

# Red Hat OpenShift sizing and subscription guide

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## Introduction

This document will help you understand the subscription model for Red Hat® OpenShift Container Platform and provide easy-to-follow, step-by-step instructions for how to approximate the size of an OpenShift environment. More accurate sizing information is available on request.

## Red Hat OpenShift subscription offerings

- **Red Hat OpenShift Online:** Multitenant OpenShift environment hosted by Red Hat
- **Red Hat OpenShift Dedicated:** Highly-available private OpenShift clusters hosted by Red Hat. Customers work with Red Hat to determine requirements and integrations, and Red Hat implements and fully manages the environment.
- **Microsoft Azure Red Hat OpenShift:** Flexible, fully-managed Red Hat OpenShift service on Microsoft Azure
- **Red Hat OpenShift Container Platform:** OpenShift environment that is implemented and maintained by the customer.
- **Red Hat OpenShift Container Engine:** OpenShift environment implemented and maintained by the customer, without commercial support for advanced networking, management, and devops features.
- **Red Hat OpenShift Container Lab:** Sales promotional program for first-time OpenShift Container Platform customers for non-production workloads

## Red Hat OpenShift Container Platform

### Subscription components

#### 1. Red Hat Enterprise Linux / Red Hat Enterprise Linux CoreOS

Each OpenShift subscription includes Red Hat Enterprise Linux entitlements<sup>1</sup>. Red Hat Enterprise Linux CoreOS is available only with Red Hat OpenShift.

#### 2. Red Hat OpenShift Container Platform

Each subscription includes entitlements for OpenShift and its integrated components, including the following integrated solutions:

- **Log aggregation** Aggregates container logs and platform logs using Elasticsearch, Fluentd, and Kibana
- **Metrics aggregation** Aggregates container performance metrics such as memory use, CPU use, and network throughput using Prometheus and Grafana

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<sup>1</sup> Customers with existing, excess entitlements may want to consider Red Hat OpenShift Container Platform for Red Hat Enterprise Linux as an alternative. This offering, available at a slightly lower cost, does not include Red Hat Enterprise Linux entitlements.

These solutions are supported only in their native integrations with OpenShift, with limited support for customization; they are not supported for general use outside of OpenShift.

### 3. Red Hat Software Collections

OpenShift lets you use the container images provided in Red Hat Software Collections. These images include popular languages and runtimes – such as PHP, Python, Perl, Node.js, and Ruby – as well as databases, such as MySQL, MariaDB, MongoDB, and Redis. This offering also includes an OpenJDK image for Java™ frameworks, such as Spring Boot. For more information, read the technology brief at [redhat.com/en/resources/red-hat-software-collections](https://redhat.com/en/resources/red-hat-software-collections).

### 4. Red Hat JBoss Web Server

OpenShift subscriptions include Red Hat JBoss Web Server, an enterprise solution that combines the Apache web server with the Apache Tomcat servlet engine, supported by Red Hat. OpenShift includes an unlimited right to use JBoss Web Server. Learn more at [redhat.com/en/technologies/jboss-middleware/web-server](https://redhat.com/en/technologies/jboss-middleware/web-server).

### 5. Single sign-on

Red Hat provides Web SSO and identity federation based on Security Assertion Markup Language (SAML) 2.0, OpenID Connect, and Open Authorization (OAuth) 2.0 specifications. This capability, included in OpenShift subscriptions, may only be deployed inside OpenShift environments. However, any application – whether deployed inside or outside of OpenShift – may use Red Hat's SSO.

### 6. Red Hat CodeReady Workspaces

A collaborative Kubernetes-native development solution that delivers OpenShift workspaces and an in-browser integrated development environment (IDE).

## Subscription types

The OpenShift Container Platform, 2 Core subscription is based on the number of logical cores on the CPUs in the system where OpenShift runs.

As with Red Hat Enterprise Linux:

- OpenShift Container Platform subscriptions are stackable to cover larger hosts
- Cores can be distributed across as many VMs as needed. For example, 10 2-core subscriptions will provide 20 cores that can be used across any number of virtual machines (VMs).

OpenShift Container Platform subscriptions are available with Premium or Standard support.

## Disaster recovery

Red Hat OpenShift does not offer disaster recovery (DR), cold backup, or other subscription types. Any system with OpenShift installed, powered-on or powered-off, running workload or not, requires an active subscription. See the section titled Infrastructure nodes and masters to understand more about subscription requirements.

## Cores vs vCPUs and hyperthreading

Making a determination about whether or not a particular system consumes 1 or more cores is currently dependent on whether or not that system has hyperthreading available. Note that hyperthreading is only a feature of Intel CPUs; to determine whether a particular system supports hyperthreading, visit <https://access.redhat.com/solutions/7714>.

For systems where hyperthreading is enabled and where 1 hyperthread equates to 1 visible system core, then a calculation of cores at a ratio of 2 cores = 4 vCPUs is used.

In other words, a 2-core subscription covers 4 vCPUs in a hyperthreaded system. A large VM might have 8 vCPUs, equating to 4 subscription cores. As subscriptions come in 2-core units, you would need two 2-core subscriptions to cover these 4 cores or 8 vCPUs.

Where hyperthreading is not enabled, and where each visible system core correlates directly to an underlying physical core, a calculation of 2 cores = 2 vCPUs is used.

### **Splitting cores**

Systems that require an odd number of cores will need to consume a full 2-core subscription. For example, a system that is calculated to require only 1 core will end up consuming a full 2-core subscription once it is registered and subscribed.

When a single VM with 2 vCPUs uses hyperthreading (see prior section), resulting in 1 calculated vCPU, a full 2-core subscription is required; a single 2-core subscription may not be split across two VMs with 2 vCPUs using hyperthreading.

It is recommended that virtual instances be sized so that they require an even number of cores.

### **OpenShift Container Platform environments**

OpenShift Container Platform can be used anywhere that 64-bit x86 Red Hat Enterprise Linux is certified and supported.

For on-premise deployments, OpenShift can be installed on:

- Bare metal
- Virtualized environments, including:
  - VMware
  - Microsoft Hyper-V
  - Red Hat Virtualization
- Private clouds, including Red Hat OpenStack® Platform

OpenShift can also be installed and used on any Red Hat Enterprise Linux-certified public cloud, such as:

- Amazon Web Services (AWS)
- Google Cloud Platform (GCP)
- Microsoft Azure

Registration for Red Hat Cloud Access is required to use your OpenShift subscriptions on certified public clouds. For more information, visit [redhat.com/en/technologies/cloud-computing/cloud-access](https://access.redhat.com/en/technologies/cloud-computing/cloud-access).

For more information on platforms and clouds that OpenShift has been tested and certified on, refer to OpenShift Container Platform Tested Integrations at <https://access.redhat.com/articles/2176281>.

## Red Hat OpenShift Dedicated

Red Hat OpenShift Dedicated provides one or more single-tenant, high-availability OpenShift clusters delivered as a managed, public cloud service on Amazon Web Services (AWS). OpenShift Dedicated clusters are managed by Red Hat OpenShift operations experts, who use years of experience to increase security while providing a streamlined path to use OpenShift in public cloud environments.

Similar to OpenShift Container Platform, the right number of application nodes for OpenShift Dedicated depends on the size of applications – their memory footprint – and the total number of application instances.

Red Hat OpenShift Dedicated pricing is based on several variables, including application node sizing, single versus multiple availability zones, and standard versus bring-your-own cloud configurations.

**Table 1: Red Hat OpenShift Dedicated package overview**

	Standard Plan Deploy in cloud provider accounts owned by Red Hat	Bring-your-own-cloud plan Use your existing cloud provider infrastructure
Single availability-zone cluster	Starts at \$36,000 per year	Starts at \$16,000 per year
Multiple availability-zone cluster	Starts at \$81,000 per year	Starts at \$36,000 per year
Choice of general purpose, memory-optimized, and compute-optimized instances	X	X
Choice of application node sizes	X	X

## Additional Red Hat products for use with OpenShift

Many of Red Hat’s middleware, storage, and management offerings may be purchased for use with OpenShift. Some middleware offerings are also available as curated bundles for use with OpenShift. These solutions include:

Container Registry:

- Red Hat Quay

Middleware:

- Red Hat JBoss Enterprise Application Platform (EAP)
- Red Hat Data Grid
- Red Hat AMQ
- Red Hat Decision Manager
- Red Hat Process Automation Manager
- Red Hat Fuse
- Red Hat OpenShift Application Runtimes

- Red Hat 3scale API Management<sup>2</sup>

Storage:

- Red Hat OpenShift Container Storage<sup>2</sup>

### Red Hat Consulting OpenShift offerings

Red Hat has an extensive catalog of consulting offerings, ranging from initial software deployment to complete programs designed to support your organization's digital transformation journey.

- **Discovery Session:** No-cost Discovery Sessions create open discussion on how an organization can adopt Red Hat OpenShift, take advantage of DevOps practices, and establish innovative application development. Discovery Sessions are designed to produce a summary report presenting the focus areas discussed, scope and priority information, and a proposed approach for continuing to work with Red Hat Consulting to increase adoption.
- **OpenShift Container Platform Pilot:** This twelve-week, extended introductory services engagement puts organizations on a path to modernizing application delivery through efficient use of container and container orchestration technologies.
- **Container Adoption Program:** This comprehensive program supports enterprise-scale container adoption, including establishing container platform infrastructure, deployment pipeline automation, and mass migration of applications to containers. The program begins with a pilot offering and incorporates Red Hat Open Innovation Labs to support faster innovation and time to market.
- **Red Hat Open Innovation Labs:** In this immersive experience program, customers visit Red Hat's labs to experiment, become more agile, learn DevOps practices, and catalyze innovation alongside Red Hat experts. Learn more at [redhat.com/en/open-innovation-labs](https://redhat.com/en/open-innovation-labs).

### Red Hat Training OpenShift offerings

Red Hat Training courses can help you and your staff quickly become familiar with OpenShift and related technologies. Red Hat offers a variety of ways to access training – from no-cost online webinars available on demand to scheduled training held on-premise at your location.

#### **Paid, instructor-led training:**

- Introduction to Containers, Kubernetes, and Red Hat OpenShift (DO180)
- Red Hat OpenShift Administration I (DO280)
- Red Hat OpenShift Administration II (DO380)
- Red Hat OpenShift Development I: Containerizing Applications (DO288)
- Red Hat OpenShift Development II: Creating Microservices with Red Hat OpenShift Application Runtimes (DO292)

#### **No-cost, self-paced training:**

- Deploying containerized applications technical overview (DO080)
- Red Hat OpenShift Interactive Learning Portal: <https://learn.openshift.com>

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<sup>2</sup> Not currently available for use with Red Hat OpenShift Dedicated

\*All Red Hat Training courses are available in a single platform as part of the [Red Hat Learning Subscription](#).

### Red Hat Technical Account Management services

Red Hat offers Technical Account Management services to support your organizations adoption, deployment, and management of our technologies. Red Hat Technical Account Managers (TAMs) are highly technical, product specialists who partner with your organization. Your TAM will develop a personal relationship with you in order to understand your unique business needs, strategically plan deployments, and assist you with faster issue resolution.

TAMs are your advocate in the Red Hat ecosystem. With a direct line to the Red Hat engineering organization, you can impact product feature requests and updates. By working with Red Hat Product Security, TAMs provide you with proactive notifications and resolutions for critical security issues. They also organize multivendor collaboration in order to solve technical issues. TAMs deliver new information and insight to influence your IT strategy and how you manage risk, reliability, and security. Your TAM is there to help your organization evolve and succeed.

### Suggested Initial OpenShift deployment

The following suggested bill of materials provides an extremely flexible, scalable OpenShift environment designed to run in VMs and support hundreds of application containers:

- 16 x OpenShift Container Platform, 2-Core Premium subscriptions, including:
  - Multimaster HA (3 VMs)
  - Redundant infrastructure nodes (3 VMs)
  - Application nodes (16 VMs)
- 3 x Red Hat OpenShift Container Storage: Adds scalable block and file storage for applications inside OpenShift.
- 16 x Red Hat OpenShift Application Runtimes: Adds support for Java and JavaScript applications on OpenShift.

### Red Hat OpenShift Container Platform sizing

To conduct a more thorough sizing exercise to determine how many OpenShift Container Platform or add-on subscriptions you need, use the following questions and examples.

A few basic OpenShift terms are used in these sizing exercises:

- **Pod:** The deployed unit in OpenShift. A running instance of an application – for example, an app server or database.
- **Application instance:** Effectively the same as pod and used interchangeably.
- **Node:** Instances of Red Hat Enterprise Linux or Red Hat Enterprise Linux CoreOS where pods run. OpenShift environments can have many nodes.
- **Masters:** Instances of Red Hat Enterprise Linux CoreOS that act as the orchestration/management layer for OpenShift. Masters are included in OpenShift Container Platform subscriptions. See the “Infrastructure nodes and masters” section for more details.

- **Infrastructure nodes:** Instances of Red Hat Enterprise Linux or Red Hat Enterprise Linux CoreOS that are running pods supporting OpenShift's infrastructure. Infrastructure nodes are included in OpenShift Container Platform subscriptions. See the "Infrastructure nodes and masters" section for more details.
- **Cluster:** A group of OpenShift masters and nodes.

In summary:

- Applications are packaged in container images.
- Containers are grouped in pods.
- Pods run on nodes, which are managed by masters.

### Infrastructure nodes and masters

Each OpenShift Container Platform subscription provides extra entitlements for OpenShift, Red Hat Enterprise Linux, and other OpenShift-related components. These extra entitlements are included for the purpose of running either OpenShift Container Platform masters or infrastructure nodes.

### Infrastructure nodes

To qualify as an infrastructure node and use the included entitlement, only the following included OpenShift components may be run as application instances:

- Red Hat OpenShift-included registry
- Router
- OpenShift cluster monitoring
- OpenShift log aggregation
- Red Hat Quay
- Red Hat OpenShift Container Storage

No other application instances or types may be run on an infrastructure node using the included entitlement. To run other infrastructure workloads as application instances on OpenShift, you must run those instances on regular application nodes.

### Masters

Masters generally are not used as nodes and, by default, will not run application instances. However, you could use a master as a functional node. Whether a master requires a full OpenShift Container Platform subscription depends on the application instances it runs. See the Infrastructure nodes section above.

### Cores and vCPUs

Because of the way that Red Hat Enterprise Linux recognizes CPUs—and due to how modern CPUs work—it often appears that there are twice as many CPUs present. Because of this effect and how virtualization works, Red Hat implements a 2:1 mapping of subscription cores to vCPUs.

In the case of a VM—whether in a public cloud, private cloud, or local virtualized environment—1 subscription core would cover 2 vCPUs. In other words, if a VM has 4 vCPUs assigned, a 2-core subscription would be required.



### Sizing process

OpenShift subscriptions do not limit application instances. You can run as many application instances in the OpenShift environment as the underlying hardware and infrastructure will support. Larger-capacity hardware can run many application instances on a small number of hosts, while smaller-capacity hardware will require many hosts to run many application instances. The primary factor in determining the size of an OpenShift environment is how many pods, or application instances, will be running at any given time.

#### Step 1: Determine standard VM or hardware cores and memory

You may have a standard VM size for application instances or, if you typically deploy on bare metal, a standard server configuration. The following questions will help you more accurately understand your VM and hardware needs. Remember that in most cases, 2 vCPUs is equivalent to 1 core.

**Table 2: VM and hardware sizing questions**

Relevant questions	Example answer
What is the memory capacity of the VMs you will use for nodes?	Our VMs have 64GB of memory and 4 vCPUs and hyperthreading is used
What is the number of vCPUs for the VMs you will use for nodes?	
Is hyperthreading in use?	

#### Step 2: Calculate number of application instances needed

Next, determine how many application instances, or pods, you plan to deploy. When sizing the environment, any application component deployed on OpenShift – such as a database, front-end static server, or message broker instance – is considered an application instance.

This figure can simply be an approximation to help you calculate a gross estimate of your OpenShift environment size. CPU, memory oversubscription, quotas and limits, and other features can be used to further refine this estimate.

**Table 3: VM and hardware sizing questions**

Relevant questions	Example answers
How many application instances do you anticipate deploying in each OpenShift environment?	We have around 1,250 application instances in our development environment and around 250 application instances in production.
What type of applications are they (e.g., language, framework, database)?	We mainly deploy Java but have some Microsoft .NET Core and Ruby applications as well. We also use a lot of MySQL.

#### Step 3: Determine preferred maximum OpenShift node utilization

We recommend reserving some space in case of increased demand, especially if autoscaling is enabled for workloads. Your preferred utilization will vary, based on historical load for the applications that will run on OpenShift.

**Table 4: Preferred maximum OpenShift node utilization questions**

Relevant question	Example answer
How much space do I want to reserve for increased demand?	We want to run nodes at a maximum average of 80% of total capacity (leaving 20% in reserve).

**Step 4: Determine total memory footprint**

Next, calculate the total memory footprint of the deployed applications. If you are considering a completely greenfield environment, memory use data may not be available, but you can use educated approximations – for example, 1GB of memory per Java application instance – to make an estimate.

**Table 5: OpenShift memory footprint questions**

Relevant question	Example answers
What is the average memory footprint of applications?	Our application instances use 2GB of memory or less.  We typically allocate 2GB for JVM heap.

**Step 5: Calculate totals**

Finally, determine the number of OpenShift subscriptions needed based on the data gathered in steps 1-5.

- Effective per node memory capacity (GB)  
= Preferred maximum OpenShift node utilization (%) \* Standard VM or hardware memory
- Total memory utilization  
= Application instances \* Average application memory footprint
- Number of nodes required to cover utilization  
= Total memory utilization / Standard VM or hardware memory
- Total required cores  
= Number of nodes required to cover utilization \* Standard VM or hardware cores
- Effective virtual cores  
= Total required cores / 2
- Number of OpenShift Container Platform subscriptions<sup>3</sup>  
= Total cores / 2 OR  
= Effective virtual cores / 2

<sup>3</sup> If hyperthreading is in use, 2 virtual cores count only as 1 core of a subscription. See the section titled Cores versus vCPUs and hyperthreading for details on whether to use effective or actual cores in this calculation.

### Example calculation for virtualized environments

System sizing (from steps 1-6 above)

- Standard number of VM cores = 4 (hyperthreading used, 2 effective virtual cores)
- Standard VM memory = 64 GB
- Preferred maximum node utilization = 80%
- Average application memory footprint = 2 GB
- Number of application instances = 1500

Subscription calculations

- Effective node memory capacity
  - = 80% preferred maximum node utilization \* 64 GB standard VM memory
  - = 51 GB
- Total memory utilization
  - = 1500 application instances \* 2 GB average application memory footprint
  - = 3000 GB
- Nodes required to cover utilization
  - = 3000 GB total memory utilization / 51 GB effective node memory capacity
  - = 59 nodes
- Total cores
  - = 59 nodes required \* 2 cores per node
  - = 118 total cores
- Total subscriptions
  - = 118 total cores / 2 cores per subscription
  - = 59 subscriptions

In this example, 59 2-core OpenShift Container Platform subscriptions would be needed.

**Note:** OpenShift supports many scalability, overcommitment, idling, and resource quota/limiting features. The calculations above are guidelines, and you may be able to tune your actual environment for better resource use and/or smaller total environment size.

### Red Hat JBoss Middleware integration

#### Portability

Red Hat Middleware subscriptions not specifically designed for OpenShift may be used in OpenShift environments or across OpenShift and non-OpenShift environments.

If you have existing Red Hat Middleware subscriptions, you can use them in OpenShift without having to purchase OpenShift-specific subscriptions. If you purchase OpenShift-specific Red Hat Middleware subscriptions, you may use them outside of OpenShift. All cases are valid with correct core or socket accounting.

For more details on Red Hat Middleware portability, refer to Section 1.5.2 of the Red Hat Global Subscription Services Appendix, Appendix 1 of the Enterprise Agreement, available at [redhat.com/en/about/licenses](https://redhat.com/en/about/licenses).

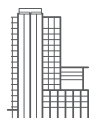
#### Partial coverage

You are not required to provide middleware subscription coverage for an entire OpenShift Container Platform environment. Platform administrators can work to ensure that the middleware workload runs only on the correct, subscribed and entitled hosts inside your OpenShift environment.

#### Developer access

OpenShift does not have a developer access model for Red Hat Middleware products. Customers who wish to use Red Hat Middleware products on OpenShift must purchase subscriptions, regardless of whether the use is for development, test, or production environments.

#### About Red Hat



Red Hat is the world's leading provider of open source software solutions, using a community-powered approach to provide reliable and high-performing cloud, Linux, middleware, storage, and virtualization technologies. Red Hat also offers award-winning support, training, and consulting services. As a connective hub in a global network of enterprises, partners, and open source communities, Red Hat helps create relevant, innovative technologies that liberate resources for growth and prepare customers for the future of IT.



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