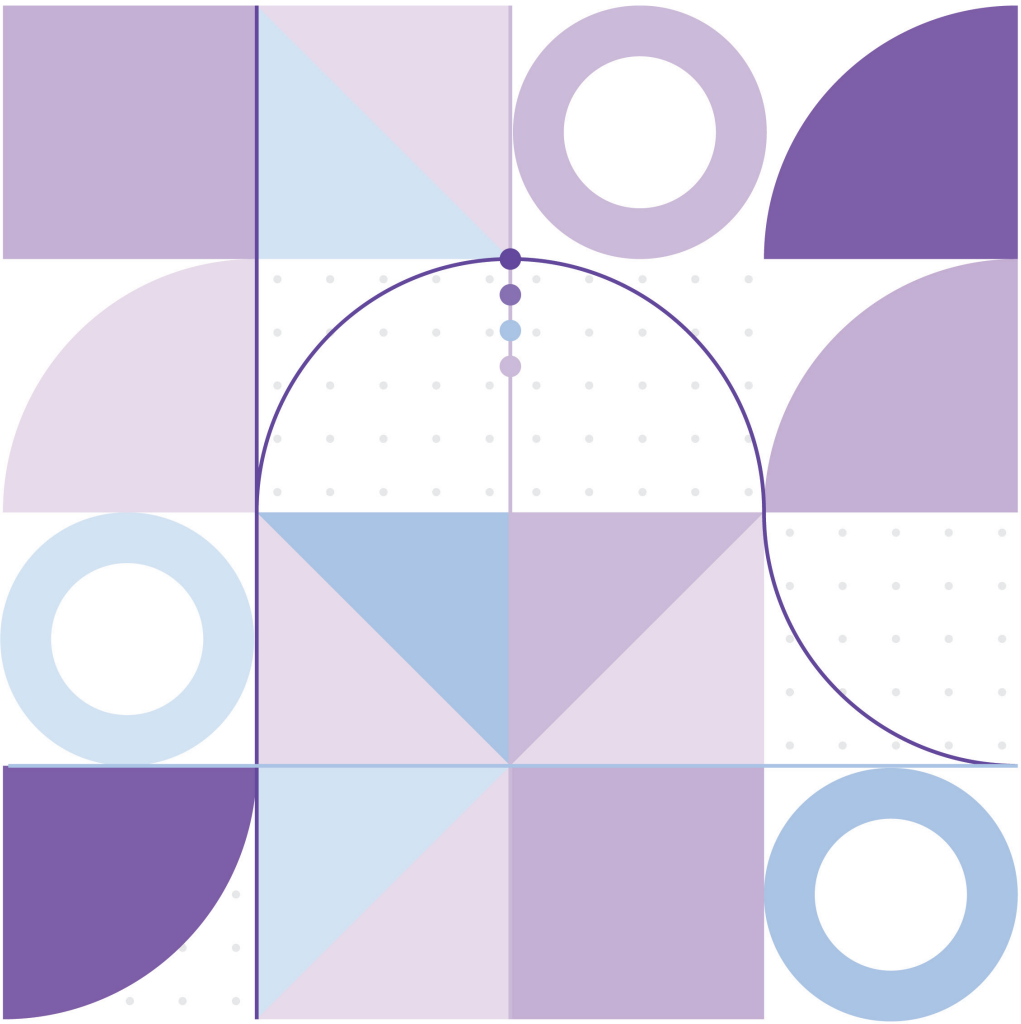

IBM Cloud step by step

• comprehensive guide • create an account • work effectively in IBM Cloud portal • create and deploy sample application into Kubernetes cluster

IBM

IBM **Cloud**

Introduction

This guidebook was created to introduce IBM Cloud® to a wider audience. The goal is to make it easier for a new user to get started with this platform, to present a wide range of its possibilities and to show, that it can meet the needs of both individuals and large companies.

Essential resources:

IBM Cloudu portal	*cloud.ibm.com*
Registration/account	*cloud.ibm.com/registration*
IBM Cloudu Catalog	*cloud.ibm.com/catalog*
Online documentation	*cloud.ibm.com/docs*
Online Status	*cloud.ibm.com/status*
News and announcement	*cloud.ibm.com/status/announcement*
IBM Cloud Support	*watson.service-now.com/wcp*

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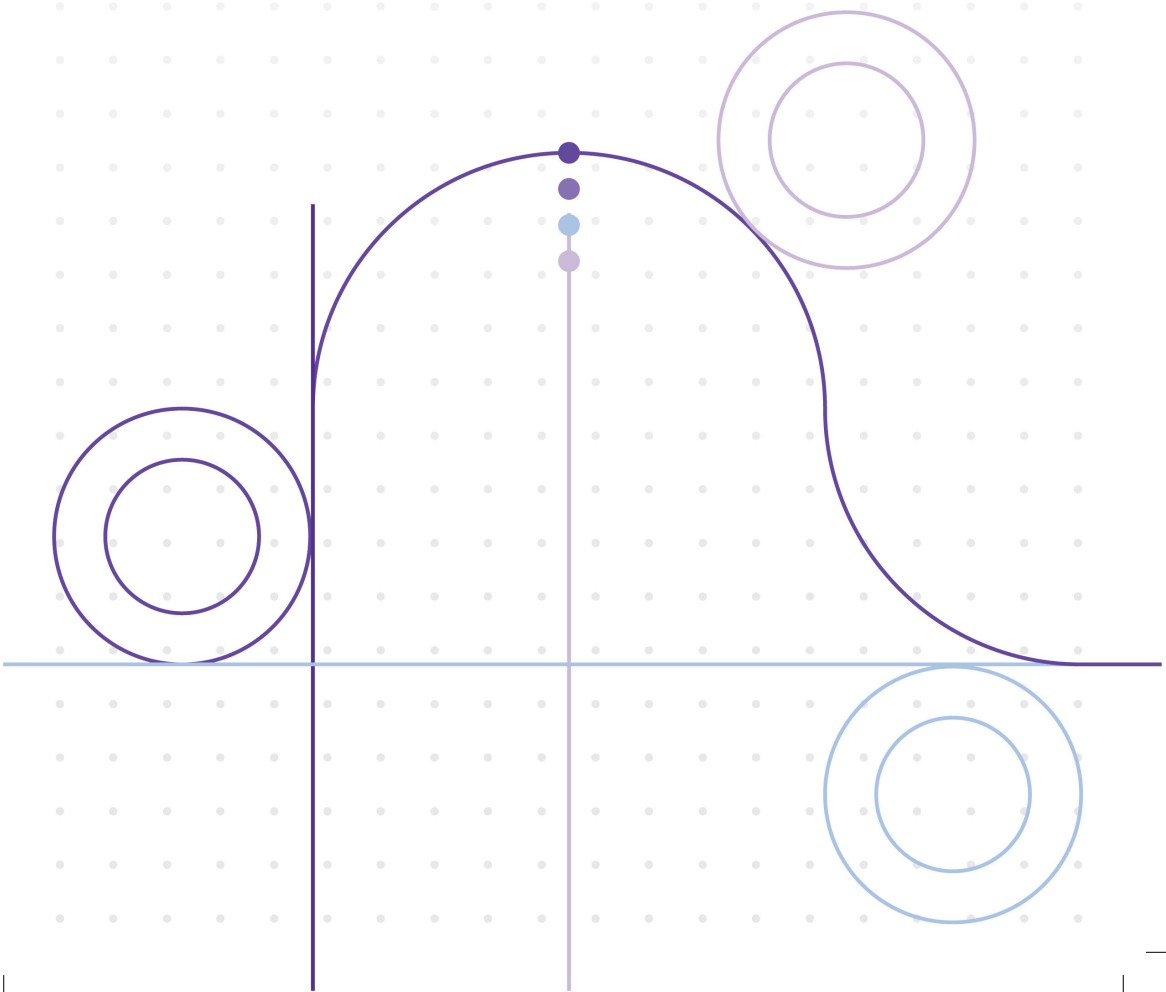
Another information about IBM Cloud can be found here:
ibm.com/cloud

Contents

01

Meeting the IBM Cloud

- IBM Cloud in a nutshell
- IBM Cloud focus
- Unique features
- Security
- Certifications and industry standards



IBM Cloud in a nutshell

- IBM Cloud is an **open platform** for developing, operating and managing applications of all types . It is based on open standards and supports the operation of Java, PHP, NodeJS, NET applications, as well as cloud native applications operated in Docker, Kubernetes, or even Red Hat OpenShift.

- IBM Cloud is the public cloud and provides **IaaS** (Infrastructure as a service) and **PaaS** services (Platform as a service).

- It also provides more than **170 cloud services**, including infrastructure technologies, VMware, Confidential computing, security, databases, analytical technologies, containerization platforms, VPC, DevOps, artificial intelligence Watson, IoT, Blockchain and also the progressive technology of Quantum Computing.

- Among these services, you will find not only your favourite IBM products, but also a vast number of services from third-party providers and open-source communities.

- Data centers are geographically located in **EU**, **America** and **Asia**. They are connected by a redundant private optical networks.In terms of HW and SW, the data centers are equipped with identical infrastructures.

- All services can be connected and integrated via an internal network (**IBM Private Network**), which is available to clients free of charge not only within the **AZ** (Availability Zone), but also in the **MZR** (Multi-Zone Region) and globally.

- You can run IBM Cloud services in both **multi-tenant** and **single-tenant modes**. Alternatively, you can use a **hybrid model** using the IBM Cloud satelite, which allows IBM cloud services to run as well in your data center or data centers of competing providers.

- IBM Cloud supports principles like **BYOL** (Bring Your Own Licence), **BYOIP** (Bring Your Own IP), **BYOK** (Bring Your Own Key), **KYOK** (Keep Your Own Key).

- You can start using IBM Cloud immediately and free of charge without time restrictions. Most services are available in **Lite** tiers, alternatively as a **Free** service, for which you are not billed at all.

- IBM Cloud uses a pre- paid subscription billing model (**subscription**), then mode **Pay-As-You-Go** (you pay for what you consume), and a free account is also possible, within which you can use the entire portfolio of services for free.

Do you know, that...

The geographically closest data center to the Czech Republic is in Frankfurt.
cloud.ibm.com/docs/overview?topic=overview-locations#data-centers

Selected IBM cloud services can be deployed and operated in your data center? IBM Cloud Satellite is able to deploy the public cloud service on the client supplied hardware and run it just like in the cloud. You can find more information here: *cloud.ibm.com/satellite*

IBM Cloud focus

IBM Cloud is not limited to running IaaS and PaaS services in IBM Cloud, but also supports the following models:

Hybrid Cloud

Thanks to IBM Cloud, you will be able to connect your own data centers or other cloud providers with IBM Cloud services. IBM Cloud Satellite is a great choice, if you want to run IBM Cloud services in your own data centers.

Multicloud

If you use the services of multiple cloud providers.

Virtual Private Cloud

It is de facto Cloud in the Cloud. Selected services can be run in a network-isolated public cloud infrastructure.

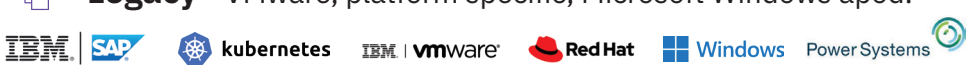
From an application point of view, IBM Cloud can run both legacy applications and applications, that can be transferred to the cloud, as well as applications written only for the cloud, the so-called cloud-native.

Cloud- native application - natively on K8s, Red Hat OpenShift

Cloud-enabled application - PHP, Java, Node.js, .NET

Serverless - represented by Cloud Functions a Code Engine

Legacy - VMware, platform specific, Microsoft Windows apod.



IBM Cloud is an ideal platform for ERP systems such as SAP S/4 HANA including EDW, SAP NetWeaver and SAP AnyDB. IBM Cloud provides certified configurations for both x86 and VPC (Virtual Private Cloud) and also configurations for POWER-as-a-Service.

Unique features

IBM Cloud offers a wide range of unique features. Among the most significant are undoubtedly single-tenant and multi-tenant services, a hybrid cloud service operation model and the IBM cloud data center internal network, which is worldwide free for clients.

Dedicated HW infrastructure - x86 servery with Intel and AMD
Dedicated firewalls - FortiGate, Juniper vSRX etc.
IBM POWER-as-a-Service - IBM AIX®, Linux®, IBM System i
Security technologies - Cloud HSM, KeyProtect, Certificate Manager
Manager Database - IBM DB2, IBM Informix®
Open Source - MySQL, Redis, Cloudant, PostgreSQL
Global internal network is free in IBM Cloud
GPU na serverech - NVIDIA Tesla - dedicated and virtualised
VMware and SW technologies connected to it - HyTrust, Veeam, Zerto, Caveonix etc.
Object Storage - S3 compatible, at unbeatable prices
Red Hat OpenShift - managed by IBM, Master nodes are free of charge

Tip 1

You can bring your own operating system, hypervisor, middleware and application software (e.g. SAP) licenses to IBM Cloud.

Tip 2

IBM data centers have a consistent architecture and therefore do not allow BYOD (Bring-Your-Own-Device), but support the possibility of bringing your own SW appliance to the cloud (e.g. Juniper vSRX).

Tip 3

In IBM Cloud, it is possible to operate HW in the form of hosting, i.e. you can order the HW itself without the operating system and then install the operating systems as BYOL (Bring-Your-Own-License). Applies to both commercial systems (MS Windows) and free operating systems (Linux).

IBM Cloud is based on the following security principles:

- The client knows where the data is located – the configuration of the IBM Cloud service requires the selection of a data center, without the selection of an IBM Cloud data center, the service can not be configured.
- The physical location of the IBM cloud data center is documented and available to the client.
- All client data is exclusively property of the client, and the client has full control over its management.
- Any manipulation with client data by IBM is performed solely on the basis of contractual documentation. So you do not have to worry about their potential misuse.
- IBM does not provide client data to third parties.
- IBM Privacy guidelines clearly state what data is used for which purpose (invoicing, etc.. .).
- IBM never accesses the clients data and does not arbitrarily perform data manipulation, backup, replication, both within the data center and between zones.
- The client can put the data in and put them out at any time (Exit strategy).
- Data security is determined by the client.Supported is BYOK (Bring-Your-Own-Key), KYOK (Keep-your-Own-Key), data encryption during transmission and processing.

IBM Cloud provides 3 encryption and security principles:

During transmission (Data-In-Motion)

- TLS/HTTPS protocol level
- VPN for environment management, especially for virtual, physical servers and their remote management
- Site-2-Site VPN as a secure transmission path from the client to the IBM cloud data center
- Via IBM Direct Link, allowing to create a dedicated line between IBM Cloud and the customers environment

Saving (Data-At-Rest)

- All shared storage is AES-256 encrypted by default
- The client has an option of encryption with its own algorithm

During processing (Data-In-Use)

- Confidential computing technology
- IBM provides a trusted environment at the physical hardware level (TEE-Trusted Execution Environment)
- Data protection during the entire life cycle
- The highest certification level: FIPS 1402 Level 4 HSM Data protection during the entire life cycle

Do you know, that...

IBM Cloud provides a dedicated hardware module for managing encryption keys - IBM Cloud HSM
cloud.ibm.com/catalog/infrastructure/hardware-security-module

Disks, that are defective are standardly shredded according to DoD 5220.22-M industry standard and a report is issued to the client upon request.

Certifications and industry standards

IBM Cloud meets a wide range of industry certifications, here is available the current list:
ibm.com/cloud/compliance

Certifications can be divided into:

1. **Global** (ISO 27x, CSA, SOC1, 2, 3)

2. **Industry specific** (PCI, HIPAA, EBU)

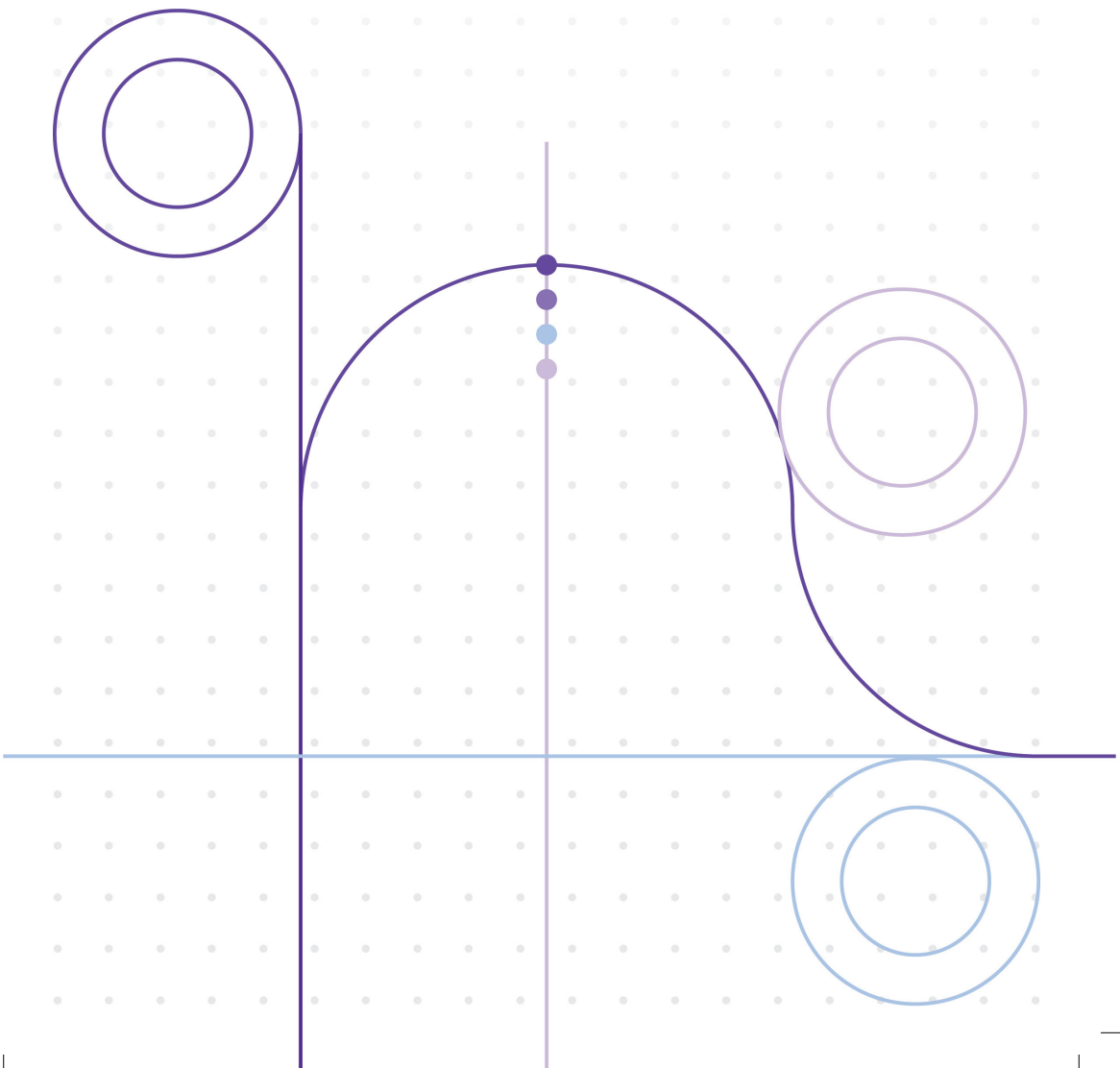
3. **Regional and national** (GDPR, C5)

4. **State and goverment** (FEDRAM, FISMA)

02

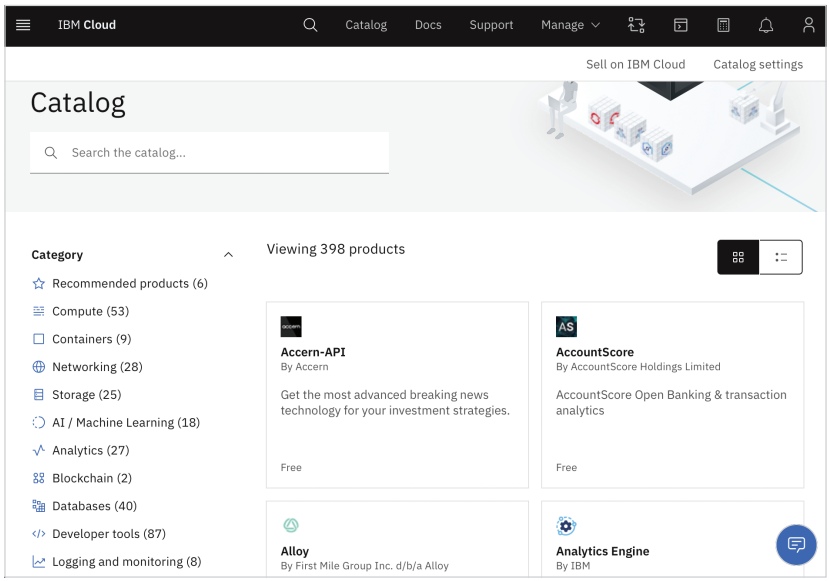
IBM Cloud Catalog

- IBM Cloud categories



IBM Cloud categories

The catalog is available online here even without logging into IBM Cloud: *cloud.ibm.com/catalog#services*



Compute

Physical or virtual servers, that are offered for hourly or monthly rent. In addition to servers, it is also possible to use a containerized serverless solution, which allows you to run the code only when it is necessary.

Containers

Automatically deploy containerized applications to achieve high scalability.

Networking

Maintain an equal load of application containers, create a private cloud and connect your data centers with IBM Cloud services.

Storage
Choose the type of storage, that you need. You have number of options: file storage, block storage and object storage. You can adjust the power and speed settings for all of them.

Converged infrastructure
Converged infrastructure for the operation of OpenShift, Virtual Private Cloud and Virtual Servers.

Enterprise Applications
Infrastructure services ensuring the implementation of infrastructure for the operation of enterprise applications (e.g. SAP HANA).

AI a Machine Learning
Build your own Watson chatbot, convert speech to text in many supported languages, train your own models.

Watson X
Harness the power of AI with the new Watson X platform.

Analytics
A set of services and APIs will allow to store the data and analyze them in real time.

Databases
Choose from a large number of databases. RDS databases, NoSQL databases, data warehouses and in-memory databases are available.

Developer tools
Automate application deployment or infrastructure creation, whether in test or production environments in the IBM Cloud.

Logging and monitoring
Use logging and monitoring of individual services and applications operated in IBM Cloud.

Migration tools

Easily and quickly migrate your applications, databases and microservices to the IBM Cloud.

Integration

Interconnect individual components to create a robust solution.

Internet of Things (IoT)

Any device, that can connect to a network can be IoT. It can be sensors, smart devices,phones. IBM Cloud offers a complete platform, that is set up, so that any device can be connected IBM Cloud. Data sent to IBM Cloud can be analyzed in real time thanks to IoT services.

Security

The range of security services is primarily intended for application security. For example, it allows you to scan your web or mobile applications and evaluate their vulnerabilities.

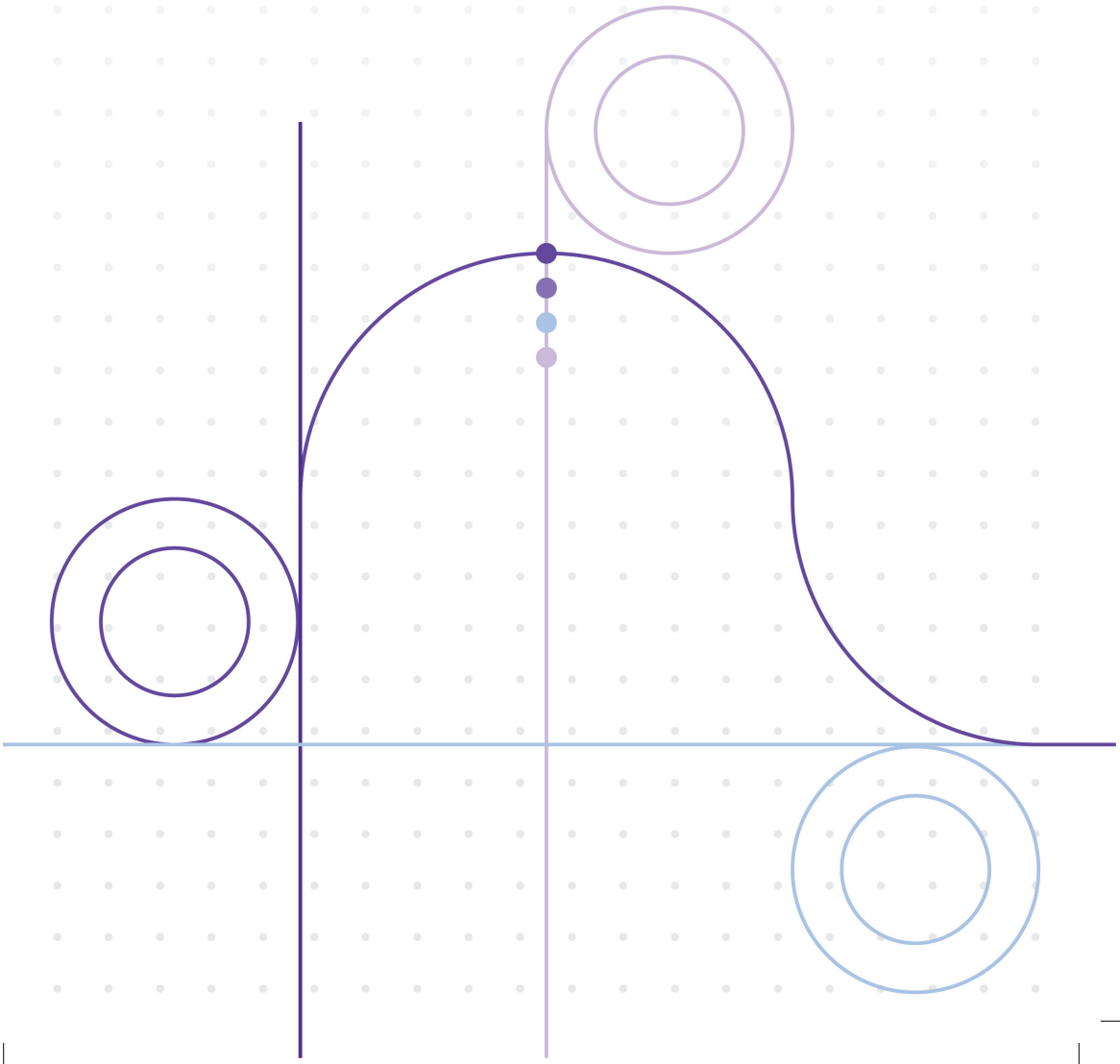
Mobile

Together with rich possibilities for mobile development, we offer a complete plarform for the development and operation of mobile applications.

03

Support

- Support levels
- Contact



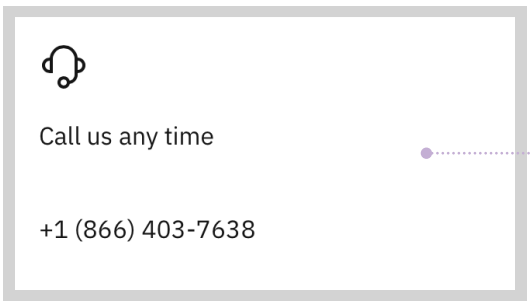
Support

IBM Cloud offers 3 levels of support:

Basic Advanced Premium

	Basic	Advanced	Premium
Description	Basic support is included in your IBM cloud Pay-As-You-Go or Subscription account.	Proritization of requirements according to client needs. Suitable for **supporting the production environment**.	The highest level of support, suitable for support of critical applications.
Availability	IBM Cloud support 24/7, through mobile, chat, or ticket.	IBM Cloud support 24/7, through mobile, chat, or ticket.	IBM Cloud support 24/7, through mobile, chat, or ticket.
Time for reaction	No guarantee	Severity 1: Less than 1 hour Severity 2: Less than 2 hours Severity 3: Less than 4 hours Severity 4: Less Than 8 hours	Severity 1: Less than 15 minutes Severity 2: Less than 1 hour Severity 3: Less than 2 hours Severity 4: Less than 4 hours
Request prioritization	No priority	Priority 1-4	Priority 1-4
Additional services	No	No	Assignment of a support employee Quarterly analysis Individual solution of IBM specialist client requirements.

All levels provide 24/7 live chat support with a physical person, telephone or ticketing system, which is available here in English:
cloud.ibm.com/unifiedsupport/supportcenter

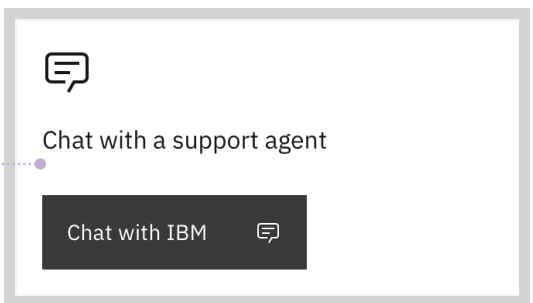


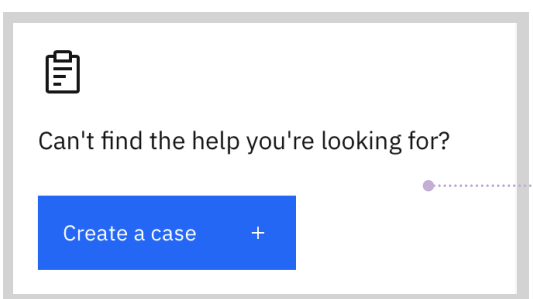
Operator

Telephone support
in English language 24/7

Chat

You can use chat
in urgent cases





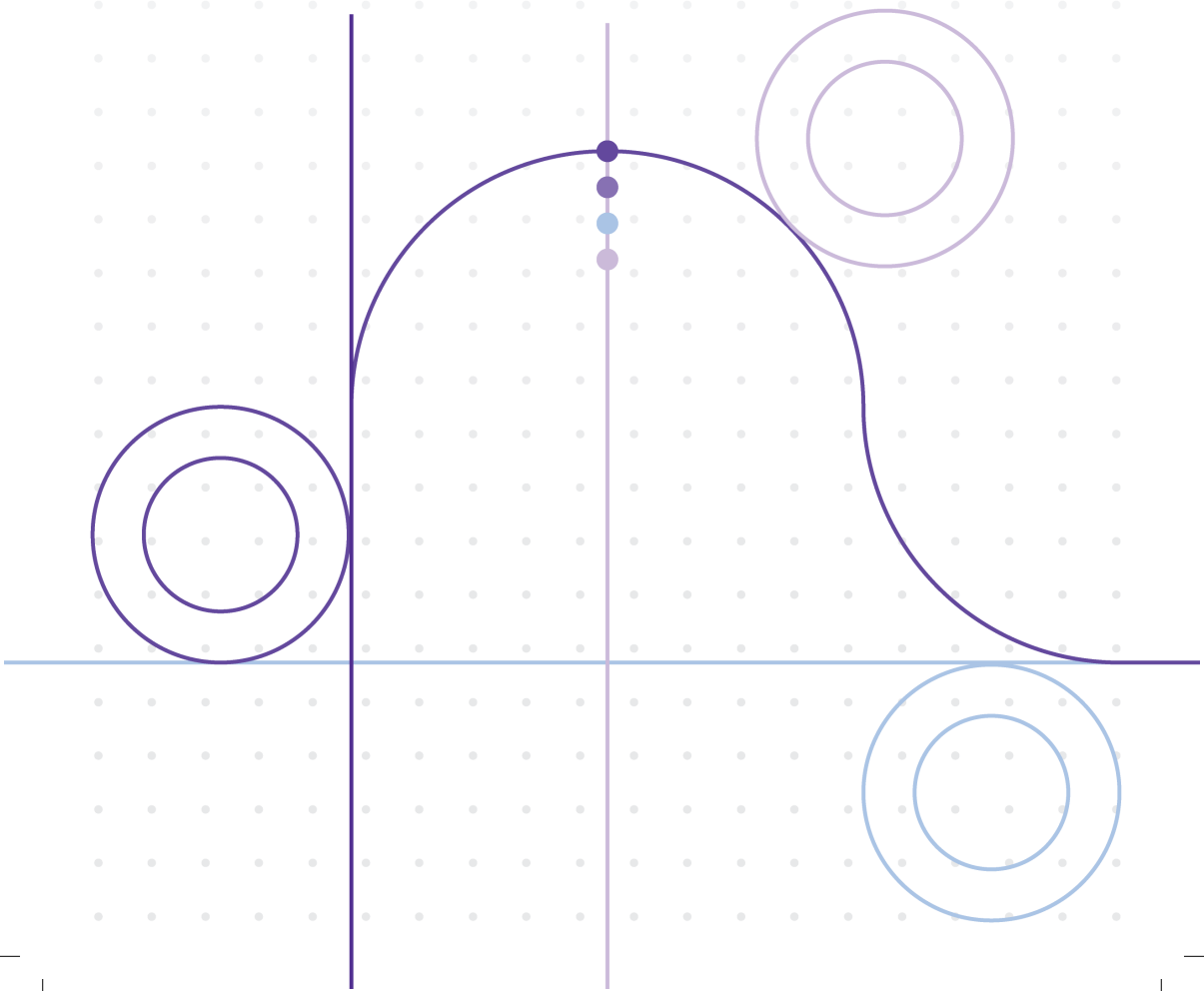
Case

You can create ticket
on IBM Cloud web

04

Account creation and login

- IBM Cloud accounts
- Account creation



There are 3 types of accounts in IBM Cloud:

Lite, Pay-As-You-Go and **Subscription**

1. **Lite** account is suitable, if you want to familirize yourself with IBM Cloud services, because you can use a large number of services completely free of charge in the so-called Lite mode. You can upgrade your account to Pay-as-you-go or Subscription at any time.

2. As part of **Pay-As-You-Go**, you can use any services, and you pay exactly for what you use in the IBM Cloud Type. The Pay-as-you-go account type is especially useful, if it is not easy to determine, which services and in what volume you will use.

3. **Subscription** is a type of account, where you pre-pay your for services and draw the pre-paid amount for a certain period of time (6, 12, 36 months). You can get a significant discount for this type of account, which depends on the amount and time, where you want to subscribe to IBM Cloud.

Account creation

If you already have an account, you can skip this chapter.

What will you need?

- Email address
- Your data - name, surname, address, telephone number
- Credit card

Steps:

1. Go to *cloud.ibm.com/login* and click on **Create account.**
2. Fill in your e- mail and password and then verify your email address.
3. Fill in the information about you or your company according to the selected type of account.
4. Fill in the billing information.
5. You can optionally fill in your tax identification number.
6. Fill in your card details. As long as you do not use paid services, you won't pay anything.
7. Click on **Create account.**
8. To log in, go to *cloud.ibm.com/login* and fill in your email and password.

You now have an IBM Cloud account set up and can log in.

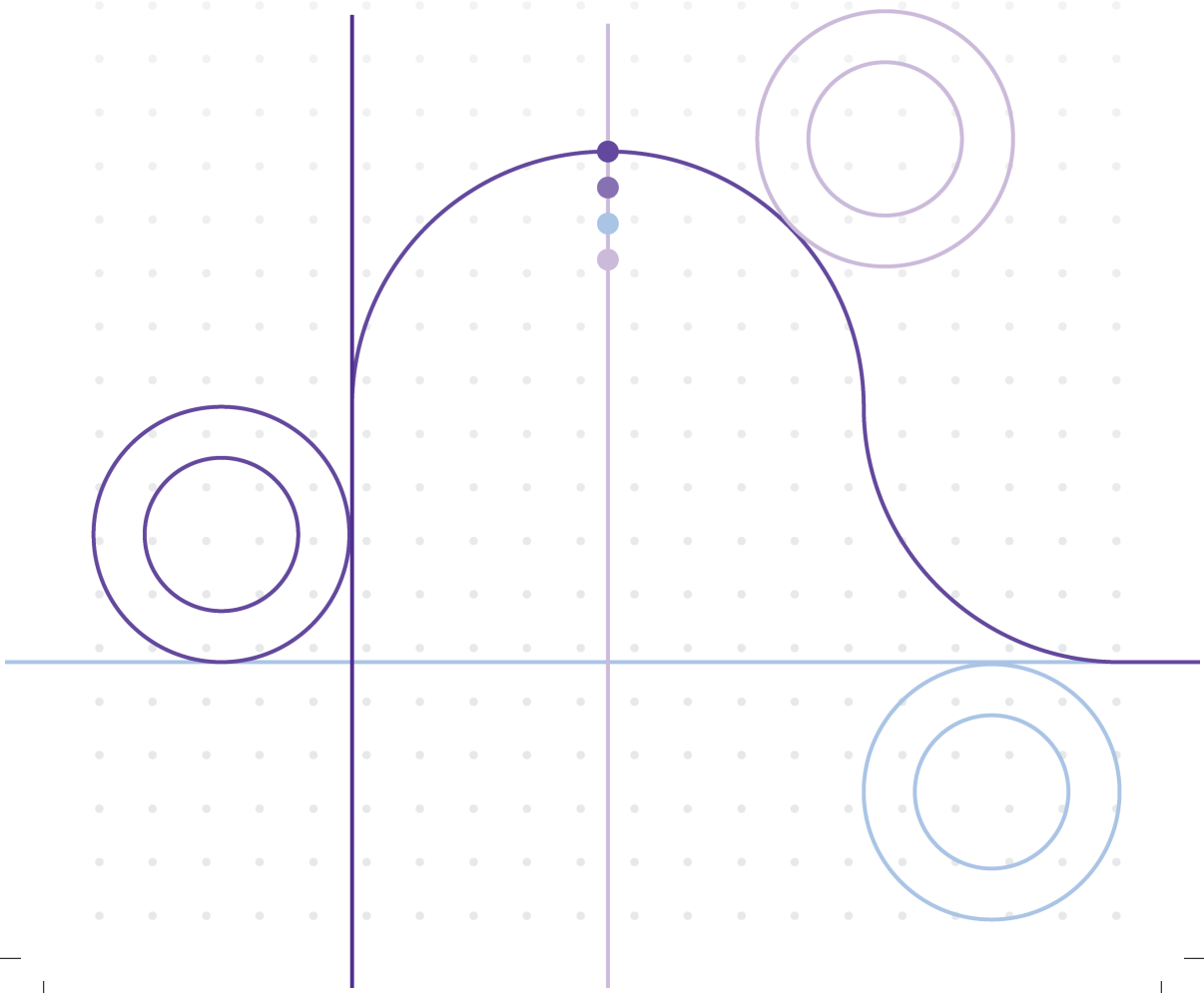
Tip

A credit card is only required for the verification of your user account. The card will be used only if you decide to use paid services.

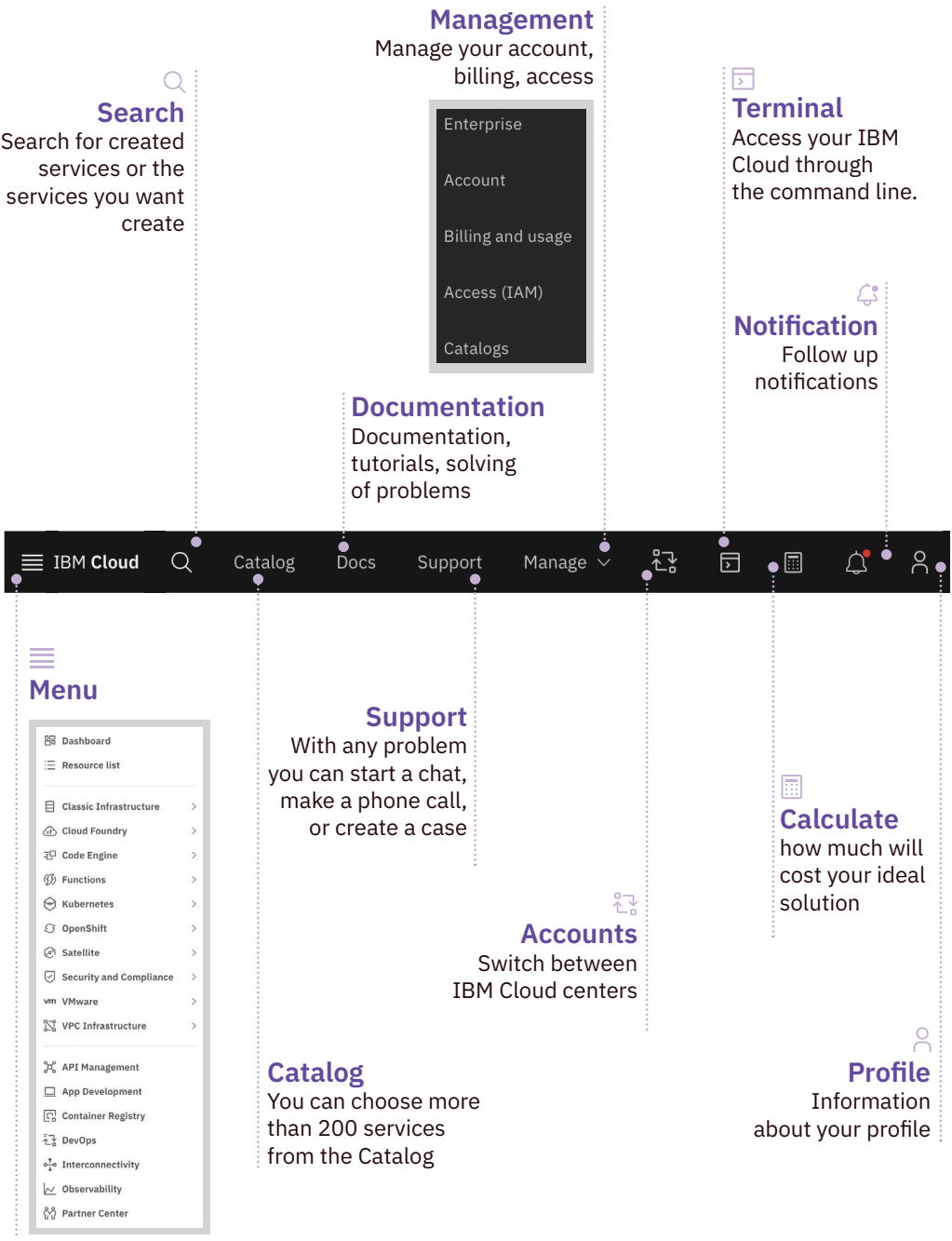
05

Navigation in the IBM Cloud platform

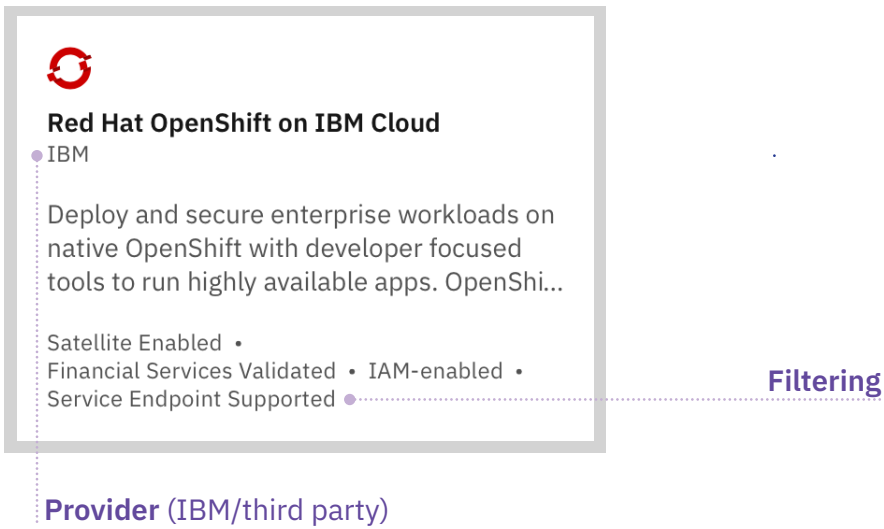
- IBM Cloud Interface
- IBM Cloud Catalog

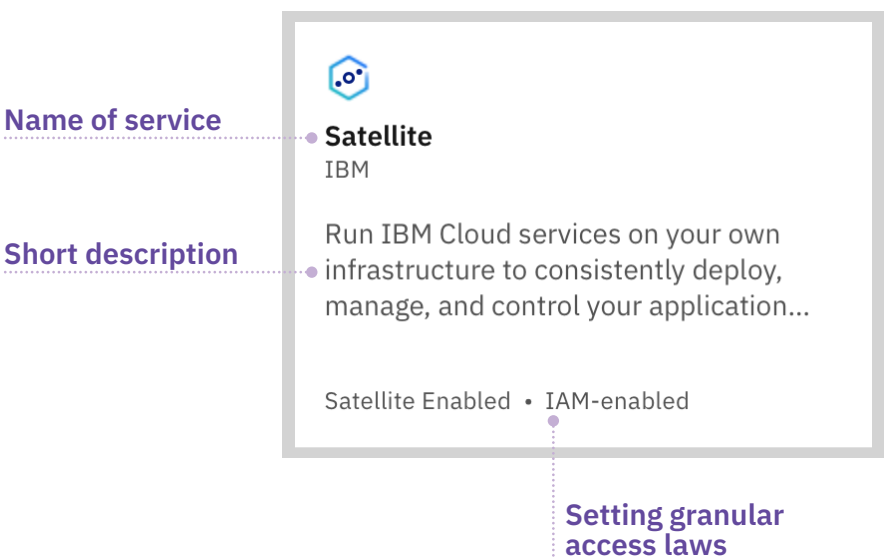


IBM Cloud Interface



IBM Cloud Catalog

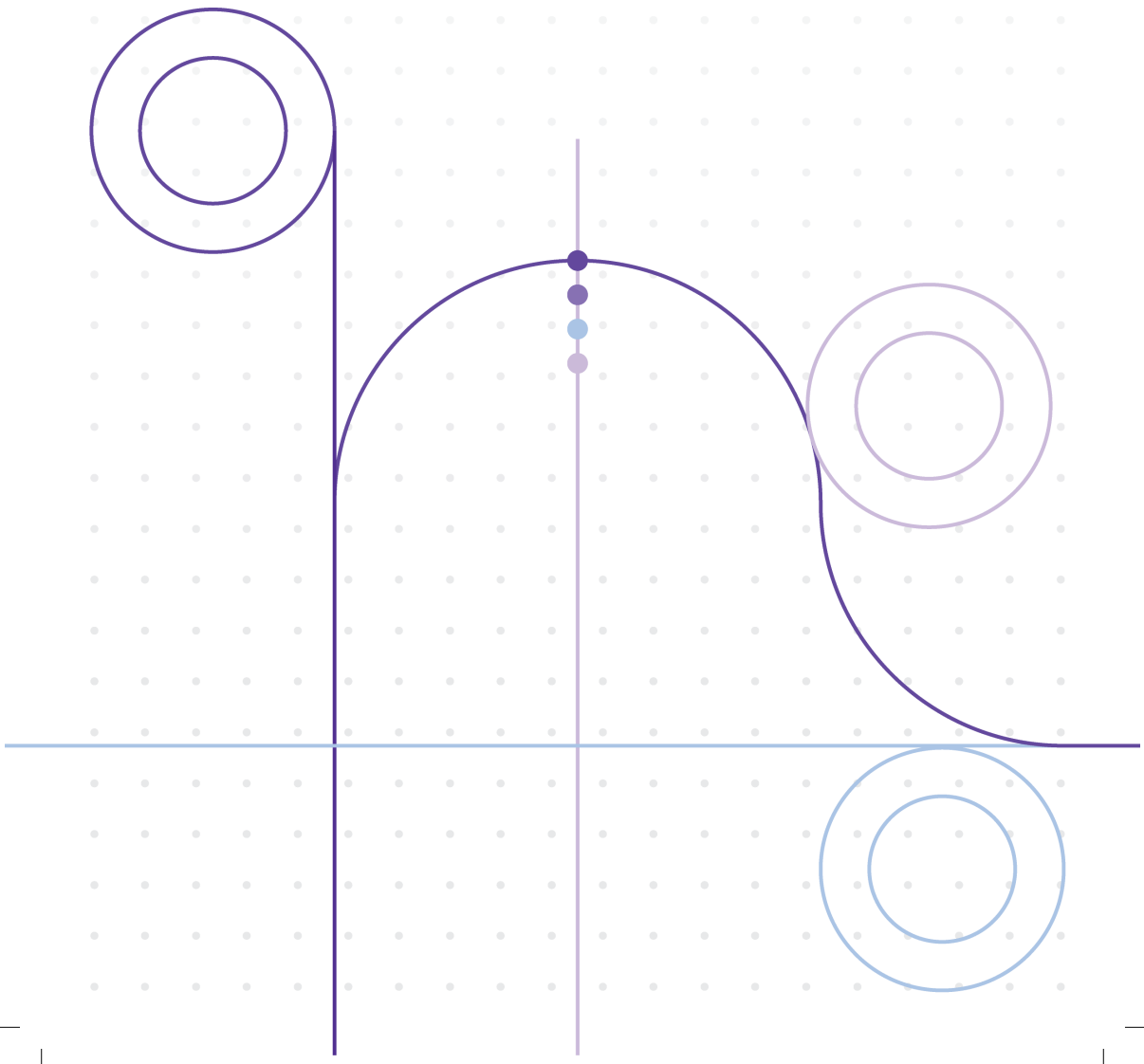




06

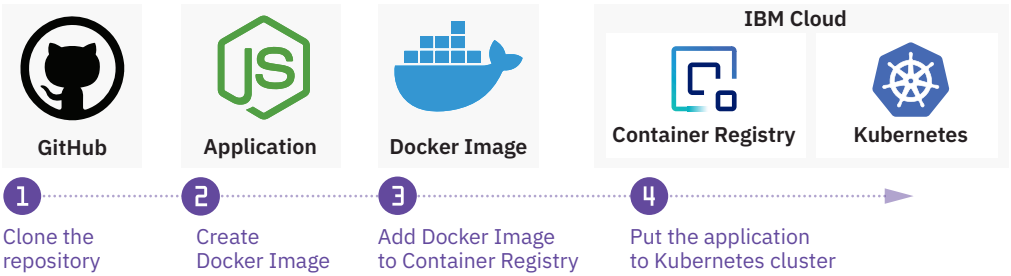
Creation of the application

- Creation of the first containerized application in Kubernetes



Creation of the first application

The purpose of this tutorial is to deploy a node js. Application to a Kubernetes cluster in the IBM Cloud The following figure outlines the 4 key steps:



What will you need

1. IBM Cloud account
You create IBM Cloud account according to the Instructions in Chapter 4.

2. Docker in version at least 19.03.13
For installation, we recommend to visit the official Docker website: *docker.com/get-started*. If you want to verify, that you have installed the docker, you can type for example the command: `$ docker --version`

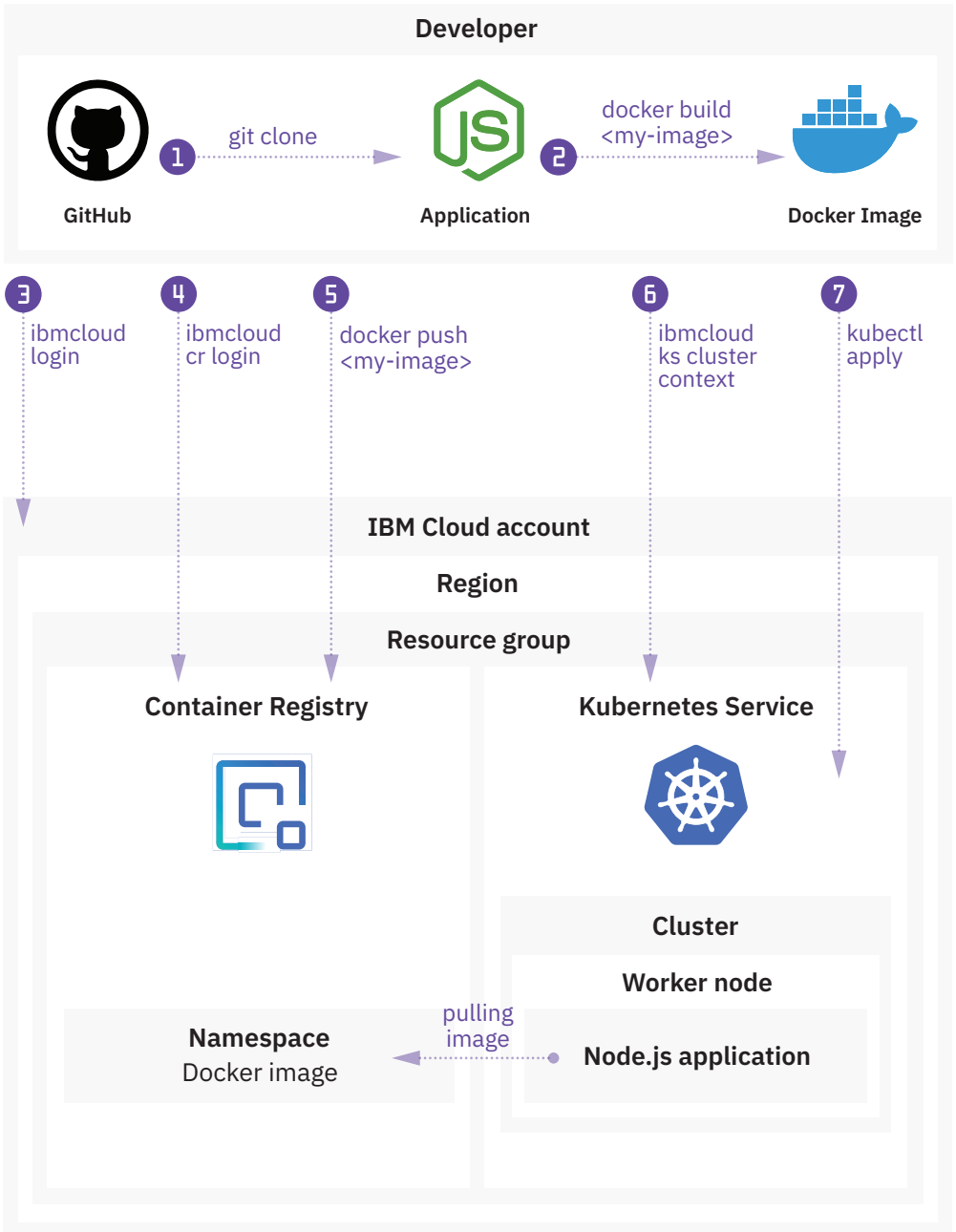
3. IBM Cloud CLI in version at least 2.0.0
Follow the documentation here: *cloud.ibm.com/docs/cli?topic=cli-getting-started*

4. IBM Cloud CLI Kubernetes plugin
Enter the following command (you must already have installed the IBM Cloud CLI): `$ ibmcloud plugin install kubernetes-service`

5. IBM Cloud CLI Container Registry Plugin
Enter the following command (you must already have installed the IBM Cloud CLI): `$ ibmcloud plugin install container-registry`

6. Git
Download and install the git here: *git-scm.com/downloads*

The following diagram shows the architecture of this solution and the commands, that will be used:



You can find the demo at: *github.com/IBM/CZ-IBM-Cloud-Guide*

Here you will find:
- **Dockerfile** - file, that creates Docker Image.
- **Deployment.yml** – file, that defines deployment to Kubernetes.
- **App folder**, that contains the source code of application.

Steps

1. Creation of Kubernetes Service in IBM Cloud
Sign in in to your IBM Cloud account and click on **Catalog** in the top. In the search tool for the catalog, type **Kubernetes Service** and click on this service. In the **Service Configurator**, select the **Classic** variant in infrastructure, then in **Location** set **Geography** to Europe, availability to single zone and Worker zone on Frankfurt 02. In **Worker pool** select **Change flavor** and choose a minimum configuration of 2 vCPU a 4GB RAM, that will be sufficient for operation. **Worker nodes per zone** set on **1**.

You can change the name for **Cluster** and **Resource Group**, but we recommend toleave the default names for these purposes. Let all other settings without change. For the cluster creation click on **Create**.

Tip

It is a paid service, however 2 CPU, 4GB RAM and 125GB of storage is the minimum configuration, that you will need for the demo. Later it is also possible to expand the cluster for real use.

If you want to try the service completely free, contact the authors of this document who are listed on page 2, who wil then provide you with a promo code for a free trial.

A-1 node Kubernetes cluster will have an Ingress status of warning. This is not an error, but the Kubernetes cluster will not have functional Application Load Balancing. You remove the message by adding another worker node to the configuration.

2. Creating Container Registry in IBM Cloud
In IBM Cloud, click on the menu in the upper left corner and select the **Container Registry service** (located approximately in the middle of the menu). In **Container Registry**, click on the **Namespaces**, select Location Frankfurt and click on **Create namespace**. Here, choose a unique **Name** and **Resource Group**, that can be default.

3. Opening of the command line
For most of the following steps you will need a command line. On MacOS search **Terminal**, on Windows **Command Prompt**. And if you have Linux, you will know for sure.

4. Clonning of the repository
Enter the following command:

```
$ git clone https://github.com/IBM/CZ-IBM-Cloud-Guide.git
```

Now go to the repository via the command line:

```
$ cd CZ-IBM-Cloud-Guide
```

5. Login to IBM Cloud via command line and Container Registry
In addition to the user interface, you can work with IBM Cloud services via the command line. For this, it is important to have the IBM Cloud CLI installed and logged into your account. Log into your IBM Cloud account via this command:

```
$ ibmcloud login --sso
```

After entering this command, you will be prompted for a one- time password. You receive the password from the URL address, that the command line offers you. If you have multiple IBM Cloud accounts, you will be able to choose, which one you want to log into.

Set your account location to Frankfurt:

```
$ ibmcloud target -r eu-de
```

After logging into IBM Cloud, log into **Container Registry**:

```
$ ibmcloud cr login
```

6. Save the context of your Kubernetes cluster

In order to be able to deploy an application to your cluser, it is necessary to store the context of this cluster locally,for this operation you need to obtain the **Cluster ID**. Therefore, in the user interface in the browser, go to Kubernetes Cluster via the top left menu, here select Resource list, then click on Clusters and select your cluster. Here you will see the Cluster ID, copy it and enter the following command in the command line:

```
$ ibmcloud ks cluster config --cluster <here save your Cluster ID>
```

Example:

```
$ ibmcloud ks cluster config --cluster c6f4v6hf0vb1mmfmdhi0
```

7. Create docker image

Make sure, that you are in the root folder of the cloned repository, where the **Dockerfile** is reported. You can do this, for example, with a `ls` command on MacOS and Linux, or `dir` on Windows. Then create the **Docker Image** itself with the following command:

```
$ docker build -t de.icr.io/<your-namespace>/<any-application-name>:<any-tag> .
```

Example:

```
$ docker build -t de.icr.io/my_namespace/my_application:0.1 .
```

Building a **Docker Image** can take several minutes. If it was created correctly, the tag you have selected will be displayed after entering the following command:

```
$ docker image ls
```

8. Save the Docker Image in Container Registry

The created Docker Image now needs to be saved in the Container Registry, so that the Kubernetes Service can continue to work with it. To save to Container Registry, enter the following command :

```
$ docker push de.icr.io/<your-namespace>/<any-application-name>:<any-tag>
```

Example:

```
$ docker push de.icr.io/my_namespace/my_application:0.1
```

Now in the user interface in the browser under **Container Registry** under **Images** will display your image.

9. Set the application into Kubernetes cluster

In this step, you will work with the Deployment.yml. Put the Docker Image name in the Deployment.yml file in the place marked with little stars.
After changing and saving the file, use this command:

```
$ kubectl apply -f deployment.yml
```

Verify, that you can see the node js. Application in Kubernetes with the following command:

```
$ kubectl get svc
```

10. Make sure, that the application is implemented

Now you can check, if the application is set up properly. Switch to your Kubernetes Cluster and in the right part click on Worker nodes. In this window, copy the public IP address, in our case 159.122.181.104 and enter the port (default 30080), which is defined in the Deployment.yml. file.

```
http:// <Enter IP Address here> : < Enter port here>
```

Example: `http://159.122.181.104:30080/`

Congratulations!

You have built the docker image, pushed it to the container registry in IBM Cloud and deployed this application into the Kubernetes cluster!
Well done!

Congratulations, you have now created the first application!

Rejstřík

With the terms below, you will meet not only in this brochure, but also on *ibm.com/cloud*, or in the documentation on *cloud.ibm.com/docs*, or elsewhere.

AZ	Availability Zone: It is de facto independent data center with 1 or more PODs(Point Of Delivery). Each POD consists of servers, network elements, data storage ensuring continuous operation (electrical generators, cooling, etc.)
Bluemix	IBM platform providing PaaS services. From 2017 it is a part of the IBM Cloud.
BYOK a KYOK	Bring Your Own Key: Option to bring your own encryption keys to IBM Cloud. Keep Your Own Key: Option of key management and management of their complete life cycle (incl. Issuing new keys).
BYOL	Bring Your Own License: Option to bring the own purchased license into cloud. It applies both to the operating system, the hypervisor, and also to the database or application software.
Cloud-enabled	Programmatic applications, like those, that are operated outside the cloud, but with little or no modification, it is possible to transfer them into cloud.
Cloud-native	Appplications, that are programmed and operated exclusively in the cloud and using the principles of containerization and micro-service architecture.
Internet of Things (IoT)	Internet of Things. A network of sensors, so-called smart devices, gates (gateways) interconnected with each other. IBM Cloud is able to process, visualize and store data.
Multi-tenant	Cloud Service (IaaS or PaaS) is operated on shared hardware, operational system. Example: Database-as-a-Service in this model is „run“ on hardware, where the same service „runs“ for multiple clients. Separation from other clients is done by software.

MZR	Multi Zone Region. It consists of 3 zones (datacenters), which are independent on each other, connected at least 1 Gbps and with a latency less than 2 miliseconds. The SLA for the operation of the cloud service in MZR is 99.99%.
Pay-As-You-Go	Payment for the use of cloud services during specified period, usually 1 month. The use of cloud services is accumulated, and after a month the client is issued a summary invoice for the use of all services for the given period.
Single-tenant	Cloud service (IaaS or PaaS) is operated exclusively for a single client. There is no share of HW and SW resources (hard- ware, operational system, hypervisor, etc.)
SoftLayer®	A company purchased by IBM in 2013 with a worldwide network of data centers and providing IaaS services. It is currently integrated in to IBM Cloud.
Software appliance	IT tool operated as a software application. In cloud, it only needs hardware for its operation. An example can be a firewall, load balancer, etc..
Subscription	Subscription for cloud services. The subscription allows you to pay in advance for the usage in the form of credit, which is then used to cover the costs of the IaaS and PaaS cloud services used.
SZR	Single zone region: It consists of 1 zone (datacenter). SLA (Service Level Agreement) for the cloud service operation is 99.9%.
VPC	Virtual private cloud: Option to create a Private Cloud in the IBM Public Cloud. VPC tools are separated from each other by network and operated separately for clients.

IBM Cloud step by step

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