreed to the license terms for IBM Cloud Pak for Data that were provided to me at time of purchase.
OpenShift project (NameSpace)	zen	The OpenShift project that will be created for deploying Cloud Pak for Data. It can be any lowercase string.
Output S3 bucket name	Requires Input	The Existing S3 bucket name where the zip file output should be placed.



Parameter label (name)	Default	Description
(ICPDDeploymentLogsBu cketName)		

IBM Cloud Pak for Data Base Services:

Parameter label (name)	Default	Description
Watson Knowledge Catalog service (WKC)	False	Choose True to install the Watson Knowledge Catalog service.
Watson Machine Learning service (WML)	False	Choose True to install the Watson Machine Learning service.
Data Virtualization service (DV)	False	Choose True to install the Data Virtualization service.
Watson Studio service (WSL)	False	Choose True to install the Watson Studio service.
Watson OpenScale and Watson Machine Learning services (OSWML)	False	Choose True to install the Watson OpenScale and Watson Machine Learning services.
Spark Service (SPARK)	False	Choose True to install the Apache Spark Engine
Cognos Dashboard (CDE)	False	Choose True to install the Cognos Dashboard Engine service

IBM Cloud Pak for Data Cartridge (This option is enabled only for Cartridge subscriptions)

Parameter label (name)	Default	Description
Cloud Pak for Data Premium Service	Blank	Choose the premium service that you want to install. You can select from Db2, Db2 with Management Console, DataStage, Cognos Analytics, Planning Analytics, Watson Discovery,
(PremiumService)		OpenPages, or Open Data for Industries.

OPTION 2: PARAMETERS FOR DEPLOYING CLOUD PAK FOR DATA INTO AN EXISTING VPC

Parameter label (name)	Default	Description
Number of Availability Zones (NumberOfAZs)	3	The number of Availability Zones to be used for the deployment. Keep in mind that some Regions may be limited to two Availability Zones. For a single IBM Cloud Pak for Data cluster to be highly available, three Availability Zones are needed to avoid a single point of failure when using three, five, or seven master nodes or etcd nodes. With fewer than three Availability Zones, one of the Availability Zones will have more master nodes (or etcd nodes) than can be lost without losing a majority of the etcd instances. Allowed values: 1, 3
VPC ID (VPCID)	Requires input	The ID of your existing VPC for deployment.
VPC CIDR (VPCCIDR)	Requires input	The CIDR block for the VPC to be created.
Private subnet 1 ID (PrivateSubnet1ID)	Requires input	The ID of the private subnet in Availability Zone 1 for the workload (e.g., subnet-a0246dcd).
Private subnet 2 ID (PrivateSubnet2ID)	Requires input	The ID of the private subnet in Availability Zone 2 for the workload (e.g., subnet-b1f432cd).
Private subnet 3 ID (PrivateSubnet3ID)	Requires input	The ID of the private subnet in Availability Zone 3 for the workload (e.g., subnet-b1f4a2cd).
Public subnet 1 ID (Public Subnet 1 ID)	Requires input	The ID of the public subnet in Availability Zone 1 for the ELB load balancer (e.g., subnet-9bc642ac).
Public subnet 2 ID (PublicSubnet2ID)	Requires input	The ID of the public subnet in Availability Zone 2 for the ELB load balancer (e.g., subnet-e3246d8e).
Public subnet 3 ID (PublicSubnet3ID)	Requires input	The ID of the public subnet in Availability Zone 3 for the ELB load balancer (e.g., subnet-e324ad8e).
BootNodeAccessCIDR (BootNodeAccessCIDR)	Requires input	The CIDR IP range that is permitted to access the Boot Node instance. We recommend that you set this value to a trusted IP range. The value `0.0.0.0/0` permits all IP addresses to access. Additional values can be added post- deployment from the Amazon EC2 console.
Cluster Network CIDR (ClusterNetworkCIDR	Requires input	The Cluster Network CIDR IP range that is used as IP address pools for pods.

Network configuration:

DNS configuration:



Parameter label (name)	Default	Description
Domain name (DomainName)	Requires input	The domain name configured for the cluster.

Amazon EC2 configuration:

Parameter label (name)	Default	Description
Key pair name (KeyPairName)	Requires input	The name of an existing public/private key pair, which allows you to securely connect to your instance after it launches.

OpenShift hosts configuration:

Parameter label (name)	Default	Description
Number of master nodes (NumberOfMaster)	3	The desired capacity for the OpenShift master instances. Must be an odd number. For a development deployment, 1 is sufficient; for production deployments, a minimum of 3 is required.
Number of compute nodes (NumberOfNodes)	3	The desired capacity for the OpenShift node instances. Minimum of 3 nodes required.
		Warning If the number of node instances exceeds your Red Hat entitlement limits or AWS instance quotas, the stack will fail. Choose a number that is within your limits.
Master instance type (MasterInstanceType)	m5.xlarge	The EC2 instance type for the OpenShift master instances.
Compute instance type (NodesInstanceType)	m5.4xlarge	The EC2 instance type for the OpenShift node instances.
Cluster name (ClusterName)	Requires input	Custom cluster name for kubernetes.io/cluster/tags. If left blank, will use the stack name suffixed with the AWS Region.
Enable Fips (EnableFips)	false	Enable Fips for OpenShift
Publish (PrivateCluster)	false	To Deploy a Private cluster select true and false for Public cluster
Choose OpenShift Version (OpenShiftVersion)	4.10.34	Choose OpenShift Version.
Choose username to login to OpenShift Console (OpenShiftUser)	Requires input	Username to be used to login to OpenShift Console.
Choose password to login to OpenShift and Cloud Pak for Data consoles (OpenShiftUser)	Requires input	Password to be used to login to OpenShift Console.

Storage Configuration:

Parameter label (name)	Default	Description
OCS instance type (OCSInstanceType)	m4.4xlarge	Update this value if Storage type selected is OCS. The EC2 instance type for the OpenShift Container Storage instances.
Number of OCS nodes (NumberOfOCS)	3	Update this value if Storage type selected is OCS. The desired capacity for the OpenShift container storage instances. Minimum of 3 is required.

Red Hat subscription information:

Parameter label (name)	Default	Description
RedHat subscription pull secret	Requires input	S3 path of OpenShift Installer Provisioned Infrastructure pull secret(e.g., s3://my-bucket/path/to/pull-secret).
<pre>(RedhatPullSecret)</pre>		

IBM Cloud Pak for Data configuration:

Parameter label (name)	Default	Description
IBM Cloud Pak for Data version (ICPDVersion)	4.6.0	The version of Cloud Pak for Data to be deployed
IBM Cloud Pak for Data Entitled Registry User (APIUsername)	ср	Enter the IBM Cloud Pak for Data Username value to access IBM Container Registry.
IBM Cloud Pak for Data Entitled Registry API key Value (APIKey)	_	Enter the IBM Cloud Pak for Data API key to access IBM Container Registry
License agreement (LicenseAgreement)	_	I have read and agreed to the license terms for IBM Cloud Pak for Data that were provided to me at time of purchase.
OpenShift project (NameSpace)	zen	The OpenShift project that will be created for deploying Cloud Pak for Data. It can be any lowercase string.
Output S3 Bucket (ICPDDeploymentLogsBu cketName)		The name of the S3 bucket where IBM Cloud Pak for Data deployment logs are to be exported. The deployment logs provide a record of the boot strap scripting actions and are useful for problem determination if the deployment fails in some way



Parameter label (name)	Default	Description
Watson Knowledge Catalog service (WKC)	False	Choose True to install the Watson Knowledge Catalog service.
Watson Machine Learning service (WML)	False	Choose True to install the Watson Machine Learning service.
Data Virtualization service (DV)	False	Choose True to install the Data Virtualization service.
Watson Studio service (WSL)	False	Choose True to install the Watson Studio service.
Watson OpenScale and Watson Machine Learning services (OSWML)	False	Choose True to install the Watson OpenScale and Watson Machine Learning services.
Spark Service (SPARK)	False	Choose True to install the Apache Spark Engine
Cognos Dashboard (CDE)	False	Choose True to install the Cognos Dashboard Engine service

IBM Cloud Pak for Data Base Services

IBM Cloud Pak for Data Cartridge (This option is enabled only for Cartridge subscriptions)

Parameter label (name)	Default	Description
Cloud Pak for Data Premium Service	Requires input	Choose the premium service that you want to install. You can select from Db2, Db2 with Management Console, DataStage,
(PremiumService)		Cognos Analytics, Planning Analytics, Watson Discovery, OpenPages

- 5. On the options page, you can <u>specify tags</u> (key-value pairs) for resources in your stack and <u>set</u> <u>advanced options</u>. When you're done, choose **Next**.
- 6. On the **Review** page, review and confirm the template settings. Under **Capabilities**, select the check box to acknowledge that the template will create IAM resources.
- 7. Choose **Create stack** to deploy the stack.
- 8. Monitor the status of the stack. When the status is **CREATE_COMPLETE**, the Cloud Pak for Data cluster is ready.



9. Use the URLs displayed in the **Outputs** tab for the stack to view the resources that were created. The URL for the **ICPDWebClientURL** output key will navigate to the console login page.

Step 5. (Optional) Edit the application security group

Optional: You might need to edit the AWS application group to add IP addresses that can access the Cloud Pak for Data web client.

Navigate to Load Balancers on your AWS console and filter on tags, for example *kubernetes.io/service-name: openshift-ingress/router-default.*

1. In Load Balancers, filter and select the security group.

Launch Templates	Create Load Balancer Actions *					÷
Savings Plans	Q kubernetes.io/service-name : op	enshift-ingress/router-default 💿 Add filter				K < 1 to 1 of 1
Reserved Instances New	Name	DNS name	- State	- VPC ID	 Availability Zone 	es Type
Scheduled Instances	a0fff65e6f1e74174bdeee104d8b5b	7c a0fff65e6f1e74174bdee	e104	vpc-06f510a8c05	513b9ad us-east-1a	classic
Capacity Reservations						
▼ Images						
AMIs	Description Instances Heal	th check Listeners Monitoring Tags	Migration			
Elastic Block Store	Basic Configuration					
Volumes	Name	a0fff65e6f1e74174bdeee104d8b5b7c		Creation time	July 20, 2021 at 3:24:25 PM UT	TC+5:30
Snapshots	* DNS name	a0fff65e6f1e74174bdeee104d8b5b7c-126409167	5.us-	Hosted zone	Z35SXDOTRQ7X7K	
Lifecycle Manager New		east-1.elb.amazonaws.com (A Record)		Status	2 of 9 instances in service	
Network & Security	Туре	Classic (Migrate Now)		VPC	vpc-06f510a8c0513b9ad	
Security Groups	Scheme	internet-facing				
Elastic IPs	Availability Zones	subnet-05fae39fb16363426 - us-east-1a				
Placement Groups	Port Configuration					
Key Pairs	Port Configuration	90 (TCP) forwarding to 20010 (TCP)				
Network Interfaces	Fort Comiguration	Stickiness options not available for TCP protoc	cols			
▼ Load Balancing		443 (TCP) forwarding to 32137 (TCP)				
Load Balancers		Stickiness options not available for TCP protoco	cols			
Target Groups New	Security					
 Auto Scaling Launch Configurations 	Source Security Group	sg-09ddcb0748bca3ba2, k8s-elb-a0fff65e6f1e7	4174bdeee104d8b5b7c			

2. Select Security Group and modify the Inbound rules

New EC2 Experience X	Security Groups (1/1) Info	C Actions V Create security group
EC2 Dashboard	Q Filter security groups	< 1 > ©
Events	Security group name: k8s-elb-a0fff65e6f1e74174bdeee104d8b5b7c X Clear filters	
Tags		
Limits	☑ Name ▽ Security group ID ▲ Security group name	▽ VPC ID ▽ Description ▽ Owner
▼ Instances	✓ - sg-09ddcb0748bca3ba2 k8s-elb-a0fff65e6f1e74174bdeee104d8b5b7c	vpc-06f510a8c0513b9ad 🔀 Security group for Kub 295635262
Instances New		
Instance Types		
Launch Templates		
Spot Requests	sg-09ddcb0748bca3ba2 - k8s-elb-a0fff65e6f1e74174bdeee104d8b5b7c	
Savings Plans	Details Inbound rules Qutbound rules Tags	
Reserved Instances New		
Dedicated Hosts		
Scheduled Instances	Inbound rules (3)	C Manage tags Edit inbound rules
Capacity Reservations	Q Filter security group rules	< 1 > @
▼ Images		
AMIs	Name ▼ Security group rule ▼ IP version ▼ Type	▽ Protocol ▽ Port range ▽ Source
Elastic Block Store	- sgr-0c5f8333f7a8adf16 IPv4 HTTPS	TCP 443 0.0.0.0/0
Volumes	- sgr-0cbffde8eaf5d0aea IPv4 Custom ICMP - IPv	4 Destination Unreachable fragmentation require 0.0.0.0/0
Snapshots	- sgr-0b83b9b9586fee567 IPv4 HTTP	TCP 80 0.0.0/0
Lifecycle Manager New		
Network & Security		
Security Groups		

Figure 5: OpenShift node security group

3. Choose Add Rule, and fill in the rule details. For the rule Type, select either HTTP or HTTPS in the drop-down menu. Port 80 or 443 is filled in automatically. Add the network CIDR for the group of IP addresses that you want to permit HTTP or HTTPS access to the proxy nodes. To allow any IP address, use 0.0.0.0/0.

EC2 🗦 Security Groups 🍃 sg-09ddcb0748bca3ba2 - k8s-elb-a0fff65e6f1e74174bdeee104d8b5b7c 👌 Edit Inbound rules							
Edit inbound rules Info							
Inbound rules control the incoming traffic t	hat's allowed to reach the instance.						
Inbound rules Info							
Security group rule ID	Type Info	Protocol Info	Port range	Source Info		Description - optional Info	
sgr-0c5f8333f7a8adf16	HTTPS 🔻	ТСР	443	Custom 🔻	Q		Delete
					0.0.0.0/0 ×		
sgr-0cbffde8eaf5d0aea	Custom ICMP - IPv4	Destinat 🔻	fragmen 🔻	Custom 🔻	Q		Delete
					0.0.0.0/0 ×		
sgr-0b83b9b9586fee567	HTTP 🔻	ТСР	80	Custom 🔻	Q		Delete
					0.0.0.0/0 ×		
Add rule							
						Cancel Preview changes	Save rules



4. In the rule editor window, choose Save.



Step 6. Login to Cloud Pak for Data web client

When the AWS CloudFormation template has successfully created the stack, all server nodes will be running with the software installed in your AWS account. In the following steps, connect to Cloud Pak for Data web client to verify the deployment, and then use the web client to explore Cloud Pak for Data features.

1. To access the Cloud Pak for Data web client, first get the console URL and password from the Cloud Formation Stack output for key ICPDWebClientURL

CloudFormation \times	CloudFormation > Stacks > tCaT	-1AZ-lite-ocs-vpc-9f54c3				
Stacks Stack details Drifts	Stack info Events Reso	-lite-ocs-vpc-9f54c3	nge sets	Delete	Update Stack actions V	Create stack 🔻
Exports	Outputs (7)					C
Designer	Q Search outputs					۲
Registry	Key 🔺 Valu	ie	♥ Description		xport name	∇
Public extensions	BootnodeInstanceId i-Oa	:11e30cddff19c0	Bootnode Insta	nce ID		
Activated extensions Publisher	BootnodePublicIp 3.23	8.63.42	The boot node address.	public IP -		
	ICPDWebClientPasswor arn: d eBej	aws:secretsmanager:us-east-1:295635262768:secret:CPDSecret- bJ2is8LSS-kmVAZ7	CloudPak for Da client URL.	ata web -		
	ICPDWebClientURL	s://cpd-zen.apps.pk-existing-vpc.osonawsonline.com	CloudPak for Da client URL.	ata web -		
Feedback	OpenshiftPassword e0X-	aws:secretsmanager:us-east-1:295635262768:secret:OpenshiftSecr 45Ep8ZGML-Oispm4	et- OpenShift pass secret.	word -		
	OpenshiftURLValue http vpc.	s://console-openshift-console.apps.pk-existing- osonawsonline.com	The URL for the OpenShift UI.	-		
	OpenshiftUsername e0X-	aws:secretsmanager:us-east-1:295635262768:secret:OpenshiftSecr 45Ep8ZGML-Oispm4	et- OpenShift pass secret.	word -		

2. from the Secret Manager

Secret name Description Last retrieved (UTC) OpenshiftSecret-kQyMXxjBv3A7
OpenshiftSecret-kQyMXxjBv3A7
CPDSecret-vvQTnSNair7m - 7/20/2021
AWSCredentialSecret-Bsri0rRvX45U

Figure 8: OpenShift Secret in Secret Manager



3. Click the secret prefixed with "OpenShiftSecret" and retrieve the value of the secret. Take a note of the the value of the "ocpPassword", this will be the Cloud Pak for Data password.

Secret value info Retrieve and view the secret value.	Close Edit
Secret key/value Plaintext	
Secret Key	Secret Value
ocpUsername	ocsadmin
ocpPassword	eA2dW8yH

4. Log in to the Cloud Pak for Data web client by using the user "admin" and the password from the previous step.



5. Once you log in, the welcome page is displayed.



Amazon Web Services - IBM Cloud Pak for Data on the AWS Marketplace

≣ ІВ	M Cloud Pak for Data						er 🍧 🏭
	Welcome, admin!					•	
	Discover services Extend the functionality of the platform by installing services from the catalog. →	Manage use Connect to y provider and access the pl →	e rs our identity specify who can atform.	Stay informed Monitor the services that running and understand I you are using resources. →	are now	9	
	Overview						
			My instances				
	Instances						
	Databases		openpagesinstance1 openpages				
	Documentation						
	ିଧ Community						
	A [®] Support						
	🛇 Share an idea						

Figure 9: Welcome page for Cloud Pak for Data web client

See <u>resources</u> on platform features and capabilities. For a list of supported browsers, see <u>Supported browsers</u>.

Step 7. Manage your cluster using the OpenShift Console

1. To access the Cloud Pak for Data web client, go to the **OpenShiftURLValue** output of the root stack



CloudFormation \times	CloudFormation > Stacks > tCaT-1AZ-lite-ocs-vpc-9f54c3	
Stacks	■ Stacks Lelete Update Stack actions	ite stack 🔻
Stack details		
Drifts	Stack info Events Resources Outputs Parameters Template Change sets	
StackSets		
Exports	Outputs (7)	C
Designer	Q Search outputs	0
▼ Registry	Key Value Volue Export name	▽
Public extensions	BootnodeInstanceID i-Oac11e3Ocddff19c0 Bootnode Instance ID	
Activated extensions Publisher	BootnodePublicip 3.238.63.42 The boot node public IP address.	
	ICPDWebClientPasswor arr:aws:secretsmanager:us-east-1:295635262768:secret:CPDSecret- CloudPak for Data web d eBepJ2is8L55-kmVAZ7 client URL.	
	ICPDWebClientURL https://cpd-zen.apps.pk-existing-vpc.osonawsonline.com CloudPak for Data web client URL.	
Feedback	OpenshiftPassword arr:aws:secretsmanager:us-east-1:295635262768:secret:OpenshiftSecret- e0X45Ep8ZGML-Oispm4 Secret.	
	OpenshiftURLValue https://console-openshift-console.apps.pk-existing- vpc.osonawsonline.com The URL for the OpenShift UI.	
	OpenshiftUsername arm:aws:secretsmanagerus-east-1:295635262768:secret:OpenshiftSecret- e0X45Ep8ZGML-Oispm4 secret.	

The default OpenShift administrative user is ocsadmin.

You can retrieve the secret value by clicking Retrieve secret value as shown, and use the value for the OpenShift console administrative password.

Key	▽ Value	∇
aws:cloudformation:stack- name	ICPD-CloudPakDataStack-BCIC0Q3W5TS8	
aws:cloudformation:logical-	al-id OpenshiftSecret	
aws:cloudformation:stack-id	-id arn:aws:cloudformation:us-east-1:295635262768:stack/ICPD-CloudPakDataStack-BCIC0Q3W5TS8 a1f2-0e46d57ace87	8/3dff0a10-887f-11ea-
	_	
Secret value Info Retrieve and view the secret value	alue.	Retrieve secret value
Rotation configuration	ion Info	Edit rotation

Figure 10.1: Retrieve secret value for console password

2. Open the OpenShift Console URL in a browser, select htpasswdProvider at Log in and Login with the username and password from the previous step.

Log in with kube:admin htpasswdProvider	Red Hat OpenShift Container Platform

Step 8. (Optional) Provide Boot Node SSH access

The boot node EC2 instance is used for certain command-line cluster administration tasks, such as adding compute nodes. SSH access to the boot node is required for some cluster administrators. After deployment, you only have access to the boot node. Provide the workstation IP address CIDR as the value of the BootNodeSecurityGroup rule.

This section describes the steps to modify the BootNodeSecurityGroup inbound rules.

Note These steps assume access to the AWS CloudFormation console for the IBM Cloud Pak for Data deployment.

1. In the AWS Security Groups page, filter name containing BootNodeSecurityGroup



EC2 Dashboard	Security Groups (1/1) Info Create security group
Tags	Q. Filter security groups 🔍 👌
Limits	Security group name: tCaT-1AZ-lite-ocs-44a3e3-CloudPakDataStack-1100W2PEGZABW-BootnodeSecurityGroup-GTDWDW2BZMC9 X
▼ Instances	✓ Name ▼ Security group ID ▲ Security group name ▼ VPC ID ▼ Det
Instances New	g-0211ac94f38acc57c tCaT-1AZ-lite-ocs-44a3e3-CloudPakDataStack-1100W2PEGZABW-BootnodeSecurityGroup-GT vpc-06f510a8c0513b9ad [2] Clu
Instance Types	
Spot Requests	
Savings Plans	
Reserved Instances New	
Dedicated Hosts	sg-0211ac94f38acc57c - tCaT-1AZ-lite-ocs-44a3e3-CloudPakDataStack-1100W2PEGZABW-BootnodeSecurityGroup-GTDWDW2BZMC9
Scheduled Instances Capacity Reservations	Details Inbound rules Outbound rules Tags
▼ Images	
AMIs	Inbound rules (1/1) C Manage tags Edit inbound rules
Elastic Block Store	Q. Filter security group rules < 1 > 🛞
Snapshots	☑ Name ▽ Security group rule ▽ IP version ▽ Type ▽ Protocol ▽ Port range ▽ Source
Lifecycle Manager New	✓ - sgr-08e9ed56bbf3f8d11 IPv4 SSH TCP 22 0.0.0.0/0
▼ Network & Security	
Security Groups	

Figure 11: Security Groups

2. The security group window displays the ingress rules. Select the **Inbound** tab, and choose **Edit** to bring up the rule editor, choose **Add Rule**, and fill in the rule details. Add the network CIDR for the group of IP addresses that you want to permit SSH access to the boot nodes. To allow any IP address, use 0.0.0.0/0.

EC2 👌 Security Groups 👌 sg-0211ac94f38acc57c - tCaT-1AZ-lite-ocs-44a3e3-CloudPakDataStack-11OOW2PEGZABW-BootnodeSecurityGroup-GTDWDW2BZMC9 👌 Edit inbound rules						
Edit inbound rules	Info					
Inbound rules control the incoming tr	affic that's allowed to reach the instance.					
Inbound rules Info						
Security group rule ID	Type Info	Protocol Info	Port range Info	Source Info	Description - optional Info	
sgr-08e9ed56bbf3f8d11	SSH 💌	ТСР	22	Custom 🔻 Q	Delete	
				0.0.0.0/0 ×]	
Add rule						
					Cancel Preview changes Save rules	

Figure 14: Supplying rule details

3. In the rule editor window, choose Save Rules.

Accessing the control plane through the Boot Node

The recommended method of SSH access to the OpenShift cluster instances via the bastion host is by using SSH agent forwarding, as in the following Bash instructions:

1. Run the command ssh-add -K <your-key.pem> to store the key in your keychain. On Linux, you might need to omit the -K flag.



2. Retrieve the host name of the Boot Node from the Amazon EC2 console.

EC2 Dashboard	Instar	nces (1/10) Info						C	Conne	ct Instance state		Actions	Launch i	nstance	s 🔻
Events	Q Fi	lter instances												< 1	> ©
Tags		Name	⊽ In	stance ID		Instance state	• •	Instance type	a ⊽	Status check	Alarm sta	tus	Availability Zone		Public IPv4
Limits		fusableetfrifbbrende beetrede	1.0	EQueenec (7)	1961	O Dumping		i7 large		Q 2/2 shasks passed	Ne alarma		us east 1a		ee2 7 210 4
▼ Instances		fwsghisetfyifbbyondp-boothode	1-0	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	(100 I		QQ @@	is.targe		© 2/2 checks passed	No atarms	- T	us-east-1a		ecz-3-219-4
Instances New		fwsghtsetfylfbbyondp-crtfk-master-1	1-0	0003507855507			QQ @@	m5.xtarge		© 2/2 checks passed	No atarms	т -	us-east-1a		-
Instance Types		twsgnlsettyifbbyondp-crtfk-master-0	1-0	04a447c5ca9ad4	1940	Running	ଷ୍ୟ	m5.xlarge		© 2/2 checks passed	No alarms	+	us-east-1a		-
Launch Templates		fwsghlsetfyifbbyondp-crtfk-master-2	1-0	0040019465566	337a	Running	ଷ୍ୟ	m5.xlarge		© 2/2 checks passed	No alarms	+	us-east-1a		-
Spot Requests		fwsghlsetfyifbbyondp-crtfk-worker-us-e	e I-C	ee3e68b97084	4188	Running	ଷ୍ୟ	m5a.4xlarge		© 2/2 checks passed	No alarms	+	us-east-1a		-
Savings Plans		fwsghlsetfyifbbyondp-crtfk-worker-us-e	e i-C	9d6391ef6bef6	i8ab	Running	ଭ୍ଭ	m5a.4xlarge		⊘ 2/2 checks passed	No alarms	+	us-east-1a		-
Reserved Instances New		fwsghlsetfyifbbyondp-crtfk-worker-us-e	e i-0	0fb1600c8adee	:0e5	Running	ωQ	m5a.4xlarge		② 2/2 checks passed	No alarms	+	us-east-1a		-
Dedicated Hosts		fwsghlsetfyifbbyondp-crtfk-workerocs	i-0)1d3b1fc93f836	ic4d	Running	ଷ୍	r5.4xlarge		⊘ 2/2 checks passed	No alarms	+	us-east-1a		-
Scheduled Instances							=								
Capacity Reservations	Insta	ice: i-050aeeee663bfd861 (fws	sghlsetf	yifbbyondp	-bootnoo	de)									×
▼ Images	Deta	ils Security Networking	Storage	Status c	hecks	Monitoring	Tags								
AMIs		is security networking	Storage	Status e	licero	Homeoring	rugs								
▼ Elastic Block Store	v 1	nstance summary Info													
Volumes	Insta	nce ID			Public IPv4	address				Private IPv4 a	addresses				
Snapshots	đ	i-050aeeee663bfd861 (fwsghlsetfyifbby	ondp-boo	tnode)	3 .219.	47.21 open ad	dress 🖸			D 10.0.142	2.19				
Lifecycle Manager New	Insta	nce state			Public IPv4	DNS				Private IPv4	DNS				
Network & Security	ØR	unning			🗇 ec2-3-	219-47-21.com	oute-1.am	nazonaws.com	open ad	dress 🗇 ip-10-0-	142-19.ec2	internal			
Security Groups					Ż										

Figure 15: Host name of the Boot Node

3. To log in to the bastion host, run

\$ ssh -I <path-to-private-ssh-key> ec2-user@<bootnode-host-name>

4. Run oc login to authenticate with OpenShift and and verify that services are in a running state:
 \$ oc get pods

Scaling up your cluster by adding compute nodes

Login to your OpenShift Console, navigate Compute \rightarrow Machine Sets, each machine set can be scaled up.



- An AWS instance will be created and Desired count and current count will get updated to replica value.
- After few mins once the node joins the cluster ready and available count will be updated to replica value.

Note

- 1. If you choose to scale down your cluster or reduce the number of compute nodes, there is a risk of the cluster becoming unstable because pods will need to be rescheduled. Scaling down the worker nodes is not a recommended option.
- 2. Cluster auto scaler can overrule the scaling activity to maintain the required threshold.



Cloud Pak for Data services

You can browse the various services that are available for use by navigating to the <u>Cloud Pak for</u> <u>Data Service Catalog</u> in Cloud Pak for Data.



Figure 16: Services catalog page in Cloud Pak for Data

As part of the this installation, the control plane is installed by default, and the following services can be enabled while creating the stack:

- Watson Studio
- Watson Knowledge Catalog
- Watson Machine Learning
- Data Virtualization
- Watson OpenScale
- Cognos Dashboards Embedded
- Analytics Engine for Apache Spark
- Db2 Cartridge
- DataStage Cartridge
- Cognos Analytics Cartridge



- Planning Analytics Cartridge
- Watson Discovery Cartridge
- OpenPages Cartridge
- Open Data for Industries Cartridge

System requirements for each of the services

Service Name	CPU cores(vCPUs)	Memory
Watson Studio	48	167GB
Watson Knowledge Catalog	64	180GB
Watson Machine Learning	48	176GB
Data Virtualization	64	198GB
Watson Openscale (including WML)	64	250GB
Spark Engine	7	170GB
<u>Db2</u>	16	198GB
<u>DataStage</u>	6	110GB
Cognos Analytics	27	61GB
Planning Analytics	64	256GB
Watson Discovery	15	508GB
OpenPages	7	250GB
Open Data for Industries	48	144GB

Note: The resources listed are only for the services and does not include the resources for Cloud Pak for Data control plane and foundational services.

Exception:

After deploying `Watson Discovery` on cluster, execute following command to set the memory limit of RabbitMQ pod (wd-rabbitmq-discovery-0) to 2GB:

oc patch wd wd --type=merge --patch '{"spec": {"rabbitmq": {"resource": {"limits": {"memory": "2Gi"}}}}'



After you execute the oc patch command, the RabbitMQ pod (wd-rabbitmq-discovery-0) will be restarted automatically. You can check the completion of the restarting of the pod with "oc get po wd-rabbitmq-discovery-0" where you can see its readiness new age.

Install a Cloud Pak for Data Service

- Login to your bootnode server as mentioned in <u>access section</u>.
- Follow the <u>install</u> instructions
- To get information on various other services that are available, see the <u>Cloud Pak for Data</u> <u>Service Catalog</u>.

Upgrade Cloud Pak for Data Services

See what new features and improvements are available in the <u>latest release of IBM® Cloud Pak for</u> <u>Data.</u>

- Login to your bootnode server as mentioned in <u>access section</u>.
- Follow <u>upgrade</u> instructions

Limitations

• Review the known issues and limitations for Cloud Pak for Data.

Troubleshooting

Q. I encountered a CREATE_FAILED error when I launched the CF Template

A. If AWS CloudFormation fails to create the stack, we recommend that you relaunch the template with **Rollback on failure** set to **No**. (This setting is under **Advanced** in the AWS CloudFormation console, **Options** page.) With this setting, the stack's state will be retained and the instance will be left running, so you can troubleshoot the issue. (Look at the log files in %ProgramFiles%\Amazon\EC2ConfigService and C:\cfn\log.)

Important When you set **Rollback on failure** to **No**, you will continue to incur AWS charges for this stack. Make sure to delete the stack when you finish troubleshooting.

For additional information, see <u>Troubleshooting AWS CloudFormation</u> on the AWS website.

Q. I encountered a size limitation error when I deployed the AWS CloudFormation templates.

A. We recommend that you launch the CF templates from the links in this guide or from another S3 bucket. If you deploy the templates from a local copy on your computer or from a non-S3 location, you might encounter template size limitations when you create the stack. For more information about AWS CloudFormation limits, see the <u>AWS documentation</u>.

Q. I am not able to delete the stack that I created from the CF Template

A. We recommend that you clean up the registry bucket in your S3 account and retry deleting the stack.

Additional resources

AWS resources

- <u>Getting Started Resource Center</u>
- <u>AWS General Reference</u>
- <u>AWS Glossary</u>

AWS services

- <u>Amazon EC2</u>
- Amazon Route 53
- Amazon S3
- <u>Amazon VPC</u>
- <u>AWS CloudFormation</u>

IBM Cloud Pak for Data documentation

- <u>IBM Knowledge Center</u>
- <u>Product Hub</u>
- Red Hat OpenShift Container Platform

Document revisions

Date	Change	In sections
August 2021	First Marketplace Release	
September 2021	Cloud Pak for Data v4.0.1 (including Db2 and DataStage Cartridges)	Launch the Deployment Cloud Pak for Data Services



November 2021	Cloud Pak for Data v4.0.2 (including Cognos Analytics and Planning Analytics Cartridges)	Launch the Deployment Cloud Pak for Data Services
December 2021	Watson Discovery and OpenPages Cartridges	Launch the Deployment Cloud Pak for Data Services
June 2022	Added Open Data for Industries Cartridge	Launch the Deployment Cloud Pak for Data Services
October 2022	Cloud Pak for Data v4.5.3 Refresh	
December 2022	Cloud Pak for Data v4.6.0 Refresh	Launch the Deployment Cloud Pak for Data Services

