

IBM Cloud Advocate Study Guide



This study guide will help prepare you for the IBM Cloud Advocate Certification Examination.

What's in the Study Guide

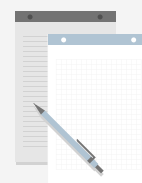
This study guide covers:

- ❖ IBM Cloud Essentials



How to Use This Study Guide

- 1) Read the content.
- 2) Take notes.
- 3) Answer practice questions.



Preparation

Thorough study is essential to a successful outcome on the exam.



- Clear your schedule.
- Find a quiet place to study.
- Focus on the content.



- Open the associated online course for reference – IBM Cloud Essentials – V3.
- Locate the Study Guide.
- Open the Study Guide.



- Review the Study Guide.
- Take notes.
- This Study Guide is not to be downloaded or shared.

Modules and Objectives

Modules

1. Introduction to IBM Cloud
2. Infrastructure
3. Deploying Applications
4. Services on IBM Cloud

Objectives

- Explain where data centers are located, the types of services available on IBM Cloud, and how to access billing information.
- Explain the different infrastructure services available on IBM Cloud.
- Describe the many open source options that IBM Cloud offers for deploying applications.
- Describe the eight most popular collection of services IBM Cloud offers.



Module 1: IBM Cloud Overview

Introduction and Objectives

In Module 1 of the Study Guide, the subject matter:

- Presents an overview of IBM Cloud.
- Shows the locations, regions, and zones where IBM Cloud data centers are located.
- Lists the account types and support plans available.
- Summarizes where to find billing and usage information.
- Shows how to use cost estimator tool.
- Provides information on Identify and Access Management (IAM) configurations to set up an IBM Cloud account.

Lessons

- Introduction and Objectives
- IBM Cloud: High Level Overview
- Locations, Regions, and Zones
- Account Types and Support Plans
- Billing and Usage
- Cost Estimator
- Identity and Access Management (IAM)
- Module Summary
- Knowledge Check Questions

Objectives

- Describe the IBM Cloud platform and its capabilities.
- Identify where IBM Cloud data centers are located around the world.
- Describe the various levels of accounts IBM Cloud offers and their support plans.
- Explain how to locate billing estimates and monthly usage information.
- Explain how to use IBM Cloud tooling to estimate how much a service would cost prior to usage.
- Explain how to set up basic IAM configurations for an IBM Cloud account.



Module 1: Introduction to IBM Cloud

IBM Cloud: High Level Overview

Why IBM Cloud?

For companies who need public cloud solutions that enable higher levels of compliance, security, and management, with proven architecture patterns and methods for rapid delivery, the IBM public cloud stands out as ready to run mission-critical workloads. IBM Cloud meets the requirements for running the world's largest incumbent businesses across many industries. In addition, users can deploy over 200 services – from containers, data, and AI, to blockchain and more.

Remember - IBM Cloud is a combination of Platform as a Service (PaaS), Infrastructure as a Service (IaaS), and Software as a Service (SaaS).

Multiple Components of IBM Cloud Platform

The IBM Cloud platform is composed of multiple components that work together to provide a consistent and dependable cloud experience.

Robust Console	Serves as the front end for managing your resources
IAM	For authentication and access control
Catalog	Consists of hundreds of offerings
Account and Billing Management System	Provides exact usage for pricing plans

Two Ways to Access IBM Cloud

1. IBM Cloud Console:

- Read the Docs to learn more about products.
- Use the Catalog to create new resources.
- Access the IBM Cloud resources you have provisioned.
- Use the Support tab to open a ticket.
- Use the Management tab to invite new users.

2. IBM Cloud command-line interface (CLI):

- Allows you to programmatically interact with IBM Cloud through a terminal or shell.



For a deeper dive into navigating the IBM Cloud Console, access the online course to view a demo.



Module 1: Introduction to IBM Cloud

IBM Cloud: High Level Overview cont.

Security Standards

IBM is committed to providing our clients with data privacy, security, and governance solutions to assist them in their journey to compliance readiness.

IBM Cloud is built on best-in-industry security standards, including:

- General Data Protection Regulation (GDPR)
- Health Insurance Portability and Accountability Act (HIPAA)
- International Organization for Standardization (ISO) 9001
- Payment Card Industry (PCI)
- Service Organization Control 2 (SOC2)



Module 1: Introduction to IBM Cloud Locations, Regions, and Zones

IBM Cloud can deploy workloads in over **6 regions**, **18 availability zones**, and **60 data centers** globally. This network spans **19 countries** on **6 continents**.

The six IBM Cloud regions are:

1. Dallas
2. Washington DC
3. London
4. Frankfurt
5. Tokyo
6. Sydney

Single-Zone versus Multi-Zone

In IBM Cloud there is the concept of a single-zone cluster and a multi-zone (or multi-region) cluster. The table below identifies the differences between single-zone and multi-zone clusters.

Single-zone Cluster	Multi-zone Cluster
Your cluster's resources remain in the same zone in which the cluster is deployed.	Your cluster's resources are spread across multiple zones for higher availability.
A single-zone cluster offers only one availability zone for that region.	A multi-zone cluster has three or more data centers (zones) within six miles of each other to ensure high availability and resiliency.
	A multi-zone cluster provides fault tolerance capability so that a single failure event affects only a single zone.

IBM cloud compute services are available in all six multi-zone capable regions and select single-zone regions. These include cities located in North America, South America, Europe, and Asia Pacific.

IBM Cloud object storage uses multi-zone availability.



Module 1: Introduction to IBM Cloud Locations, Regions, and Zones cont.

Hierarchy of Geographic Locations

IBM Cloud resources are organized into a hierarchy of geographic locations. Locations can be broken down as follows.

Geography

A geography is an organizational grouping based on a continent.



Country

Countries are locations within a geography.



Metro

A metro is the city where the data centers are located. The name of a city where one or more data centers are located. A metro might have a multi-zone region, such as Dallas, or might have a single-zone region, such as Mexico City.



Data Center (zone)

The physical location of the compute network and storage infrastructure that hosts cloud services and applications. In a region, clusters can be spread across data centers, or zones, in a multi-zone architecture for high availability. Zones are isolated from each other, which ensures no shared single point of failure.

IBM Cloud provides cloud infrastructure in Ashburn, VA and Dallas, TX that are built to meet Federal Risk and Authorization Management Program (FedRAMP) and Federal Information Security Modernization Act (FISMA) privacy and security standards and are connected to each other through an independent high-speed private network.



For a deeper dive into creating a Kubernetes cluster, access the online course to view a demo.



Module 1: Introduction to IBM Cloud Account Types and Support Plans

Account Types

IBM Cloud has three main types of accounts.

1. Lite

- This account is free of charge.
- Ideal for users who want to explore IBM Cloud for free.
- Benefits include access to over 40 services like cloud object storage, cloud databases, and artificial intelligence (AI) services.
- No credit card required, and the account never expires.

2. Pay-as-you-go

- Ideal for users who want full access to IBM Cloud with no long-term commitment.
- Benefits include access to all services in the catalog and to basic support, and it is fit for production use cases.

3. Subscription

- Ideal for organizations that would benefit from predicted billing and have committed to a certain amount of spend.
- Benefits available for enterprise customers include discounted pricing for services and support, and access to all services in the catalog.

Support Plans

There are three levels to IBM Cloud support plans.

1. Basic support plan
2. Advanced support plan
3. Premium support plan

Examine the table on the following page to view what is included in each support plan.



Module 1: Introduction to IBM Cloud Account Types and Support Plans

IBM Cloud Support Plans

	Basic	Advanced	Premium
Description	Included with IBM Cloud pay-as-you-go or subscription account.	Prioritized case handling and support experience that is aligned with your business needs.	Client engagement that is aligned with your business outcomes to accelerate time-to-value.
Availability	Provides access to create cases or tickets. Allows the pay-as-you go and subscription accounts to talk with support via phone or chat.	24/7 access to the IBM Cloud technical support team through cases, phone, and chat.	24/7 access to the IBM Cloud technical support team through cases, phone, and chat.
Response Time	N/A	Guarantees a response time of 1 to 8 hours based on the severity of the ticket.	Guarantees a response time of 15 minutes to two hours.
Additional Support	N/A	N/A	Assigns a technical account manager to the user's account for quarterly business reviews.

Case severity ranking is available for Advanced and Premium support plans. How quickly your support cases are addressed depends on the assigned severity.

4 = Minimal

3 = Some

2 = Significant

1 = Critical



For a deeper dive into creating a ticket, access the online course to view a demo.



Module 1: Introduction to IBM Cloud Billing and Usage

Billing and usage enables you to view detailed information about your IBM Cloud spending. To locate the Billing and Usage data:

1. Access the IBM Cloud Console.
2. Select **Manage** from the top navigation pane.
3. Select **Billing and usage**.

You can view billing by getting a monthly overview, or you can view it by specific service, and you can also export your usage as a CSV file.




For a deeper dive on how to view billing and usage data using the IBM Cloud Console, access the online course to view a demo.



Module 1: Introduction to IBM Cloud Cost Estimator

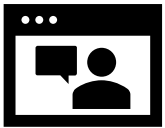
The cost estimator tool does exactly what its name suggests. It estimates the cost of an IBM Cloud service before you create the service. The tool is supported by all IBM Cloud services ranging from AI services to infrastructure services and Kubernetes clusters.

In the IBM Cloud Console, select the Cost Estimator icon . Explore the catalog to find offerings to add to an estimate. Then select your pricing plan and enter other configuration details as needed.

Enter in the estimated usage to calculate the cost.

The estimate can be calculated in over 15 different currencies, including U.S. dollars, South African rands, and Japanese yen. By default, the estimator shows the pricing and billing currency set for the account.

When finished, the estimate can be downloaded as a PDF, an XLSX, or a CSV.



For a deeper dive into how the Cost Estimator tool works, access the online course to view a demo.



Module 1: Introduction to IBM Cloud Identify and Access Management (IAM)

IAM Concepts

In IBM Cloud, IAM is comprised of four concepts:

1. Users – The people that log in and use the account.
2. Access groups – A collection of users.
3. Resources – A provision service offering with selections from the catalog.
4. Resource groups – A way of grouping resources together.

At the very highest level of IAM in IBM Cloud, we have an account. An **account** is comprised of many users. Each user has an email address that they use to log in to IBM Cloud.

In each account there is an account owner. In practice, for most enterprises this is usually a shared enterprise email that multiple people access.

Service vs. Resource

Before we talk about resources, let's understand the difference between a service and a resource.

Service	Resource
A service is an entry from the IBM Cloud catalog, like a virtual machine or object storage, or one of the many other offerings.	A resource is an instance of a service. For example, in the IBM Cloud catalog there is a database service called Cloudant. We can provision two instances of this service and call them DB-dev and DV-prod. These would be our resources.

A **user** represents an IBM ID enabled account. Users are invited to join **accounts** which can be done through the console, IBM Cloud CLI, or application programming interface (API). Users can create API keys to use with the CLI as an alternative to passwords for authentication. Users are given a role for the platform when invited, and these roles range from read-only viewer role to the administrator role, which can invite other users and view billing information.

Access groups are a collection of users. This is a way of grouping users together. For instance, you may decide to group your users into access groups such as admins, billing, and basic users. Access groups help enable a cleaner separation of control, and it's worth noting that users can be a part of multiple access groups at the same time.



Module 1: Introduction to IBM Cloud Identify and Access Management (IAM)

As previously mentioned, a **resource** is an instance of a service. Resources have an automatically generated service ID and can be deployed to specific regions. Resources have roles that can limit user access for that resource. For example, with cloud object storage, a user with the reader role could list and download objects in buckets.

A user with a writer role could create and destroy buckets, and a user with a manager role could control all aspects of data storage, like adding a retention policy and bucket firewall.

Resource groups are a collection of IBM Cloud resources. By grouping resources together, you can easily provide access to multiple resources at once. Note: The first resource group created is automatically named **Default**. You can update the name of this group or any other groups that you create.

Keep in mind that resource groups:

- Are specified at service creation time.
- **Cannot** be changed. (a resource's resource group cannot be changed)
- Have no geographical restrictions. This means you can put resources from Dallas and resources from Sydney in the same group, bringing it all together which is the concept of an access policy.

An **access policy** is the combination of a subject (which is a user or an access group), their role, and a target, resource, or resource group.



For a deeper dive into IBM Cloud IAM and how to set up an API key and invite users to an account, access the online course to view a demo.



Module 1: Introduction to IBM Cloud

Module Summary

- IBM Cloud has a catalog of over 200 products and services covering IaaS, PaaS, containers, data and AI, blockchain and more; more than 60 data centers globally; is built on best-in-industry security standards, including GDPR, HIPAA, ISO 9001, PCI, and SOC2.
- In terms of locations and regions, IBM Cloud has data centers in 19 countries and is divided into 6 regions; there is support for both single and multi-zone regions for better resiliency; there are federal regions for government workloads.
- There are three account types on IBM Cloud: Lite, Pay-as-you-go, and Subscription; and there are three support levels on IBM Cloud: Basic, Advanced, and Premium.
- IBM Cloud provides a month-to-month overview of billing and usage; usage and billing can be broken down by service; billing and usage reports can be exported as CSV files.
- IBM Cloud's Cost Estimator tool is supported by all IBM Cloud services; can convert to multiple currencies and can generate reports as PDF documents.
- An IBM Cloud account can have many users and access groups, which are a collection of users; resources are instances of services from the catalog; roles are assigned on a user or access group and a resource or resource group, coming together to become an access policy.

Module 1

Check Your Knowledge



Question 1.

What are two ways to access IBM Cloud?

- A. IBM Cloud SDK and SSH key
- B. IBM Cloud Console and IBM Cloud CLI
- C. IBM Cloud Shell and API key
- D. SSH key and API key



Answer B. IBM Cloud Console and IBM Cloud CLI are two ways to access IBM Cloud.

Module 1

Check Your Knowledge



Question 2.

What is a multi-zone cluster?

- A. A region that achieves 99.9 availability for your apps and services.
- B. A region that is comprised of two or more zones that are independent from each other to ensure that single failure events affect only a single zone.
- C. A region where you can host the power cooling, compute, network, and storage resources for services and apps.
- D. A region that is comprised of three or more zones that are independent from each other to ensure that single failure events affect only a single zone.



➡ Answer D. A multi-zone cluster is a region that is comprised of **three** or more zones that are independent from each other to ensure that single failure events affect only a single zone.

Module 1

Check Your Knowledge



Question 3.

What are the three account types in IBM Cloud?

- A. Standard, Pay-per-use, and Contract
- B. Free, Monthly, and Annual
- C. Lite, Pay-as-you-go, and Subscription
- D. Basic, Advanced, and Premium



➔ Answer C. The three account types in IBM Cloud are Lite, Pay-as-you-go, and Subscription.

Module 1

Check Your Knowledge



Question 4.

What account type never expires, does not require a credit card, and has access to over 40 services?

- A. Lite
- B. Enterprise
- C. Pay-as-you-go
- D. Subscription



➔ Answer A. The Lite account never expires, does not require a credit card, and has access to over 40 services.

Module 1

Check Your Knowledge



Question 5.

Which support plan provides a technical account manager?

- A. Basic
- B. Advanced
- C. Premium
- D. AdvancedPlus



➔ Answer C. The Premium support plan provides a technical account manager for quarterly business reviews.

Module 1

Check Your Knowledge



Question 6.

What severity level should be assigned to a support case in the event of a minimal function becoming inoperable?

- A. 1
- B. 2
- C. 3
- D. 4



➔ Answer D. In the event of a minimal function becoming inoperable, the severity level of 4 should be assigned to the support case.

Module 1

Check Your Knowledge



Question 7.

What two ways can you view your billing information?

- A. Daily summary
- B. Monthly overview
- C. Specific service
- D. Weekly overview



➔ Answer B & C. You can view your billing information in a monthly overview or by a specific service.

Module 1

Check Your Knowledge



Question 8.

When using the Cost Estimator tool, what three formats can be used to download the completed estimate?

- A. CSV
- B. DOC
- C. PDF
- D. PPT
- E. XLSX



➔ Answer A, C, & E. When using the Cost Estimator tool, you can download the completed estimate as a PDF, an XLSX, or a CSV.

Module 1

Check Your Knowledge



Question 9.

What is a resource?

- A. A collection of services
- B. An instance of a service
- C. An entry in the Cloud Catalog
- D. A service



➔ Answer B. A resource is an instance of a service.

Module 1

Check Your Knowledge



Question 10.

Resource Groups are used _____.

- A. to provide access to multiple resources at once.
- B. to secure network traffic around virtual servers in a VPC.
- C. as services running under Kubernetes that are deployed to specific regions.
- D. to mark out the classic infrastructure services which make up an application.



➔ Answer A. Resource Groups are used to provide access to multiple resources at once.



Module 2: Infrastructure

Introduction and Objectives

In Module 2 of the Study Guide, the subject matter:

- Explores the similarities and differences of compute options available on IBM Cloud.
- Provides an overview of block and file storage services available on IBM Cloud.
- Summarizes object storage and how to implement it on IBM Cloud.
- Explores networking services available on IBM Cloud.
- Summarizes virtual private clouds (VPCs) and how they are architected at IBM.
- Provides an overview of VMware solutions that are available on IBM Cloud.

Lessons

- Introduction and Objectives
- Virtual Servers and Bare Metal
- Block and File Storage
- Object Storage
- Network Services
- Virtual Private Cloud
- VMware
- Module Summary
- Knowledge Check Questions

Objectives

- Describe the various compute options on the IBM Cloud.
- Describe the storage and networking options available in IBM Cloud.
- Explain the broad-level architecture of VPC and the IBM Cloud offerings that enable VPC.
- Understand the value of using a managed VMware solution.



Module 2: Infrastructure

Virtual Servers and Bare Metal

Compute Options for IBM Cloud

There are **four** types of virtual server offerings on IBM Cloud: virtual server service, bare metal service, power system service, and hyper protect service. The features and capabilities of each virtual server are shown here.

Virtual Servers offer a range of operating systems and configurable random-access memory (RAM) and processing power.

Deployment	Billing	Images	More Options
Deploy in any IBM data center around the world.	<ul style="list-style-type: none"> • Public servers: multi-tenant; billed monthly or hourly. • Dedicated servers: single tenant; more expensive than multi-tenant public servers. • Transient: least expensive; deprovisioned as capacity grows. • Reserved: committed to a one-year or three-year contract. 	<ul style="list-style-type: none"> • CentOS • Debian • Microsoft • Red Hat • Ubuntu <p>For each image, different versions of the operating systems are available.</p>	<p>Depending on the profile selected options include:</p> <ul style="list-style-type: none"> • Up to 64 vCPU. • Up to 512 gigabytes of RAM. • Upgrade to a 1 gigabyte per second network connection. • 5 Storage Area Network (SAN) volumes. • 2 GPUs based on NVIDIA Tesla P-100 cards.

Bare Metal Servers provide horsepower for processing intensive and disk input/output (I/O) intensive workloads.

Deployment	Billing	Images	More Options
Provision in any IBM data center around the world.	Billing options range from hourly, monthly, or a one-year or three-year contract.	<p>Choose from images on there or more bare metal specific images, such as:</p> <ul style="list-style-type: none"> • VMware • Citrix • Cloud Linux • No operating system 	<p>Customized options include:</p> <ul style="list-style-type: none"> • 4 to 72 cores. • 6 terabytes of RAM. • Up to 36 drives. • GPU support based on NVIDIA Tesla P-100 cards. • Choose from VMware and SAP certified bare metal servers.



Module 2: Infrastructure

Virtual Servers and Bare Metal

Compute Options for IBM Cloud cont.

Power System Servers are used to deliver flexible compute capacity for power system workloads.

Deployment	Billing	Images	More Options
Deployed to specific data centers in Frankfurt, London, Toronto, and Dallas.	N/A.	Choose from various AIX and IBM i images or bring your own.	Choose between e880 and s922 machines.

Hyper Protect Servers allow for the creation and running of virtual servers on IBM LinuxONE (most secure Linux-based platform) and provide access to Z technology without purchasing any unique hardware or having unique Z skills. They offer added security as the servers are deployed in any secure service container. They are as easy to configure and deploy as any other virtual machine but can only be deployed to specific data centers in Dallas, Frankfurt, Sydney, and Washington.

Compare and Contrast Compute Options for IBM Cloud

The virtual server option is the cheapest, but the bare metal and power server options have the most to offer in terms of performance, while the hyper protect (LinuxONE) offering is top rated in terms of security.

	Cheapest	Performance	Security
Virtual Server	X		
Bare Metal		X	
Power System		X	
Hyper Protect			X



For a deeper dive on configuring, creating, and connecting to a virtual server instance from the IBM Cloud catalog, access the online course and view a demo.



Module 2: Infrastructure

Block and File Storage

Block and File Storage Overview

There are three types of block and file storage related services on IBM Cloud:

- **Block Storage Service** provides virtual servers and bare metal servers with SAN-like Internet Small Computer Systems Interface (iSCSi) storage.
- **File Storage Service** provides virtual and bare metal servers with a network file system (NFS) based storage.
- **Cloud Backup Service** is an enterprise level backup storage and disaster recovery solution.

Block and File Storage Services Similarities and Differences

Block and file storage have similar features and capabilities, as shown in this table.

Block Storage and File Storage Similarities

Block storage and file storage are both:

- Managed through the console or command line interface (CLI), where you can authorize a server and mount the volume.
- Highly durable and resistant (no need to create RAID arrays).

Block storage and file storage:

- Range in size from 20 GB to 12 TB (size can be increased after provisioning).
- Provide encryption for data at rest (available at no additional charge).
- Allow for adjustment of the IOPS (input output operations per second) on the fly (up to 48,000 IOPS).
- Can be provisioned in any IBM Cloud data center around the world.
- Allow for the creation of snapshots manually or scheduling them in advance.

Block storage and file storage features and capabilities also differ, as shown in this table.

Block Storage and File Storage Differences

Block Storage

- Uses iSCSi.
- May only be attached to a single host at time.
- Used for high intensity workloads (e.g., a database).

File Storage

- Uses NFS.
- May be attached to many hosts at one time.
- Used for workloads that do not require fast connectivity to storage.



Module 2: Infrastructure Block and File Storage

IBM Cloud Backup Service

The IBM Cloud Backup service is an automated agent-based backup system used to backup and restore data between servers in one or more IBM Cloud data centers. Benefits of this service are shown here.

Customize Backup

- Back up daily, weekly, or on a custom schedule.
- Back up full system, specific directories, or even individual files.

Management Portal

- Browser-based portal that allows scheduling jobs, setting retention policy, and performing one click restores.

Plugin Availability

- Plugins are available for MS SQL, MS SharePoint, and Oracle.

Data Encryption

- End-to-end data encryption protects data at source, in transit, and to the destination vaults with 256-bit private key encryption.

Geo Redundancy

- Protect data across geographically dispersed sources.



For a deeper dive on attaching a volume to a virtual server instance from the IBM Cloud catalog, access the online course and view a demo.



Module 2: Infrastructure

Object Storage

Object Storage Overview

Object storage is great for storing vast amounts of unstructured data. Files are uploaded as objects and saved into buckets. Buckets have no directory or tree structure. Each object in the bucket is given a unique identifier with metadata such as when the data was uploaded or last accessed. Objects can be very small up to 10 TB. All requests and responses to access data from IBM Cloud Object Storage using a RESTful API are using HTTPS protocol.

Benefits of Object Storage Service

Management Control

- Set policies for accessing and modifying objects via IBM Cloud Identity and Access Management (IAM) settings.

Encryption

- All objects stored in IBM Cloud Object Storage are encrypted by default.
- Encrypt data using your own keys with IBM Key Protect.

SQL Query Support

- Run SQL queries against objects stored in buckets.

High Speed Transfer

- Leverage Aspera to upload data quickly.

SDKs and APIs

- Objects can be accessed via S3 compatible REST application programming interfaces (APIs) or software development kits (SDKs) written for many popular programming languages.



Module 2: Infrastructure

Object Storage

Levels of Resiliency

IBM Cloud Object Storage service offers different levels of resiliency: cross region, regional, and single data center.

Cross Region	Regional	Single Data Center
Data is stored across three regions within a geography. Offers the highest possible availability, but lowest performance.	Great blend of availability, performance, and service integration. Data is less available than cross region but provides higher performance and more integration with other services.	Data is stored across multiple devices in a single data center. Recommended option when keeping data in-country is a top priority.

Object Storage Tiers

You can create buckets with different storage tiers. These buckets incur charges on different schedules.

Smart	Standard	Vault	Cold Vault
For those who don't know where to start as it automatically calculates the lowest storage rate based on monthly activity.	<ul style="list-style-type: none">For frequently accessed data.Higher cost per gigabyte (GB) but has higher performance.	<ul style="list-style-type: none">For data that is accessed once a month or less.Cheaper than standard storage, but more expensive than the cold vault option.	For archives when data is only accessed a few times a year.



Module 2: Infrastructure Network Services

IBM Cloud Network Services Overview

IBM Cloud has two different services for networking:

1. Cloud Internet Services (based on Cloudflare)
2. Collection of networking infrastructure services with options for virtual local area networks (VLANs), virtual private networks (VPNs), and content delivery networks (CDNs).

Cloud Internet Services

Cloud Internet Services provides reliable, secure options for internet-facing application by leveraging Cloudflare. Cloudflare is a web infrastructure company that provides domain name system (DNS) services to 12 million websites and has over 165 points of presence all over the world.

Within IBM Cloud, you can use Cloud Internet Services to configure:

Service	Benefit of Service
Domain Name Servers (DNS)	For host name resolution.
Transport Layer Security (TLS)	To secure data.
Global Load Balancers	To reduce latency and increase availability by routing traffic based on server availability and health.
Rate Limiting	To automatically identify and mitigate excessive request rates.
Distributed Denial of Service (DDoS) Protection	Scalable, configurable service to protect against brute force attacks.
Web Application Firewalls	A layered defense to protect data against sophisticated attackers and malicious bots.
Caching	To reduce latency and improve performance.



Module 2: Infrastructure Network Services

Network Infrastructure Services

There are many **network infrastructure related services** on IBM Cloud, including gateway appliances, VPNs, VLANs, Direct Link, CDNs, and load balancers.

Gateway Appliance, VPNs, and VLANs

The use, features, and capabilities of these services are shown here.

Gateway Appliance	VPN	VLAN
<ul style="list-style-type: none"> Enables creation of virtual routers, firewalls, and private networking devices. Choice of a Juniper or AT&T-based appliance. Select from hardware and software-based firewalls. Prevent malicious activity and ensure server uptime. Add a firewall to a specific virtual server. 	<ul style="list-style-type: none"> Facilitates connectivity from client network to IBM's private network. Subnets and IPS subnets provide additional IP addresses for virtual machines. Managed independently of virtual machine resources. Available until canceled. 	<ul style="list-style-type: none"> Provides packet identification and lets multiple workloads coexist on the same physical equipment. Managed separately; does not always require direct interaction.

Direct Link



Direct Link creates a direct private connection between remote networks and IBM Cloud. Direct Link provides:

- A secure, dedicated, connectivity.
- Private access to IBM Cloud infrastructure.
- A fully integrated hybrid environment (creates multi cloud connectivity in a single environment).
- Speed (50 Mbps – 5 Gbps).



Module 2: Infrastructure Network Services

Network Infrastructure Services cont.

CDNs



A CDN is a highly distributed platform of servers used to help minimize delays. IBM Cloud's CDN services is based off Akamai, a best of breed CDN provider. IBM Cloud's CDN service:

- Provides smart scaling (automatically scales global service to over 2200 points of presence in 36 countries).
- Makes things more secure (additional layer between infrastructure and infrastructure attacks).
- Can be used to optimize dynamic content (e.g., direct customer requests through optimized routes, proactively fetching content from origin and large file compression).
- Provides usage-based pricing (pay for what you use with no minimum monthly fee).

Load Balancers



A load balancer is used to distribute traffic among virtual servers. Customers can choose between an IBM Cloud load balancer or a Citrix Netscaler VPX load balancer. Elastic load balancers allow for Layer-4 and Layer-7 load balancing, including:

- HTTP, HTTPS, and Transmission Control Protocol (TCP)
- Public and private load balancing
- Server health checks
- Secure Sockets Layer (SSL) offload
- Monitoring metrics



Module 2: Infrastructure

Virtual Private Clouds

Virtual Private Cloud Overview

A Virtual Private Cloud (VPC) is a secure, isolated, private cloud hosted within a public cloud. A VPC provides the security of a private cloud with the cost effectiveness and scalability of a private cloud.

VPCs offer:

- An on-demand configurable pool of shared resources allocated within a public cloud environment.
- Isolation between virtual machines through private IP subnets and encrypted communication channels.
- Authentication of users and remote access to shared resources.

These features and functions allow an organization to work on a virtually private cloud.

How do VPCs provide customizable networking, security, and private access to data and storage?

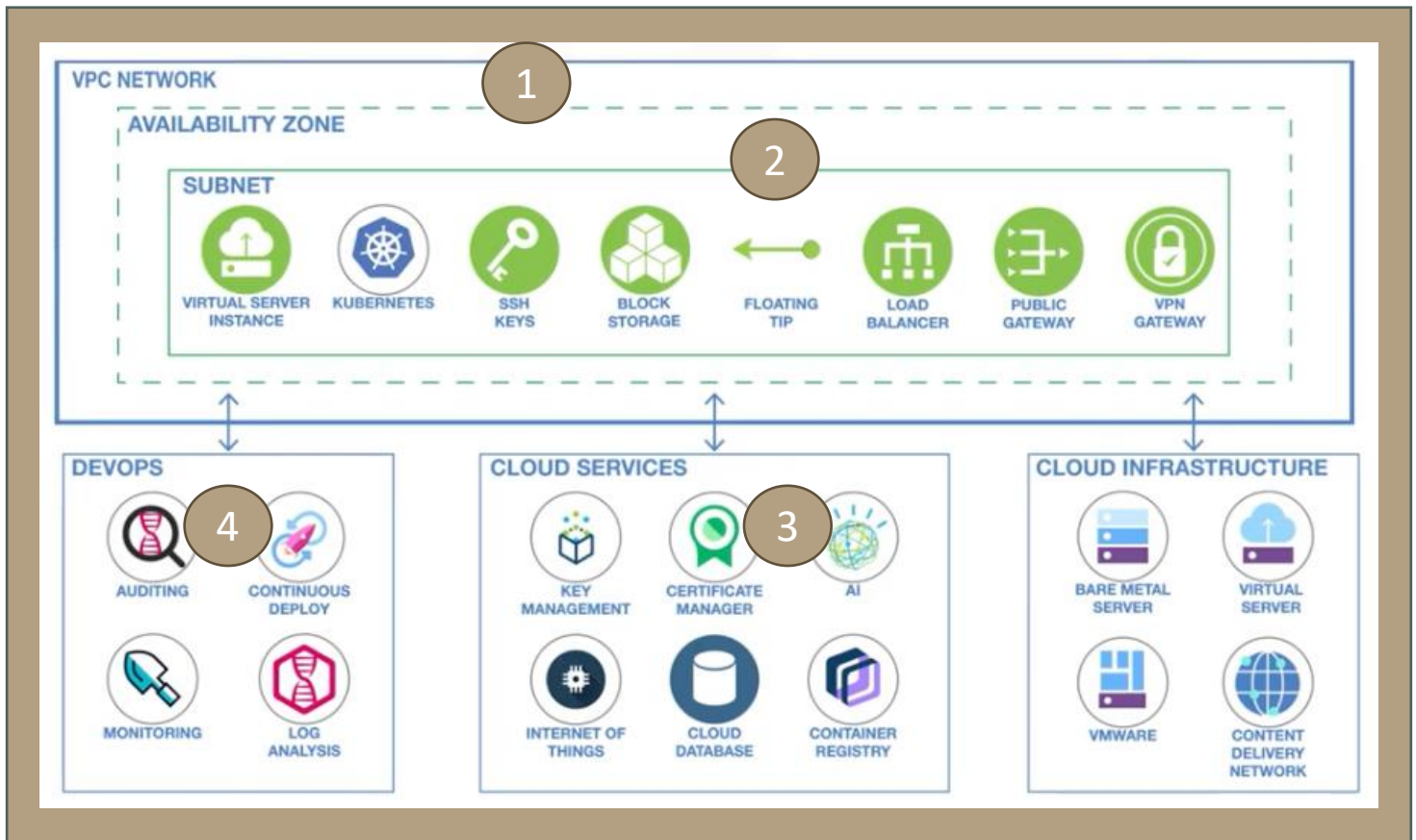
Security Groups	<ul style="list-style-type: none">• Filter each network interface by a virtual server based on IP address.
Virtual Server Instances	<ul style="list-style-type: none">• Can be created quickly using predefined profiles optimized for specific workloads. <p>Note: A Resource Group Name and SSH Key are required when creating a virtual server in a VCP on IBM Cloud.</p>
Public Gateway	<ul style="list-style-type: none">• Enables communication to the internet for all virtual server instances on the attached subnet.
Block Storage	<ul style="list-style-type: none">• Provides primary boot volumes and secondary data volumes.• A 100 GB block storage volume is automatically created and attached as a boot volume (where the operating system is stored and run) when an instance is created.



Module 2: Infrastructure Virtual Private Clouds

VPC Architecture

The graphic shows a sample architecture for an IBM VPC, and the associated notations provide a brief description of how the components interact with one another.



1

When a user connects to the internet and goes to a specific URL, they must authenticate to the network. Authentication provides the user with certain predefined access to the network. That access is indicated by the bold blue line in the graphic.

2

The VPC network is deployed in a specific zone within a region where virtual server instances, gateways, storage, load balancers and gateways are hosted.

3

The VPC network has access to many cloud services, including AI, cloud databases, Internet of Things (IoT), and container registry.

4

The VPC network has access to DevOps services, including monitoring, log analysis, and continuous deployment and delivery.



Module 2: Infrastructure

Virtual Private Clouds

VPC Options on IBM Cloud

There are two VPC generation options on IBM Cloud: Generation 1 and Generation 2. A comparison of the two options is included in the table.

Generation 1	Generation 2
<ul style="list-style-type: none">• Available in 6 regions• Networking speeds up to 16 Gbps• Provider managed security or bring your own key (BYOK)	<ul style="list-style-type: none">• Available in 5 regions• Networking speeds of up to 80 Gbps• Supports only provider managed security



Module 2: Infrastructure

VMware

VMware Overview

To understand the importance of VMware on the Cloud, it is important to understand the history of VMware. In the **early 2000s**, before major public clouds, VMware solutions were the standard for desktop and server virtualization. VMware software was deployed to servers and data centers all over the world. Many IBM clients use VMware to this day. In **2016**, IBM Cloud became the first cloud vendor to bring VMware services to the cloud.

Why is VM on a cloud platform important?

Brings cloud economies to VMware workloads

- Less spending on capital expenditures such as purchasing equipment, data centers, and so forth. All this is managed by the cloud provider.

Provides scalability and elasticity

- If you need more capacity, you order it. Scale up and down as needed.

Provides high availability

- Using a cloud provider ensures workloads take advantage of highly available networking between regions of a cloud.

IBM Cloud's VMware-based Services Overview

IBM Cloud offers two VMware-based services:

VMware Solution Dedicated	VMware Solution Shared
<ul style="list-style-type: none">• Single tenant bare metal solution.• Options for vCenter Server or VMware vSphere.	<ul style="list-style-type: none">• Multi tenant solution using shared infrastructure.• Provides a VMware environment based on vCloud Director.



Module 2: Infrastructure

VMware

VMware Solution Dedicated

The VMware Solution Dedicated is a single tenant, bare metal solution with vCenter Server and VMware vSphere options, which allows clients to retain root level access to the hypervisor. This experience is similar to an on-premises experience in a data center. Difference and similarities for vCenter Server and VMware vSphere options are shown here.

vCenter Server	VMware vSphere
<ul style="list-style-type: none"> Fully automated, standardized software defined data center. <ul style="list-style-type: none"> Networking, storage, and add-ons automatically configured at install time. Provides the opportunity to purchase IBM-provided licenses through IBM Cloud portal. Provides customers the opportunity to bring your own license (BYOL). Deploy add-on services to a new or existing instance, including security compliance services such as Big IP and business continuity and migration services such as Veeam and Zerto. 	<ul style="list-style-type: none"> Provides more options for customization. <ul style="list-style-type: none"> Networking, storage, and add-ons typically configured manually. Provides the opportunity to purchase IBM-provided licenses through IBM Cloud Portal. Provides customers the opportunity to bring your own license (BYOL). Deploy add-on services to a new or existing instance, including security compliance services such as Big IP and business continuity and migration services such as Veeam and Zerto.

VMware Solution Shared

VMware Solution Shared allows for deployment of workloads on top of IBM hosted VMware infrastructure. IBM provides a self-service on demand VMware cloud computing platform with VMware vCloud Director running on IBM Cloud. IBM manages up to the hypervisor level. Benefits of the VMware Solution Shared are listed here.

Cost Effective	Disaster Recovery	Self-service
<ul style="list-style-type: none"> Pay only for what you use. Start as small as 1 CPU and 1 GB of RAM. Perfect for temporary migration and bursts. 	<ul style="list-style-type: none"> Veeam services enable an economic landing zone for disaster recovery workloads. 	<ul style="list-style-type: none"> Shared services infrastructure is designed to get environments up and running within minutes.



Module 2: Infrastructure

VMware

Why use VMware on IBM Cloud?

Using VMware on IBM Cloud provides several unique advantages.

Security

- Provides encryption and access control.
- Provides highest level of encryption for data at rest and data in motion with Federal Information Processing Standards (FIPS) 140-2 (Level-4 based encryption).

Compliance

- Provides compliance with data sovereignty regulations and sharing.
- Provides geofencing for workloads.

Expertise

- Provides over 15 years experience as one of the largest operators of VMware workloads.
- Managing 850,000 workloads and migrating over 100,000 workloads from on prem to cloud.
- Provides experience in multiple industries, from government to banking to retail.

Rapid Setup

- Uses IBM Cloud automation for setup in hours, not days or weeks.

Optional Services Added to VMWare Deployments

There are 13 (and counting) optional services that can be added to VMware deployments, ranging from security and compliance to business continuity and migration services. Three optional services are highlighted here.

Veeam	Zerto	F5 Big IP Suite
<ul style="list-style-type: none">• Allows for easy backup and replication of virtual machines on VMware.	<ul style="list-style-type: none">• Assists in creating and managing disaster recovery with VMware.	<ul style="list-style-type: none">• Assists with networking and security related tools for VMware solutions.



Module 2: Infrastructure Summary

- Virtual servers provision a virtual machine on IBM Cloud in any data center worldwide with countless configuration choices for operating system, central processing unit (CPU), and RAM. Bare metal servers offer additional horsepower for compute-intensive workloads.
- Block Storage provides virtual servers and bare metal servers with a SAN-based storage. File storage provides virtual servers and bare metal servers with a NFS-based storage. The Cloud Backup service is an enterprise-level backup storage and disaster recovery solution.
- Data stored in IBM Cloud Object Storage is encrypted by default. IBM Cloud Object Storage has four storage classes with a Smart tier that is ideal for changing data usage patterns. SDK support for many popular programming languages and an S3 compatible API.
- IBM Cloud's Cloud Internet Service has support for DNS, TLS, caching, and rate limiting at the application layer. IBM's Cloud Networking Infrastructure offers VPNs, Subnets, CDNs, and firewalls. IBM partners with best-in-breed companies like Akamai and Cloudflare to deliver networking services.
- A virtual private cloud is a secure, isolated private cloud hosted within a public cloud. It provides the security of a private cloud with the cost-effectiveness and scalability of a public cloud. IBM Cloud VPC provides customization of the networking, security, compute, and storage aspects of the cloud by allowing customers to bring their own IP, add a VPN gateway, choose different flavors of compute, and add storage as needed. IBM Cloud VPC has two options: Gen1 and Gen2. Gen1 has more options for regions and security. Gen2 has higher networking speeds and provisioning times.
- VMware Solution Dedicated is a bare metal solution with vCenter and vSphere options. It provides a single-tenant, client-managed VMware Software Defined Data Center (SDDC) solution. VMware Solution Shared deploys workloads on top of IBM hosted VMware infrastructure running VMware vCloud Director. VMware Solutions can integrate with third-party providers, like Zerto and Veeam.

Module 2

Check Your Knowledge



Question 1.

Which compute option on IBM Cloud are the Citrix, VMware, and Cloud Linux images associated with?

- A. Virtual Server Service
- B. Bare Metal Service
- C. Power System Service
- D. Hyper Protect Service



➔ Answer B. Bare Metal Service provides images for Citrix, VMware, IBM Cloud Linux, among others.

Module 2

Check Your Knowledge



Question 2.

Which compute option on IBM Cloud offers access to Z technology without requiring the purchase of Z hardware or requiring Z technology specific skills?

- A. Virtual Server Service
- B. Bare Metal Service
- C. Power System Service
- D. Hyper Protect Service



➔ Answer D. Hyper Protect Service offers access to Z technology without requiring the purchase of Z hardware or having Z-specific skills.

Module 2

Check Your Knowledge



Question 3.

Which virtual server instance is billed hourly and monthly?

- A. Public virtual server
- B. Dedicated virtual server
- C. Transient virtual server
- D. Reserved virtual server



➔ Answer A. Public virtual server instances are billed hourly and monthly.

Module 2

Check Your Knowledge



Question 4.

Which IBM Cloud service provides virtual servers and bare metal servers with SAN-like iSCSI storage?

- A. IBM File Storage
- B. IBM Block Storage
- C. IBM Object Storage
- D. IBM Cloud Backup



➔ Answer B. IBM Block Storage provides SAN-like iSCSI storage to both virtual and bare metal servers.

Module 2

Check Your Knowledge



Question 5.

What is the maximum storage volume supported for block or file storage on IBM Cloud virtual and bare metal servers?

- A. Up to 10 GB
- B. Up to 10 TB
- C. Up to 12 TB
- D. Up to 20 GB



➡ Answer C. The maximum storage volume for block or file storage is 12 TB.

Module 2

Check Your Knowledge



Question 6.

All these services are provided by IBM Cloud Internet Services EXCEPT:

- A. DDoS Protection
- B. Global Load Balancing
- C. Rate Limiting
- D. Auditing



➔ Answer D. Auditing is not provided by IBM Cloud Internet Services.

Module 2

Check Your Knowledge



Question 7.

Which network infrastructure service is used to distribute a workload between multiple servers?

- A. Content Delivery Network
- B. Load Balancer
- C. Direct Link
- D. Gateway Appliance



Answer B. The Load Balancer is used to distribute a workload between multiple services.

Module 2

Check Your Knowledge



Question 8.

Which service can assist a client in connecting an application in IBM Cloud with their private network?

- A. Gateway Appliance
- B. VPN
- C. VLAN
- D. SSL



➔ Answer B. A VPN service can assist a client in connecting an application on IBM Cloud with the client's private network.

Module 2

Check Your Knowledge



Question 9.

Private subnets and encrypted communication channels are used to:

- A. Achieve isolation between workloads on VPCs on IBM Cloud.
- B. Allocate storage on VCPs.
- C. Provide an encrypted network tunnel between the VPC and on premises networks.
- D. Filter traffic to network interfaces.



➔ Answer A. Private subnets and encrypted communication channels are used to achieve isolation between workloads on VPCs on IBM Cloud.

Module 2

Check Your Knowledge



Question 10.

What enables communication to the internet for all virtual server instances on the attached subnet?

- A. Public Gateway
- B. Security Group
- C. Firewall
- D. Load Balancer



➔ Answer A. A public gateway enables communication to the internet for all virtual server instances on the attached subnet.

Module 2

Check Your Knowledge



Question 11.

If an organization has a VMware shared environment, who is responsible for the management and operation of that environment?

- A. IBM
- B. VMware
- C. Client
- D. Veeam



➔ Answer A. In a VMware shared environment, IBM is responsible for the management and operation of the environment.

Module 2

Check Your Knowledge



Question 12.

Which service in the IBM Cloud platform is used to backup and replicate virtual machines on VMware?

- A. Zerto
- B. F5 Big IP
- C. Veeam
- D. VM Backup



➔ Answer C. Veeam is used to back up and replicate virtual machines on VMware.



Module 3: Deploying Applications

Introduction and Objectives

In Module 3 of the Study Guide, the subject matter:

- Reviews various open source options for deploying applications available in the IBM Cloud.
- Introduces Kubernetes (k8s) a container orchestration system for automating application deployment.
- Introduces the Red Hat OpenShift platform which delivers additional capabilities on top of Kubernetes.
- Introduces Cloud Functions, IBM Cloud's Function-as-a-Service capability which provides serverless functionality.

Lessons

- Module Introduction and Learning Objectives
- Containers and Kubernetes
- OpenShift
- Cloud Foundry
- Cloud Functions
- Module Summary
- Knowledge Check Questions

Objectives

- Identify the various features and usage of containers, Kubernetes, and OpenShift on the IBM Cloud.
- Differentiate between serverless compute options on the IBM Cloud.



Module 3: Deploying Applications

Containers and Kubernetes

What is a container?

A container can be thought of as packaging up your application source code dependencies, like runtimes, binaries, libraries, and data. A packaged up container is called an **image**. A container image is stored in a registry as a read-only static file that includes executable code, libraries, and dependencies that are required by an application to run.

A container is configured to communicate with a specific Kubernetes cluster. Each cluster has a master node with at least one worker node. Each worker node can support running multiple pods. A pod runs a single image or instance of a containerized application or process.

Benefits of Using Containers

There are many benefits to using containers. The table below lists some of them.

Benefits of Using Containers
Are abstracted away from the host operating system making them portable and able to run from anywhere.
Can run uniformly consistent across any platform or cloud.
Are fast and efficient because they share the host operating system kernel and are not bogged down with extra overhead.
Deliver faster startup times because they are inherently smaller in capacity compared to VMs.
Provide increased security and isolation by inherently preventing malicious code from affecting other containers in the host operating system.
Allow defining security permissions to block unwanted components from entering containers or limiting communication with unnecessary resources.



Module 3: Deploying Applications Containers and Kubernetes (continued)

Goal of Kubernetes

These are the primary goals of Kubernetes.

Kubernetes Goals

Make everything associated with deploying and managing your containers easier.

Automate rollouts and rollbacks.

Scale services up or down depending on utilization automatically.

Ensure you are running only what you need when you need it.

Elements of Kubernetes

Containers are the building blocks for Kubernetes and provide process isolation.

Kubernetes Characteristics

Kubernetes is an open source container orchestration project that:

- Simplifies everything associated with deploying and managing containers.
- Uses automated rollouts and rollbacks to deploy and manage containers.
- Scales services up or down automatically based on utilization.
- Runs what you need when you need it.
- Monitors the health of your services to prevent bad rollouts.

Kubernetes is built to be used anywhere, allowing you to orchestrate deployments to public clouds, private clouds, on premise, and hybrid deployments.



For a deeper dive on containers and Kubernetes, access the online course and view the demo.



Module 3: Deploying Applications OpenShift

Elements of OpenShift

OpenShift is based on the open source OKD Project which is the community distribution of Kubernetes that powers OpenShift. OpenShift is a layer that is built on top of Kubernetes which makes working with it much easier.

OpenShift simplifies various difficult tasks like deploying applications and doing day-to-day administrative operations by extending Kubernetes in an opinionated way. OpenShift, like Kubernetes, is deployable on premises or in a cloud and with the exception of OKD, OpenShift benefits from enhanced security from being run on Red Hat Enterprise Linux (RHEL).

The Kubernetes object, Namespace, is referred to as a project in OpenShift. OpenShift takes the Kubernetes namespace concept and extends it with projects allowing you to control access between who can access namespaces or projects. OpenShift simplifies developer workflow with source to image and routes.

Kubernetes versus OpenShift

Kubernetes	OpenShift
Quarterly minor releases with the latest being 1.19.	Quarterly releases with the latest being 4.4 based on 1.17.
Has just the core framework.	Has Kubernetes' core framework plus all of OpenShift's abstractions.
Platform, or user, is responsible for integrating beyond the core framework.	Includes an integration of common features.

Public Clouds and Red Hat Managed OpenShift Instances

Public Clouds and Red Hat Managed OpenShift Instances

The Red Hat OpenShift on IBM Cloud service:

- Is fully managed and secure.
- Provides automatic upgrades, patching, and deployment.
- Has automated upgrades and patching.

Amazon Web Services (AWS) and Microsoft Azure are public clouds that provide Red Hat Managed OpenShift instances.



For a deeper dive on OpenShift, access the online course and view the demo.



Module 3: Deploying Applications Cloud Foundry

Elements of Cloud Foundry

Cloud Foundry is an open source project that had its initial release in 2011. In 2015, the project was transferred to the newly created Cloud Foundry Foundation. The source code for Cloud Foundry is under an Apache license.

Cloud Foundry has a container-based architecture that runs apps in any programming language and allows the use of existing tools to deploy apps to Cloud Foundry without modifying the code.

Cloud Foundry and PaaS

Cloud Foundry is an example of a Platform-as-a-Service (PaaS) offering.

Characteristics of PaaS

PaaS offerings, such as Cloud Foundry:

- Eliminate the need to worry about the underlying infrastructure, such as runtimes, operating systems, and servers.
- Enable focusing exclusively on the application, code and data.
- Allow fast deployment of applications and services typically within minutes rather than hours or days.

Features of Cloud Foundry

Deployment Automation

- Runs apps in any programming language and is container based.
- Deploys apps using existing tools without modifying the code.

Flexible Infrastructure

- Decouples applications from infrastructure.
- Enables decisions about where to host workloads: on premise, in public clouds, or in managed infrastructure.

Commercial Options

- Supports several cloud infrastructures including IBM Cloud, AWS, Azure, GCP, and others.

Community Support

- Enjoys support from a broad community of more than 3,500 contributors, 12,000 Slack participants, and 850 meetups worldwide.



Module 3: Deploying Applications

Cloud Functions

Elements of IBM Cloud Functions

IBM Cloud Functions is a Functions-as-a-Service (FaaS) programming platform built on the open source project Apache OpenWhisk. IBM Cloud Functions includes:

- An integrated Application Programming Interface (API) gateway.
- An API gateway.
- Security, OAuth (authentication protocol) support, rate limiting and custom domain support.

Cloud functions are comprised of actions, triggers, and sequences.

Deploying a Kubernetes application on IBM Cloud

IBM Cloud Continuous Delivery service includes open toolchains that automate the building and deployment of applications and can be used to deploy a Kubernetes application on IBM Cloud.

What is Serverless Computing?

Serverless computing:

- Refers to building and running applications that do not require server management.
- Enables a simpler, more cost-effective way to build and operate cloud-native applications.
- Describes a finer grade deployment model where applications bundled as one or more functions are uploaded to a platform then executed, scaled, and built in one response.

A challenge of going serverless in low-latency financial applications is that containers may need to cold start resulting in delays.

Serverless Computing Features

Benefits	Building Blocks	Use Cases
<ul style="list-style-type: none"> • Serverless computing functions are uploaded to a platform then executed, scaled, and built in one response to the exact demand needed. • Customers only pay for code execution resulting in considerable cost savings relative to other technologies. • No need to provision servers and run-times. 	<ul style="list-style-type: none"> • Actions are the building blocks of serverless architecture. • Contain the code performing the work and can be invoked through a rest API or trigger. • Triggers receive events from outside IBM Cloud functions and invoke all connected actions. 	<p>Common use cases for serverless architectures include:</p> <ul style="list-style-type: none"> • Serverless APIs • Extract, Transform, Load (ETL) workloads • Internet of Things (IoT) • Alarm driven



For a deeper dive on Cloud Functions, access the online course and view the demo.



Module 3: Deploying Applications

Module Summary

Kubernetes

- Kubernetes is an open-source container orchestration project.
- Containers are the building blocks for Kubernetes and provide process isolation.
- IBM Cloud has a managed Kubernetes service that removes the complexity of deploying and upgrading a Kubernetes cluster.
- A container can be thought of a packaging up your application source code dependencies, like runtimes, binaries, libraries, and data.
- A packaged up container is called an image.

OpenShift

- OpenShift simplifies various difficult tasks like deploying applications and doing day-to-day administrative operations easier by extending Kubernetes in an opinionated way.
- OpenShift, like Kubernetes, is deployable on premises or in a cloud.
- OpenShift takes the Kubernetes namespace concept and extends it with projects allowing you to control access between who can access namespaces or projects.

Cloud Functions

- IBM Cloud Functions is a Functions-as-a-Service (FaaS) programming platform.
- IBM Cloud Continuous Delivery service includes open toolchains that automate the building and deployment of applications.
- Actions are the building blocks of serverless architecture.
- Customers only pay for code execution resulting in considerable cost savings relative to other technologies.

Module 3

Check Your Knowledge



Question 1.

Which of these is a characteristic of a container?

- A. A package that contains public clouds, private clouds, on premise, and hybrid deployments.
- B. A package that contains application source code dependencies, like runtimes, binaries, libraries, and data.
- C. A package that contains underlying infrastructure, such as runtimes, operating systems, and servers.
- D. A package where applications are bundled as one or more functions.



➔ Answer B. A container is a package that contains application source code dependencies, like runtimes, binaries, libraries, and data.

Module 3

Check Your Knowledge



Question 2.

A _____ is configured to communicate with a specific Kubernetes cluster.

- A. Cluster
- B. Pod
- C. Container
- D. Node



Answer C. A container is configured to communicate with a specific Kubernetes cluster.

Module 3

Check Your Knowledge



Question 3.

Which of the following are benefits of containers?

- A. Can run uniformly consistent across any platform or cloud.
- B. Share the host operating system kernel increasing speed and efficiency.
- C. Provide increased security and isolation.
- D. Eliminate the need to provision servers and runtime.



➔ Answer A, B and C. Can run uniformly consistent across any platform or cloud, share the host operating system kernel increasing speed and efficiency and provide increased security and isolation.

Module 3

Check Your Knowledge



Question 4.

Kubernetes is an open source container orchestration project that simplifies everything associated with deploying and managing _____.

- A. DevOps
- B. Containers
- C. SysAdmin
- D. Site Reliability Engineering



➔ Answer B. Kubernetes is an open source container orchestration project that simplifies everything associated with deploying and managing containers.

Module 3

Check Your Knowledge



Question 5.

Which of the following are characteristics of Kubernetes?

- A. Uses automated rollouts and rollbacks to deploy and manage containers.
- B. Scales services up or down automatically based on utilization.
- C. Enables a simpler, more cost-effective way to build and operate cloud-native applications.
- D. Monitors the health of services to prevent bad rollouts.



➔ Answers A, B, and D. Characteristics of Kubernetes include it uses automated rollouts and rollbacks to deploy and manage containers, scales services up or down automatically based on utilization and monitors the health of services to prevent bad rollouts.

Module 3

Check Your Knowledge



Question 6.

OpenShift is based on which open source project?

- A. Terraform
- B. Red Hat Linux
- C. Apache OpenWhisk
- D. OKD



➡ Answer D. OpenShift is based on the open source OKD Project.

Module 3

Check Your Knowledge



Question 7.

Which of these is a feature of OpenShift?

- A. Issues quarterly releases with the latest being 4.4 based on 1.17.
- B. Issues minor releases quarterly with the latest being 1.19.
- C. Has just the core framework.
- D. Platform, or user, is responsible for integrating beyond the core framework.



➔ Answer A: OpenShift issues quarterly releases with the latest being 4.4 based on 1.17.

Module 3

Check Your Knowledge



Question 8.

What are the building blocks of serverless architecture?

- A. Triggers
- B. Actions
- C. Sequences
- D. Containers



➔ Answer B. Actions are the building blocks of serverless architecture.

Module 3

Check Your Knowledge



Question 9.

What type of platform is the IBM Cloud Functions offering?

- A. PaaS
- B. SaaS
- C. FaaS
- D. IaaS



➔ Answer C. IBM Cloud Functions is a Functions-as-a-Service (FaaS) programming platform.

Module 3

Check Your Knowledge



Question 10.

All of these are characteristic of serverless computing EXCEPT:

- A. Refers to building and running applications that do not require server management.
- B. Provides automatic upgrades, patching, and deployment.
- C. Enables a simpler, more cost-effective way to build and operate cloud-native applications.
- D. Describes a finer grade deployment model where applications are bundled as one or more functions.



➔ Answer B. Serverless computing does not provide automatic upgrades, patching, and deployment.



Module 4: Services on IBM Cloud

Introduction and Objectives

In Module 4 of the Study Guide, the subject matter:

- Explores the database services and solutions provided on IBM Cloud.
- Reviews integration services available on IBM Cloud.
- Provides an overview of the artificial intelligent services available on IBM Cloud.
- Reviews the analytics services used on IBM Cloud.
- Explores how IBM Cloud DevOps services can be implemented on IBM Cloud.
- Explains the features and functionality of the IBM Blockchain Platform.
- Explores how the Internet of Things (IoT) Platform functions.
- Explores the various Cloud Paks available on IBM Cloud and the solutions they provide.

Lessons

- Introduction and Objectives
- Databases
- Integration
- Artificial Intelligence
- Analytics
- DevOps
- Blockchain
- Internet of Things
- Cloud Paks
- Module Summary
- Knowledge Check Questions

Objectives

- Recognize the various IBM Cloud databases.
- Identify integration services in IBM Cloud.
- List the use and function of artificial intelligence and machine learning available on IBM Cloud.
- Recognize the analytics services on IBM Cloud.
- Define DevOps process and identify IBM DevOps services on the IBM Cloud.
- Identify the blockchain options available on the IBM Cloud.
- Define the basics of the IoT platform on the IBM Cloud.
- Recognize the IBM Cloud Pak options on IBM Cloud.



Module 4: Services on IBM Cloud

Databases

Database Overview

A database is an organized collection of data stored on a computer. Traditional databases organize data in rows and columns and use structured query language (SQL) to access the data. They are known as SQL databases. Databases that do not depend on SQL are known as NoSQL databases. There are many types of databases, but three are focused on here.

Relational Databases	Document Databases	Key Value Databases
<ul style="list-style-type: none"> Collection of data organized into a table structure, organized in rows and columns. SQL is used for updates and queries. Good for asset compliance and high transaction applications such as online data processing. 	<ul style="list-style-type: none"> Flexible schemas, do not depend on SQL. Best suited to store semi-structured data. Common use cases include customer data, user generated content, and order data. 	<ul style="list-style-type: none"> Non-relational databases, do not depend on SQL. Data stored as a collection of key value pairs where a key serves as a unique identifier. Common use cases include leaderboards, caches, and shopping cart data.

Database-as-a-Service Overview

Database-as-a-Service (DBaaS) is a cloud computing service that allows users to access and use a cloud database system without purchasing and setting up their own hardware, installing their own database software, or managing the database themselves.

Database-as-a-Service Benefits

Financial	<ul style="list-style-type: none"> Simpler, less costly management as the cloud provider manages everything. Clients may choose to manage certain aspects.
Operational	<ul style="list-style-type: none"> Scalable; quickly and easily provision additional storage and computing capacity at runtime or scale down database cluster during non-peak usage.
Strategic	<ul style="list-style-type: none"> Rapid development and faster time to market. Access to database capabilities that allow for configuration of a database ready to integrate with applications in minutes.



Module 4: Services on IBM Cloud

Databases cont.

IBM Cloud Relational Database Options

Relational Databases	
Db2	Fully managed, highly-performant, relational data store running the enterprise class Db2 database engine.
Db2 Hosted	Allows clients to run Db2 with full administrative access on cloud infrastructure.
MySQL	One of the most popular databases, free under the GNU General Public License.
Postgre	Open-source object relational database with 30 years of history; also known as PostgreSQL.

IBM Cloud Document Database Options

Document Databases	
MongoDB	<ul style="list-style-type: none">Most popular document database; available as a managed service on IBM Cloud.Features a flexible data model, high availability, automated backup orchestration, auto scaling and coupled allocation of storage, RAM, and vCPUs and is HIPPA compliant.
Cloudant	<ul style="list-style-type: none">IBM's Database-as-a-Service based on Apache's CouchDB; provides a 99.99% service level agreement.
Elasticsearch	<ul style="list-style-type: none">IBM Cloud's enterprise-ready fully managed solution for JavaScript Object Notation (JSON) document indexing and full text search capabilities.

IBM Cloud Key Value Databases

Key Value Databases	
Redis	<ul style="list-style-type: none">Open source in memory data structure store, used as a database, cache, and message broker
etcd	<ul style="list-style-type: none">Object relational database management system with an emphasis on extensibility and on standards compliance



Module 4: Services on IBM Cloud Integration

Integration Overview

Integration provides connectivity, routing, and transformation for different services. It enables sharing of data, connecting applications, and security. IBM Cloud has several services that enable integration, each of which have a **free** or **lite** tier plan.

Service	Description
API Connect	<p>Provides API creation and management with security-rich features and centralized governance.</p> <ul style="list-style-type: none"> • Comprehensive end-to-end API lifecycle solution enables the automated creation of APIs. • Rapidly generates swagger compliant APIs from back-end data sources. • Graphically assembles API invocation flow. • Apply access control policies. • Share, publish, manage API descriptions through a self-service portal. • View analytics and data about APIs.
App Connect	<p>Allows for connection of applications, automation of tasks with hundreds of built-in connectors.</p> <ul style="list-style-type: none"> • Connect different applications. • Enable event trigger actions between applications. • Automate workflows. • Integrate data and apps with over 75 connectors and 50+ templates. • Expose flows as REST APIs to assist in quick application development.
Event Streams	<p>Includes a high throughput message bus built with Apache Kafka.</p> <ul style="list-style-type: none"> • Fully managed Apache Kafka service (built with open-source Apache Kafka project). • Highly available and resilient. • Leverage availability zone support from IBM Kubernetes services to ensure application will continue to work if an entire zone is unavailable. • Intuitive user experience. • Event-driven architecture. • Integrate with Watson Internet of Things (IoT) and IBM Cloud function to leverage event streams.
MQ	<p>Provides enterprise-grade messaging capabilities such as point-to-point and publish subscribe models to facilitate the flow of information between applications.</p> <ul style="list-style-type: none"> • Managed messaging service. • Extend enterprise messaging to the cloud. • Connect cloud-based apps to core business systems by integrating with existing on premise MQ Network. • Provision messaging capability in the cloud of choice. • Use on IBM Cloud or Amazon Web Services (AWS). • Manage using MQ Explorer, MQ console, or script commands.



Module 4: Services on IBM Cloud

Artificial Intelligence

Artificial Intelligence (AI) Services on IBM Cloud

Many AI services are available on IBM Cloud, including AI lifecycle management tools, text analysis tools, intelligent search tools, and speech and language services.

AI Lifecycle Management Tools

Lifecycle management tools help build and scale AI with trust and transparency by automating AI lifecycle management.

Watson Studio	<ul style="list-style-type: none">• A suite of tools and collaborative environment for data scientists, developers, and domain experts.
Watson Machine Learning	<ul style="list-style-type: none">• Run and deploy machine learning models anywhere across any cloud.
Watson Knowledge Catalog	<ul style="list-style-type: none">• Discover, curate, categorize and share data assets and models with asset control.
Watson Open Scale	<ul style="list-style-type: none">• Measure and manage AI models in production to promote trust and confidence.

Text Analysis Tools

Tool	Description
Watson Natural Language Processor	Use deep learning to extract metadata from text (keywords, categories, sentiment, emotion, relation, and syntax).
Watson Tone Analyzer	Use linguist analysis to identify tones (anger, disgust, fear) and detect social propensities such as extraversion and language styles (analytical, confident, tentative) from text.
Watson Assistant	Build conversational interfaces into any application device or channel with an easy-to-use user interface. <ul style="list-style-type: none">• Includes plug-ins for Slack and other applications.• Provides a catalog of entities for industries to enable rapid start with some of the most frequently asked questions.• Integrates with Twilio, Salesforce, Zendesk and voice agents.



Module 4: Services on IBM Cloud

Artificial Intelligence cont.

Intelligent Search Tool

Tool	Description
Watson Discovery	<p>An intelligent search service that delivers specific answers to questions while serving up an entire document for exploration.</p> <ul style="list-style-type: none">• Train with entire documents.• Use Watson Knowledge Studio to build a custom model to train Watson Discovery with unique relationships and entities. <p>For example, use the car service manual to train Watson Discovery to look for information about what kind of engine oil to use.</p>

Speech and Text Tools

Tool	Description
Watson Speech-to-Text	Transcribe voice into written text.
Watson Text-to-Speech	Convert written text into natural-sounding audio in a variety of languages and voices.
Watson Language Translator	Dynamically translate new, patents, or conversational documents from over 20 languages; can identify up to 68 languages.
Watson Natural Language Classifier	Assign custom categories to input a text.



Module 4: Services on IBM Cloud Analytics

Data Analytics Overview

Data analytics is the science of analyzing raw data to make conclusions about the information. Analytics help organizations make data-driven decisions. There are multiple types of analytics.

Descriptive Analytics	Diagnostic Analytics	Predictive Analytics
<ul style="list-style-type: none">• Focus on past performance.• Mine historical data to determine reasons for past failure or success.	<ul style="list-style-type: none">• Examine data to answer the question “why did this happen?”• Use techniques such as drilldown, data discovery data mining, and correlation.	<ul style="list-style-type: none">• Analyze current and historical facts to make predictions about the future or otherwise unknown events.• Use a variety of statistical techniques from data mining, predictive modeling, and machine learning.• Take advantage of the results of descriptive and predictive analytics and suggest a decision.

Open-Source Projects in the Analytics Space

At IBM, our analytics engine offering is based on the popular open-source projects Apache Spark and Apache Hadoop.

- Apache Spark is a unified analytics engine for big data processing with built in modules for streaming SQL, machine learning, and graphic processing. It has 750 contributors from 200 organizations.
- Apache Hadoop provides for distributed processing of large data sets across clusters of computers using simple programming models. It uses the MapReduce programming model for parallel processing of large volumes of data in a distributed environment.



Module 4: Services on IBM Cloud

Analytics cont.

Analytics Services on IBM Cloud

IBM Cloud Analytics services work together to uncover new insights that may have business-changing results.

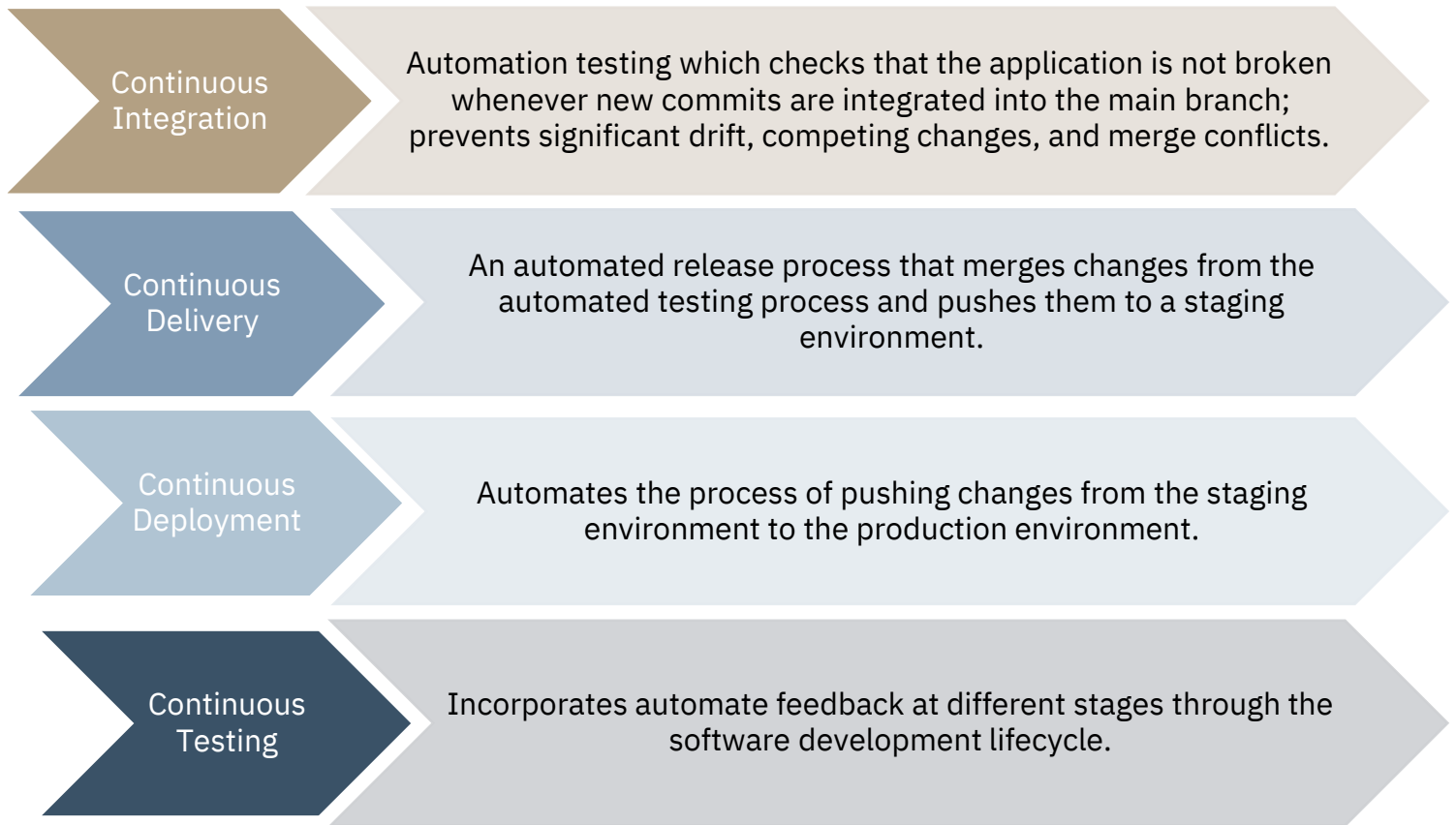
Service	Features and Functionality
Analytics Engine	<ul style="list-style-type: none"> • Deploy and develop applications using Apache Spark and Apache Hadoop. • On-demand scalability (compute and storage tiers area decoupled). • HIPAA-ready for Dallas region. • Customize the environment with third party analytics libraries and packages.
Streaming Analytics	<ul style="list-style-type: none"> • Ingest, analyze, monitor, and correlate data in real time. • Evaluate a broad range of streaming data (unstructured text, video, audio, geospatial, and sensor data). • Perform real-time analysis on data in motion. • Connect with any data source (unstructured, structured, streaming). • Create adaptive stream applications using built-in domain analytics like machine learning, natural language, spatial temporal, text, acoustics, etc.
Db2 Warehouse	<ul style="list-style-type: none"> • Fully-managed elastic cloud data warehouse delivers independent scaling of storage and compute. • Built for machine learning. • Highly scalable and secure. • Train and run models directly in Db2 Warehouse engine using SQL, Python, and R. • Control and monitor database activity with fine-grained access control and database auditing. • Leverage Db2 to run existing Oracle applications on DB2 Warehouse (Oracle compatible).
Cognos Dashboard	<ul style="list-style-type: none"> • Add end-to-end visualization to applications. • Allows end-user to interact via drag and drop functionality. • Updates to the data reflected in the visualization in real time. • Explores data using filters and navigation paths.
Information Server	<ul style="list-style-type: none"> • Market leading data integration platform with products to understand, cleanse, monitor, transform, and deliver data. • Provides collaboration to bridge the gap between business and IT. <ul style="list-style-type: none"> • Data Stage tool creates jobs to extract, transform, and load data. • Information Governance Catalog tracks data lineage. • Information Analyzer provides data profiling and analysis to accurately evaluate the content and structure of data for consistency and quality.



Module 4: Services on IBM Cloud DevOps

DevOps Overview

DevOps combines software development (dev) and IT operations (ops). The goal of DevOps is to shorten the development lifecycle by providing continuous deployment with high software quality via automated tests and delivery governance.





Module 4: Services on IBM Cloud

DevOps cont.

IBM Cloud DevOps Services

IBM Cloud DevOps services are a set of tools that support development, deployment, continuous delivery, and operational tasks.

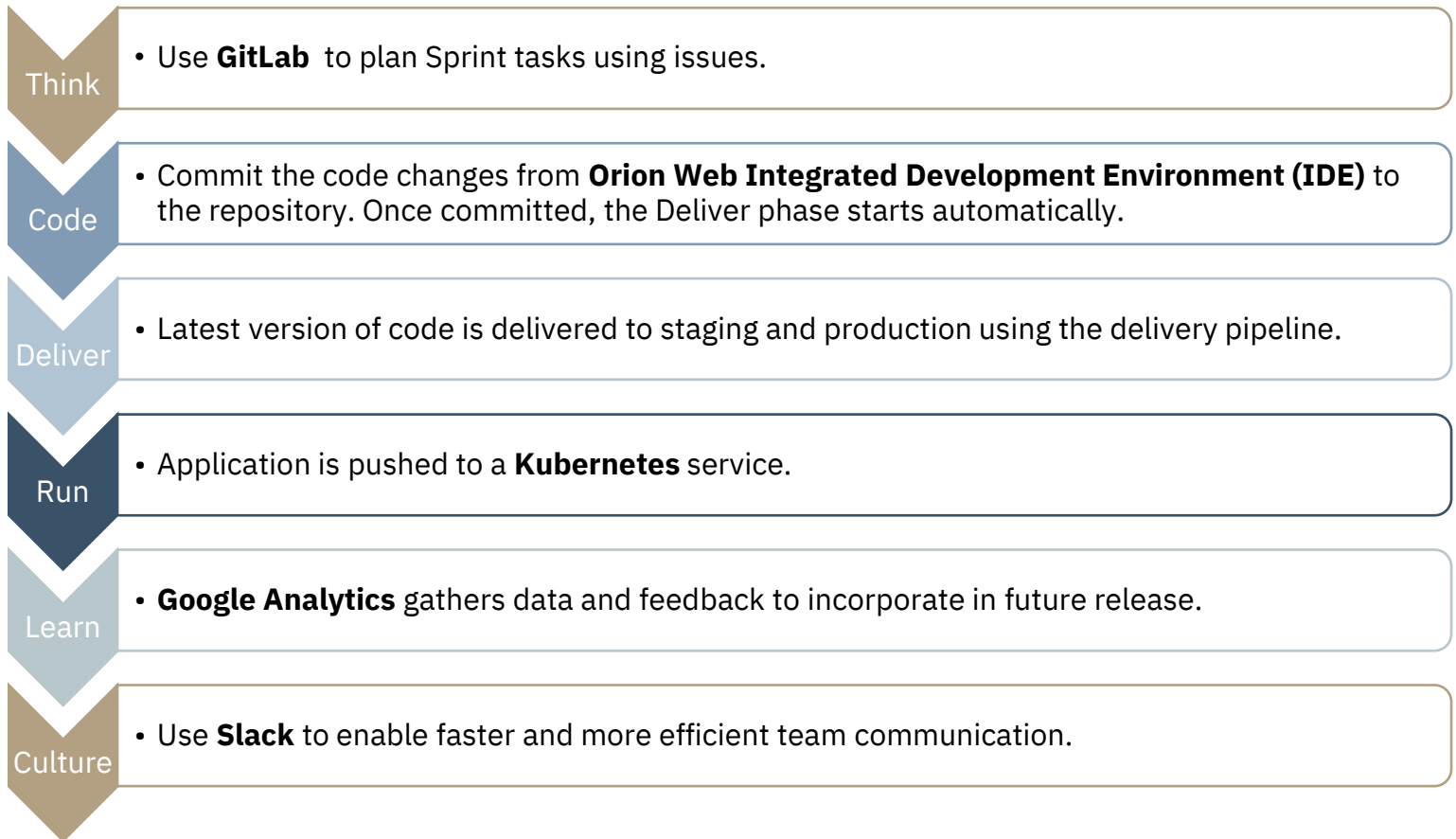
DevOps Toolchain	Continuous Delivery Service	Delivery Pipeline
<ul style="list-style-type: none">• Set of tools and templates that automate developing and deploying applications.• Includes templates for building and deploying projects.• Supports integration with third-party tools.	<ul style="list-style-type: none">• Automates the building and deployment of applications.• Limited to the building, deploying, testing, and ongoing operations of applications on the IBM Cloud platform or other compatible platform or infrastructure offerings.• A Continuous Delivery service instance is required to create and use DevOps toolchains that include certain tool integrations.	<ul style="list-style-type: none">• Part of the Continuous Delivery service .• Automates builds, unit tests, and deployments.• Tekton pipelines (specified in yaml) are used to configure and run Continuous Integration and Continuous Delivery pipelines.• Classic pipelines (specified graphically) can also be used.



Module 4: Services on IBM Cloud DevOps cont.

Example of Using DevOps with IBM Cloud Toolchain

Here is an example of using a DevOps approach with the IBM Cloud toolchain.





Module 4: Services on IBM Cloud DevOps cont.

Options for IBM Cloud Toolchain

IBM Cloud toolchain offers several options in the Code, Deliver, Run, Learn, and Culture phases.

Phase	Option
Code	Code options include: <ul style="list-style-type: none">• GitLab CE• GitHub• Bitbucket
Deliver	Deliver options in the IBM Cloud toolchain include: <ul style="list-style-type: none">• A Docker application and its Helm chart together in source control and build and deploy automatically to a Kubernetes cluster.• Develop an application and deploy changes using a Razee agent in a Kubernetes cluster.
Run	Deploy the application to one of these platforms: <ul style="list-style-type: none">• Kubernetes cluster.• Virtual server of choice.
Learn	Integration tools allowing for gathering data and feedback about application to continuously improve and prioritize features in future releases include: <ul style="list-style-type: none">• New Relic• Google Analytics• Sauce labs
Culture	Tools to improve cross functional communication between teams include: <ul style="list-style-type: none">• Slack• PagerDuty• Jira

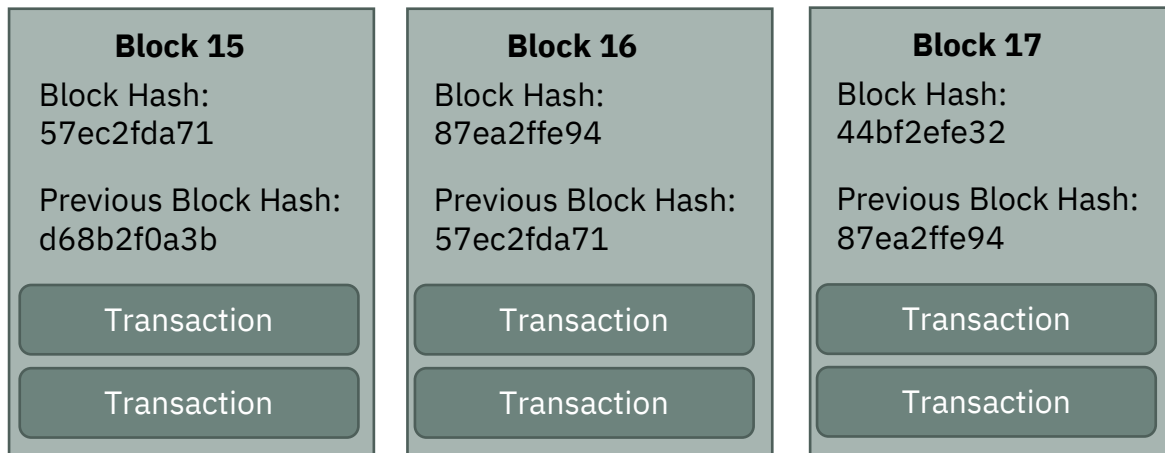


Module 4: Services on IBM Cloud

Blockchain

Blockchain Overview

A blockchain is a growing list of records, called blocks, linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. Once recorded, the data in any given block cannot be altered retroactively without alteration of all subsequent blocks, which requires consensus of the network majority.



Key Elements of Blockchain Networks

Blockchains are:

- **Distributed** All network participants have access to the distributed ledger.
- **Immutable** No one can change the transaction after it's recorded to the shared ledger.
- **Smart Contracts** Self-executing contracts stored on the blockchain, executed automatically, and recorded as transactions with the block.

What is Hyperledger Fabric?

Hyperledger fabric is a framework for building blockchain applications. Hyperledger fabric:

- Has been adopted by many cloud providers.
- Is an Apache 2 licensed open-source project.
- Was originally donated to the Linux Foundation by IBM and Digital Asset.
- Requires smart contracts to create a blockchain application.
- Offers software development kits (SDKs) in Node JS and Java..
- Plans to support Python and Go in later releases.

Value of Blockchain

The value of blockchain comes from participants sharing common smart contracts and agreeing on the source of truth. Blockchain provides participants with visibility into the history of a particular asset and how ownership has changed over time.



Module 4: Services on IBM Cloud Blockchain cont.

IBM's Blockchain Platform

The IBM Blockchain platform is based on Hyperledger fabric and runs on the IBM Cloud platform. It aims to provide an entire lifecycle for a blockchain solution, from inception through deployment and beyond.

Tools

- IBM's Blockchain platform provides tools for solution development and tools which allow the client to govern and operate blockchain business networks.

Differentiators

- Key differentiators for the IBM Blockchain platform include advanced tooling for building, operating, and growing blockchain networks and the ability to deploy blockchain networks anywhere.



Module 4: Services on IBM Cloud

Internet of Things

Internet of Things Overview

Internet of Things (IoT) is a system of interrelated computing devices that transfer data over a network without requiring human interaction. There are many use cases for IoT. Three are described here.

Predictive Maintenance	Asset Tracking	Connected Vehicles
Keep assets up and running to significantly decrease operational expenditures, saving companies millions of dollar.	Allow an enterprise to locate and monitor key assets along the supply chain to optimize logistics, maintain inventory levels, prevent quality issues, and detect theft.	Automate normal driving tasks using computer enhanced vehicles.

IBM Cloud's IoT Platform

The IBM Cloud IoT platform allows communication with and consumption of data from connected devices and gateways using a built-in web console to monitor IoT data and analyze it in real time. It has several great features.

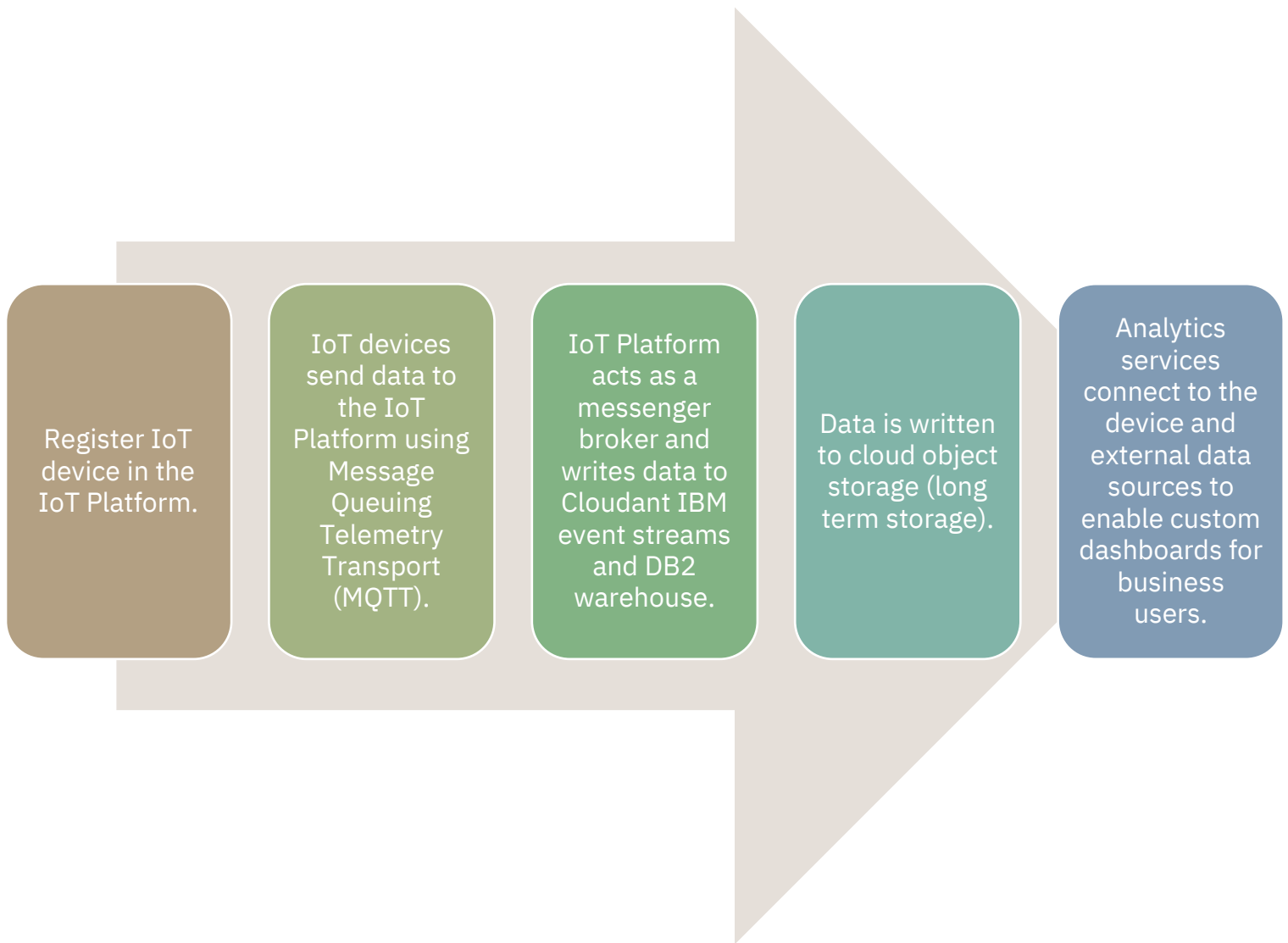
Register and Connect	<ul style="list-style-type: none"> Register and connect devices and gateways quickly and securely.
Manage Information	<ul style="list-style-type: none"> Control what happens to data from connected devices. Manage data storage, configure data transformation, and integrate with other data services.
Analyze	<ul style="list-style-type: none"> Monitor real time device data through rules, analytics, and dashboards.
Manage Risk and Security	<ul style="list-style-type: none"> Protect IoT integrity through secure connectivity and access control for users and applications.
View Dashboard	<ul style="list-style-type: none"> View connected devices by device type. View how much data has been transferred. Monitor real time sensor data and geo-location data.



Module 4: Services on IBM Cloud Internet of Things cont.

How does it work?

An overview of the IoT process is shown here.





Module 4: Services on IBM Cloud

Cloud Paks

Cloud Paks Overview

Cloud Paks are containerized software solutions built to run anywhere. They make container management and application modernization easier for organizations. Cloud Paks provide value in three main areas.

Modular Architecture

- Pick and choose which software to deploy.

Put AI to Work

- Operationalize AI throughout a business.

Built on OpenShift

- Run anywhere.

What does it mean to run anywhere?

IBM Cloud Paks can run on any platform (IBM Cloud, on premises, on client hardware or on any cloud) by first provisioning OpenShift and then installing Cloud Paks on top.

What IBM Cloud Paks are available?

The six Cloud Paks covered in this course are applications, data, multi cloud management, integration, security, and business automation.

IBM Cloud Pak for Applications

The purpose of the IBM Cloud Pak for Applications is to assist in modernizing existing applications and building new cloud-native applications. Tools and the use of those tools in this Cloud Pak are listed here.

Tool	Use
Cloud-native accelerators	Accelerate cloud-native development by bringing together open-source technologies and putting them in a microservices-based framework.
IBM modernization and transformation	Modernization guidance provides a plan to strategically update applications.
Java EE Platform	A collection of Java APIs that assist in writing secure, flexible, server-side applications.
Mobile app development tools	Build apps for mobile, wearables, conversation, web, or progressive web apps.



Module 4: Services on IBM Cloud

Cloud Paks cont.

IBM Cloud Pak for Data

IBM Cloud Pak for Data has a single platform that integrates data management, data governance, and analysis. It includes both IBM and open-source databases and provides the following functionality and features.

Data Governance	Data Virtualization	IBM Cloud AI Services	AI Model Lifecycle Tools
<ul style="list-style-type: none">• Automated discovery and classification of data.• Masking of sensitive data.	<ul style="list-style-type: none">• Easily query across multiple sources, on cloud or on premises.	<ul style="list-style-type: none">• Includes Watson Assistant or Discovery.	<ul style="list-style-type: none">• Create notebooks with Jupyter or Rstudio.• Serve with Watson Machine Learning.• Automate process with Auto AI.

IBM Cloud Pak for Multi-Cloud Management

IBM Cloud Pak for Multi-Cloud Management is an IT management platform that provides full visibility and control wherever the workload runs. It also provides the following features and capabilities.

Feature/Functionality	Use
Dashboard	<ul style="list-style-type: none">• Monitor application lifecycle management.• Deploy and move applications across clouds.
Cloud Protection and Compliance	<ul style="list-style-type: none">• Automate policy enforcement and compliance testing.
SRE Tooling with AI Ops	<ul style="list-style-type: none">• Use event correlation and machine learning to improve operational efficiency and readiness.
Add-on Capabilities	<ul style="list-style-type: none">• Include add-on capabilities from IBM partners such as Turbonomic, Sysdig, Humio, and Hazelcast.



Module 4: Services on IBM Cloud

Cloud Paks cont.

IBM Cloud Pak for Integration

IBM Cloud Pak for Integration is a complete set of integration capabilities to efficiently connect applications and data wherever they reside. With IBM Cloud Pak for Integration, you can use any of the following to move data.



IBM Cloud Pak for Security

IBM Cloud Pak for Security is a platform that assists in uncovering hidden threats and allows organizations to make more informed decisions about risks. Core platform services and integration capabilities are shown here.

Core Platform Services

- Threat Intelligence Insights (prioritized, actionable threat intelligence)
- Data Explorer (federated search for investigation)

Integration Capabilities

- Qradar
- Splunk

IBM Cloud Pak for Business Automation

IBM Cloud Pak for Business Automation provides applications in core areas where automation provides benefits. Other functionality this Cloud Pak provides is shown here.

Low Code Tools

- Use tools, APIs, and application connectors to consume content in business application.

Business Workflow Automation

- Use IBM Business Automation Workflow to automate end-to-end workflows.

Business Policy Automation

- Use IBM Operational Decision Manager to automate the implementation of business policies.



Module 4: Services on IBM Cloud

Summary

Databases

- There are many types of databases that store data in different ways. Relational databases use a table structure. Document databases are semi-structured and provide more flexibility. Lastly, Key-Value databases use dictionaries to make for effective caches.
- Database-as-a-Service (DBaaS) allows users to provision a database on a cloud without setting up their own hardware, installing their own database software, or managing the database themselves.
- IBM Cloud has several managed database options, such as Db2, Postgres, MongoDB, Cloudant, Elasticsearch, Redis, and etcd.

Integration

- Integration enables secure communication between services and allows for sharing data between applications.
- IBM Cloud offers many integration services such as API Connect, App Connect, Event Stream, and MQ.

Artificial Intelligence

- IBM Cloud offers model lifecycle management tools such as Watson Studio, Watson Machine Learning, and Watson OpenScale.
- IBM Cloud has AI services with pre-made models that can be extended with easy-to-use interfaces. These include Watson Language Translator, Watson Assistant, Watson Discovery, and Watson Natural Language Understanding.
- AI services on IBM Cloud have well documented APIs and SDK support for popular languages such as Python, Go, Android, Node JS, Swift, Java, and Salesforce.

Analytics

- Data analytics is the science of analyzing raw data in order to make conclusions about that information. Any type of information can be subjected to data analytics techniques to get insight that can be used to strategize and plan.
- IBM Cloud offers many integration services such as Analytics Engine, Streaming Analytics, Db2 Warehouse, Cognos Dashboard, and Information Server.
- The Analytics Engine offering is based on the popular open-source projects Hadoop and Spark.



Module 4: Services on IBM Cloud

Summary cont.

DevOps

- DevOps is a set of practices that combine software development and IT operations to shorten the development lifecycle and provide high-quality software.
- IBM Cloud DevOps services provide a set of tools that support development, deployment, delivery, and operations tasks. IBM Cloud Toolchains are assembled by combining tasks.
- The DevOps service has support for IBM Cloud deployment platforms and other third-party providers such as GitHub, Bitbucket, Slack, Jira, any many more.

Blockchain

- Blockchain is a data structure that contains an immutable history of transactions on a network in cryptographically ordered blocks. The order of the blocks on a network is reached by the agreement of the nodes using a consensus algorithm.
- Hyperledger Fabric is an open-source project that implements a distributed ledger platform. It is available on cloud providers such as IBM Cloud, AWS, GCP, and Azure.
- The IBM Blockchain platform is based on Hyperledger Fabric and adds many operational tools to accelerate the development of Blockchain solutions.

Internet of Things

- The Internet of things (IoT) is a system of interrelated computing devices, that transfers data over a network and has practical use cases in many industries.
- The IBM Cloud Internet of Things platform allows you to connect and register IoT enabled devices.
- The IoT platform provides a dashboard to manage and monitor all connected devices.

Cloud Paks

- Cloud Paks are a collection of containerized software. Choose to install all components or just a few.
- Cloud Paks are based on OpenShift and as such can be run anywhere: on IBM Cloud, on-premises, or any cloud.
- There are six Cloud Paks: Application, Data, Integration, Automation, Multi-cloud, and Security.

Module 4

Check Your Knowledge



Question 1.

Which type of database would be appropriate for shopping cart data?

- A. Document
- B. Relational
- C. Key-Value
- D. SQL



➡ Answer C. Key-Value databases are commonly used for leaderboards, caches, and shopping cart data.

Module 4

Check Your Knowledge



Question 2.

Which database is classified as a document-oriented database?

- A. Db2
- B. Db2 Hosted
- C. MongoDB
- D. Redis



➔ Answer C. MongoDB is considered a document-oriented database.

Module 4

Check Your Knowledge



Question 3.

Which statement best describes Event Streams?

- A. Provides API creation and management with security-rich features and centralized governance.
- B. Allows for connection of applications, automation of tasks with hundreds of built-in connectors.
- C. Provides enterprise-grade messaging capabilities such as point-to-point and publish subscribe models to facilitate the flow of information between applications.
- D. Integrates with Watson Internet of Things (IoT) and IBM Cloud functions to leverage event streams.



➔ Answer D. Event Stream integrates with Watson Internet of Things (IoT) and IBM Cloud functions to leverage event streams.

Module 4

Check Your Knowledge



Question 4.

Which IBM Cloud service is used to run and deploy machine learning models anywhere across any cloud?

- A. Watson Knowledge Services
- B. Watson Machine Learning
- C. Watson Open Scale
- D. Watson Studio



➔ Answer B. Watson Machine Learning is used to run and deploy machine learning models anywhere across any cloud.

Module 4

Check Your Knowledge



Question 5.

Which statement best describes Watson Assistant?

- A. Converts written text into natural-sounding audio.
- B. Delivers specific answers to questions while serving up an entire document for exploration.
- C. Uses linguist analysis to identify tones and detect social propensities.
- D. Builds conversational interfaces into any application device or channel.



Answer D. Watson Assistant is used to build conversational interfaces into any application device or channel.

Module 4

Check Your Knowledge



Question 6.

Which statement best describes the Analytics Engine service?

- A. Controls and monitors database activity.
- B. Deploys and develops applications using Apache Spark and Apache Hadoop.
- C. Provides end-to-end visualization to applications.
- D. Performs real-time analysis on data in motion.



➔ Answer B. The Analytics Engine deploys and develops applications using Apache Spark and Apache Hadoop.

Module 4

Check Your Knowledge



Question 7.

Which practice includes frequently committing code to prevent significant drift, competing changes, and merge conflicts?

- A. Continuous Development
- B. Continuous Delivery
- C. Continuous Integration
- D. Continuous Testing



➔ Answer C. Continuous Integration includes frequently committing code to prevent significant drift, competing changes, and merge conflicts.

Module 4

Check Your Knowledge



Question 8.

Which statement is true regarding Continuous Delivery pipelines?

- A. Tekton pipelines are specified in XML.
- B. Tekton pipelines are specified in YAML.
- C. Tekton pipelines are specified in JSON.
- D. Tekton pipelines are specified graphically.



➡ Answer B. Tekton pipelines are specified in YAML.

Module 4

Check Your Knowledge



Question 9.

Hyperledger fabric is the framework for building _____ applications.

- A. AI
- B. Analytic
- C. Blockchain
- D. Internet of Things (IoT)



Answer C. Hyperledger fabric is the framework for building blockchain applications.

Module 4

Check Your Knowledge



Question 10.

Which statement best describes the Internet of Things (IoT)?

- A. A system of interrelated computing devices that transfer data over a network without requiring human interaction.
- B. A flexible way to build, operate and grow blockchain solutions.
- C. A dashboard to view devices connected to the internet.
- D. A type of continuous delivery pipeline.



➡ Answer A. The Internet of Things (IoT) is best described as a system of interrelated computing devices that transfer data over a network without requiring human interaction.

Module 4

Check Your Knowledge



Question 11.

Which IBM Cloud Pak provides tools to automate the implementation of business policies?

- A. IBM Cloud Pak for Business Automation
- B. IBM Cloud Pak for Data
- C. IBM Cloud Pak for Integration
- D. IBM Cloud Pak for Security



➔ Answer A. IBM Cloud Pak for Business Automation provides tools to automate the implementation of business policies.

Module 4

Check Your Knowledge



Question 12.

IBM Cloud Paks can run on any platform because they are installed on top of _____.

- A. Blockchain
- B. Docker
- C. Kubernetes
- D. OpenShift



➔ Answer D. Provisioning OpenShift and installing an IBM Cloud Pak on top of OpenShift allows IBM Cloud Paks to run anywhere.



Acronyms

Acronym	Acronym Expansion
AI	Artificial Intelligence
API	Application Programming Interface
AWS	Amazon Web Service
BYOK	Bring Your Own Key
BYOL	Bring Your Own License
CDN	Content Delivery Networks
CLI	Command-Line Interface
CPU	Central Processing Unit
DBaaS	Database-as-a-Service
DDoS	Distributed Denial of Service
DNS	Domain Name Servers
DNS	Domain Name Systems
ETL	Exact, Transform, Load
FaaS	Functions-as-a-Service
FedRAMP	Federal Risk and Authorization Management Program
FISMA	Federal Information Security Modernization Act
GB	Gigabyte
Gbps	Gigabits per second
GCP	Google Cloud Platform
GDPR	General Data Protection Regulation
GNU	GNU's Not Unx
GPU	Graphics Processing Unit
HIPAA	Health Insurance Portability and Accountability Act
HTTP/HTTPS	Hypertext Transfer Protocol/Hypertext Transfer Protocol Secure



Acronyms cont.

Acronym	Acronym Expansion
IaaS	Infrastructure as a Service
IAM	IBM Access Management
IAM	Identity and Access Management
IDE	Integrated Development Environment
I/O	Input/Output
IOPS	Input/Output Operations Per Second
IoT	Internet of Things
IPS	Intrusion Prevention System
iSCSi	Internet Small Computer Systems Interface
ISO	International Organization for Standardization
JSON	JavaScript Object Notation
K8s	Kubernetes
Mbps	Megabits per second
MQTT	Message Queing Telemetry Transport
NFS	Network File System
NLU	Natural Language Understanding
OKD	Distribution of Kubernetes
PaaS	Platform as a Service
PCI	Payment Card Industry
RAID	Redundant Array of Independent Disks
RAM	Random Access Memory
REST	Representational State Transfer
RHEL	Red Hat Enterprise Linux
SaaS	Software as a Service



Acronyms cont.

[illegible]