

*Comprehensive, hands-on training that solves real-world problems*

# **Red Hat JBoss Application Administration**

**Student Manual**

# Introduction

## JBoss Application Administration

*JBoss Application Administration* focuses on installing and configuring JBoss Enterprise Application Platform 8.0 (EAP8). This hands-on class covers the real-world tasks that a system administrator must know to deploy and manage applications on JBoss EAP.

### Goals

- Students will learn to implement and configure EAP8 both in the domain standalone and managed, as well as using the web management console, the Command Line Interface (CLI), and customizing the configuration files.

### Recipients

- System administrators who are not familiar with JBoss or who have experience with EAP 6 or EAP7

### Previous requirements

Students must meet one or more of the following prerequisites:

- Basic experience in administering systems that work with the systems Windows, UNIX or Linux operating systems
- Knowledge of hardware and networks.
- No prior knowledge of Java™, scripting, or JBoss Developer Studio is required.

# CHAPTER 1

## RED HAT JBOSS ENTERPRISE APPLICATION PLATFORM: ARCHITECTURE AND FUNCTIONS

<b>Meta</b>	<b>Describe the architecture and features of Red Hat JBoss Enterprise Application Platform.</b>
<b>Goals</b>	<ul style="list-style-type: none"><li>• <b>Describe the architecture and features of JBoss EAP.</b></li><li>• <b>Describe the available installation methods and how to install JBoss EAP.</b></li><li>• <b>Describe the architecture of extensions, subsystems, modules and profiles.</b></li><li>• <b>Describe the management options available for JBoss EAP.</b></li></ul>
<b>sections</b>	<ul style="list-style-type: none"><li>• <b>JBoss EAP Architecture Exploration (and quiz)</b></li><li>• <b>Installation of JBoss EAP (and guided exercise)</b></li><li>• <b>Understanding extensions, subsystems and profiles (and questionnaire)</b></li><li>• <b>JBoss EAP administration (and guided exercise)</b></li></ul>
<b>Laboratory work</b>	<b>• Red Hat JBoss EAP architecture and features</b>

# Exploring the JBoss EAP architecture

## Goals

After completing this section, you should be able to do the following:

- Describe the architecture and features of JBoss EAP.
- Describe the relationship between JBoss EAP 8 and Jakarta EE 10
- Describe the relationship between JBoss EAP 8 and Wildfly
- Describe what changed in JBoss EAP 8, compared to JBoss EAP 7

## What is JBoss EAP?

Red Hat JBoss Enterprise Application Platform 8, JBoss EAP 8, or simply EAP 8, is an *application server* that serves as a *middleware platform*, providing the environment and infrastructure required to host and manage Jakarta EE applications.

EAP 8 is developed in open standards, based on open source software Wildfly, and offers the following features:

- Provides a reliable, efficient, lightweight, and compatible infrastructure to deploy Applications.
- Provides a modular structure that allows service enablement, only when required. This improves performance, provides security benefits, and reduces startup and reboot times.
- Web-based management console and management command line interface (CLI) eliminate the need to edit XML configuration files, and provide the ability to script and automate tasks.
- It is full Jakarta Enterprise Edition 10, and web profile, certified.
- Provides centralized management of multiple server instances and physical hosts, while that a standalone server allows for a single server instance.
- Pre-configured options are also available for features such as high performance clustering, availability, messaging, and distributed caching.

JBoss EAP 8 is a cloud-ready application server. It has a very small footprint, fast startup time, and is well suited for automation. These features are critical enablers for an efficient deployment of an

application server to a cloud infrastructure. In addition, Red Hat provides other offerings to enhance EAP 8 cloud implementations:

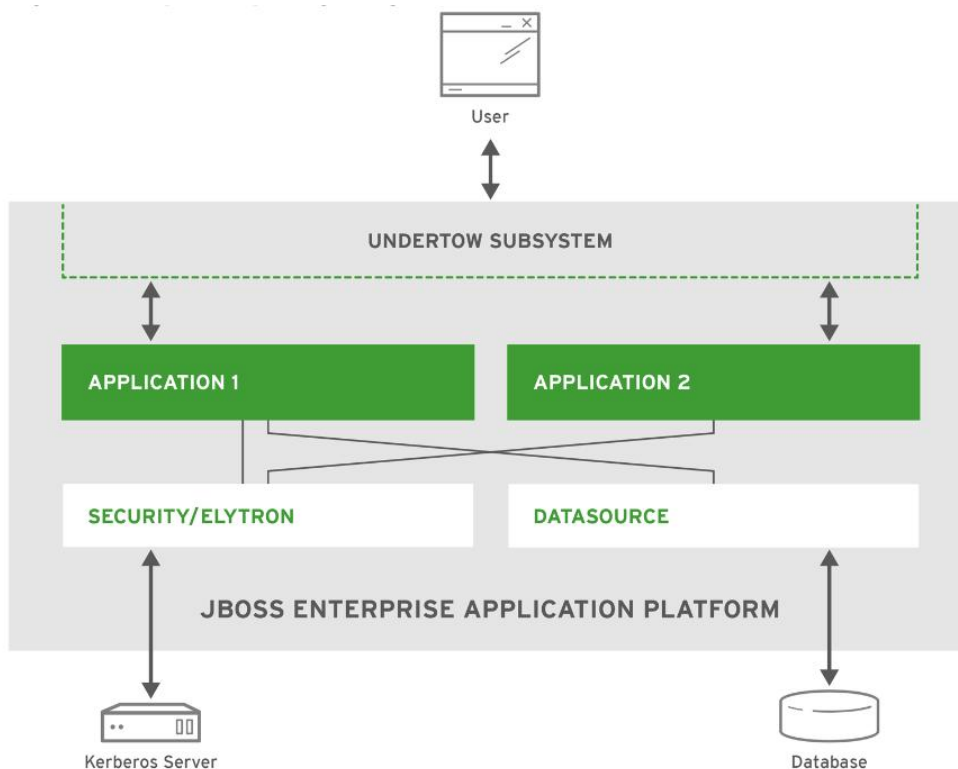
- **xPaaS container images for many JBoss middleware products, including EAP 8, as part of the OpenShift Enterprise product**
- **Container images for use with Red Hat Enterprise Linux Atomic Host and other Docker- based container hosts, provided by the Red Hat Container Image Registry**
  - **Supported virtual machine images out of the box for Amazon AWS, and other cloud platforms such as Red Hat Enterprise Linux Open Stack Platform and Microsoft Azure deployments to follow**
  - **Discovery of managed domain server instances deployed as cloud instances**
  - **Discovery of cluster server instances deployed as cloud instances or containers**

**JBoss EAP 8 is part of a growing family of Red Hat JBoss Middleware products, how to be:**

- **JBoss A-MQ: high-performance, multi-protocol messaging platform that reliably transmits information, enabling real-time integration.**
- **JBoss BPM Suite: business process management.**
- **JBoss BRMS: Business Rules Management, Enterprise Resource Optimization, and Complex Event Processing (CEP)**
- **JBoss Data Grid: NoSQL, in-memory, and distributed data storage solution**
- **JBoss Data Virtualization: data delivery and integration solution that faces to multiple data sources and allows them to be treated as a single source.**
  - **JBoss Developer Studio – Integrated development environment (IDE) for developing, testing, and deploying advanced web applications, mobile web applications, transactional business applications, and integration applications and services based on service- oriented architecture (SOA).**
- **JBoss Fuse: lightweight and flexible integration platform that enables rapid integration through the company.**

To better understand the role that EAP 8 plays within an IT infrastructure, two application scenarios are presented. The EAP 8 subsystems, to which the figures refer, will be explained later in this student guide. There is no need to understand what the Undertow or Infinispan subsystems are to understand those example scenarios.

The following figure shows an example of how EAP 8 integrates into a simple environment:



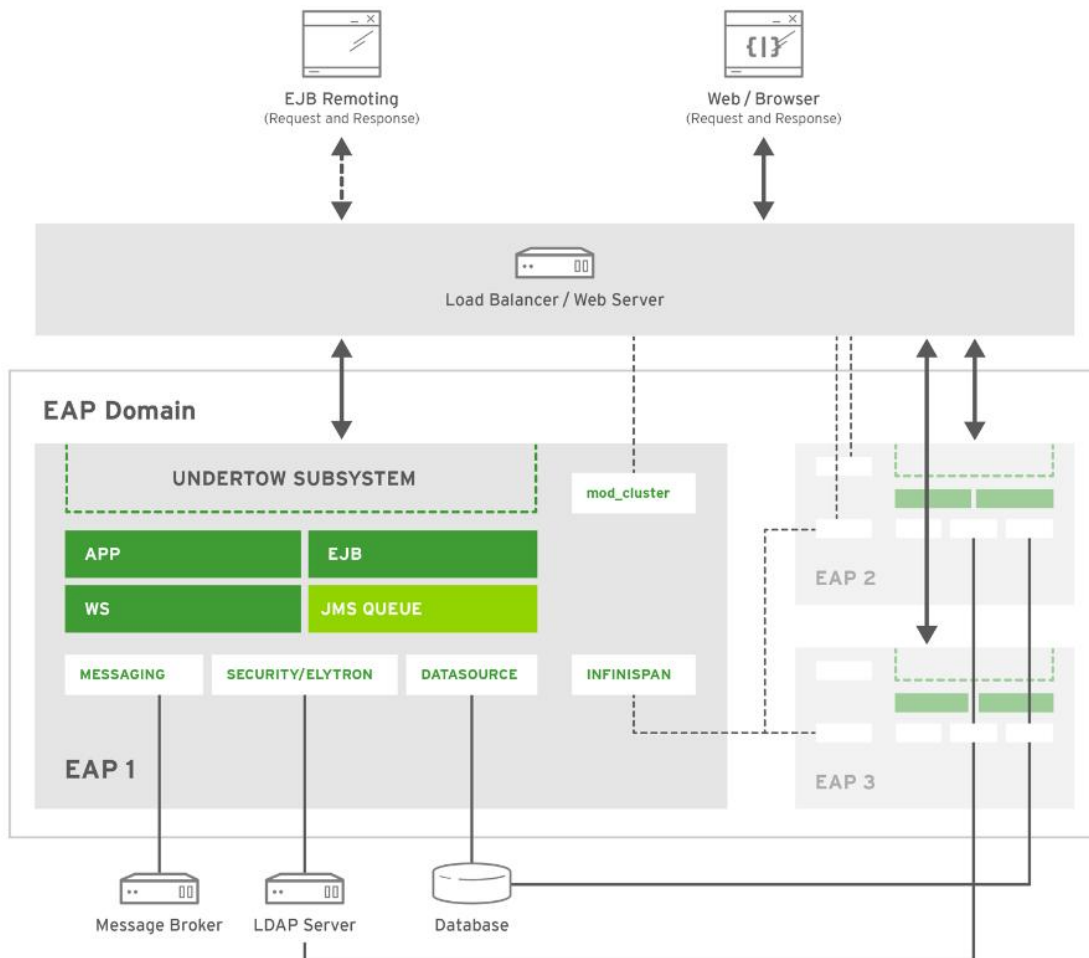
**Figure 1.1:**  
*A single EAP 8 server instance*

In this first example, the EAP 8 server instance has two applications deployed to it. It is also configured to connect to a Kerberos server and database.

JBoss EAP uses the elytron (security) subsystem to connect to the Kerberos server and expose the server to the two deployed applications.

The JBoss EAP instance handles network requests and directs these requests to the appropriate application. Applications use the APIs exposed by JBoss EAP to connect to the Kerberos server and database, and perform their implemented business logic.

The following figure presents a more complex environment:



**Figure 1.2:**  
A cluster of three EAP 8 server instances

In this example, the administrator configured each instance to use `mod_cluster` and `infinispan` session replication to provide high availability (HA) support for applications. Each instance includes the following components:

- A web application
- A web service
- A deployed enterprise bean
- A database connection that was established with the `datasources` subsystem
- A connection with the LDAP server that was established with the `elytron` (security) subsystem

The diagram displays the following configurations associated with a complex JBoss EAP setup:

- EAP 8 has a `messaging-activemq` subsystem that is configured with a Jakarta Messaging queue that connects to an external message broker.
- The external message broker is shared among all running JBoss EAP instances.
- All inbound requests go through the load balancer.
  - Depending on the configured load-balancing algorithm and the information provided by each JBoss EAP instance, the load balancer directs the requests to the appropriate JBoss EAP instance.
- Each JBoss EAP instance uses the `undertow` subsystem to direct the requests to the appropriate application.
- Each application uses the APIs exposed by JBoss EAP to connect to the database and Kerberos server.
- After an application performs its work, the `undertow` subsystem to send a response to the requester.

#### Note

The `infinispan` subsystem propagates non-persisted information, such as session information, among the JBoss EAP instances.

## Package Namespace Change for JBoss EAP 8.0

This section provides additional information for the package namespace changes in JBoss EAP 8.0. JBoss EAP 8.0 provides full support for Jakarta EE 10 and many other implementations of the Jakarta EE 10 APIs. An important change supported by Jakarta EE 10 for JBoss EAP 8.0 is the package namespace change.

### javax to jakarta Namespace change

A key difference between Jakarta EE 8 and EE 10 is the renaming of the EE API Java packages from `javax.*` to `jakarta.*`. This follows the move of Java EE to the Eclipse Foundation and the establishment of Jakarta EE.

Adapting to this namespace change is the biggest task of migrating an application from JBoss EAP 7 to JBoss EAP 8. To migrate applications to Jakarta EE 10, you must complete the following steps:

- Update any import statements or other source code uses of EE API classes from the `javax` package to the `jakarta` package.
- Update the names of any EE-specified system properties or other configuration properties that begin with `javax` to begin with `jakarta`.
- For any application-provided implementations of EE interfaces or abstract classes that are bootstrapped using the `java.util.ServiceLoader` mechanism, change the name of the resource that identifies the implementation class from `META-INF/services/javax.[rest_of_name]` to `META-INF/services/jakarta.[rest_of_name]`.

#### Note

The Red Hat Migration Toolkit can assist in updating the namespaces in the application source code. In cases where source code migration is not an option, the Open Source [Eclipse Transformer](#) project provides bytecode transformation tooling to transform existing Java archives from the `javax` namespace to the `jakarta` namespace.

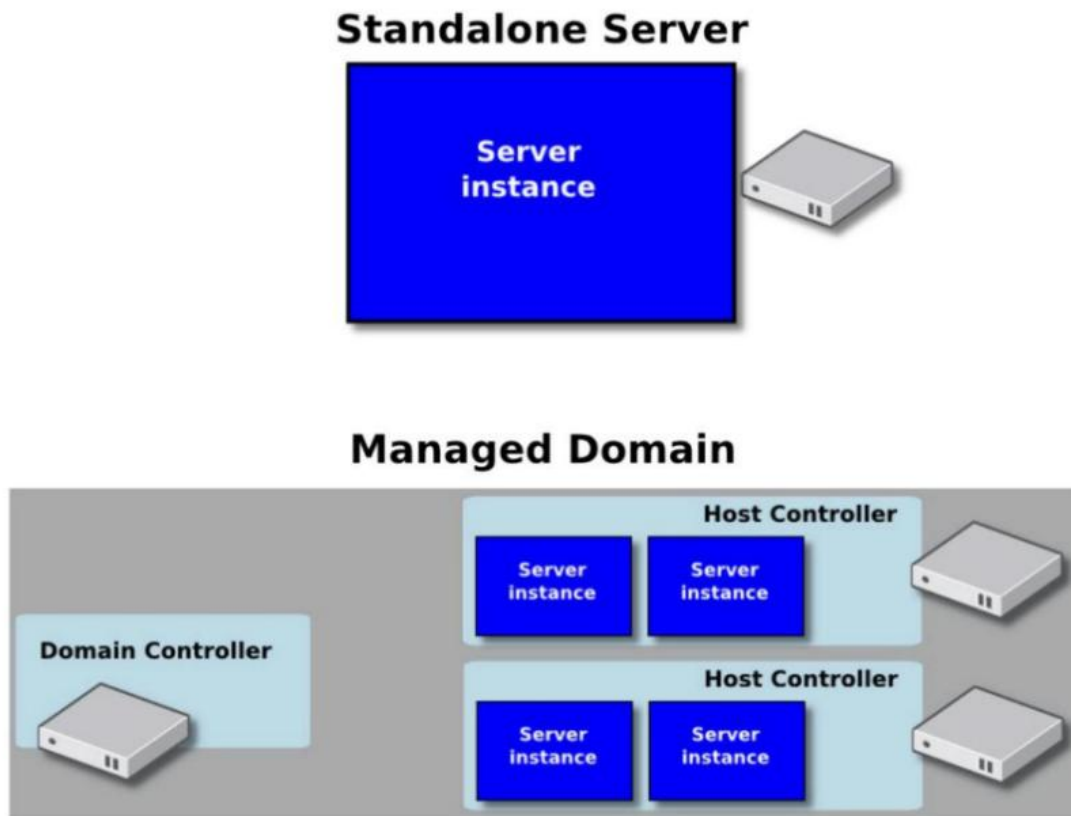
#### Note



This change does not affect javax packages that are part of Java SE.

## Standalone Server vs. Managed Domain

A JBoss EAP 8 installation can run in two operating modes: standalone server and managed domain, as illustrated in the following figure:



*Figure 1.4:*  
*JBoss EAP 8 Standalone Server vs. Managed Domain Operating Modes*

### Standalone Server

Versions of JBoss EAP up to version 5 had a single operating mode, which is similar to what EAP 8 calls the standalone server operating mode.

EAP 6 referred to this mode of operation as the standalone mode. If centralized management capabilities are not required, EAP 8 can be provisioned as a standalone server.

Standalone server mode consists of a single server with a single configuration file called standalone.xml.

### Managed Domain For

the ability to manage multiple server instances, possibly deployed on multiple

hosts, from a centralized location, EAP can be provisioned in a managed domain. This is the same mode of operation that EAP 6 referred to as domain mode.

A domain controller process functions as a centralized point of management control that communicates with the various host controllers in the managed domain. All hosts share the same management policy, and the domain controller ensures that each server instance is configured according to that policy.

Each host in the domain has a host controller. Only one of the host controllers in the domain is considered the domain controller. That is, the domain controller is also a host controller.

The domain controller is also known as the master, while the other host controllers in the domain are known as the slaves. Nothing prevents a domain controller from having its own server instances, but having it as a dedicated management host controller, as the figure above suggests, is common practice.

A managed domain can have server instances that use different configurations. This is possible because the managed domain configuration defines a number of different profiles, and groups of server instances are assigned to a single profile.

## use

The term *profile*, when referring to an EAP 8 managed domain configuration, is not related to the Jakarta EE specification profiles.

The managed domain is configured in a file named `domain.xml`, which exists only on the domain controller. Each host controller, including the domain controller, also has a specific configuration, which is found in a file named `host.xml`. When a host starts, the settings in the `host.xml` file are merged with the settings in the `domain.xml` file on the domain controller.

The standalone server and domain managed modes of operation differ only in their centralized management capabilities. All EAP features, such as security, transactions, messaging, clustering, high availability, and other Jakarta EE technologies, are available to server instances running in standalone server or managed domain operating modes.

## Host vs. server

A host in EAP 8 represents a single machine, from an OS perspective, running application server instances. For EAP, it makes no difference if it is a virtual or physical machine.

When implementing EAP as a managed domain, each host is managed by a single host controller and contains zero or more server instances. The host controller acts as a management agent, relaying commands sent by the domain controller to the

**affected server instances.**

**Server instances and host controllers run as their own OS processes, each within a dedicated Java Virtual Machine (JVM). Each host in a managed domain also runs a process controller process in another dedicated JVM. The process controller is the OS process that starts new processes for host controllers and server instances.**

**The domain controller's JVM runs the management console and management API, so all administrative requests are sent to the domain controller. It passes administrative commands to the specific host controllers that manage the affected server instances.**

**When comparing server instances in a managed domain with stand-alone servers, the former runs only the application code, not the management services. Standalone servers run the management console and management API on the same JVM that runs applications. This is the same as with previous versions of JBoss EAP, where a single running instance of EAP represented a single server.**

# Quiz: Use Cases for Standalone Server vs. Managed Domain

Choose the correct answer to the following questions:

1. A developer uses his computer to develop Jakarta EE applications with JBoss Developer Studio and tests his code on the same computer. What would be the most appropriate operating mode for EAP 8? (Choose only one option).

- a. standalone server
- b. managed domain
- c. integrated server
- d. EAP 8 cannot be integrated into current versions of JBDS

2. You must implement a two-node cluster for the purposes of failover. mistake. What operating modes can be implemented with this requirement? (Choose two options.)

- a. standalone server
- b. managed domain
- c. clustered domain
- d. integrated server

It is.  
Stand-alone server together with external clustering middleware, for example, the Red Hat RHEL8 High Availability Plug-in

3. The server topology requires EAP to operate in a cluster of four computers, each with an EAP server instance, and each server with identical configurations. Which EAP 8 operating mode would provide the easiest management? (Choose only one option).

- a. standalone server
- b. managed domain
- c. clustered domain
- d. integrated server

It is.  
Both standalone server and managed domain require manual duplication of configuration between server instances

4. Three Jakarta EE applications are deployed on one EAP server instance. Which EAP 8 operating mode would provide the easiest and lightest installation? (Choose only one option).

- a. standalone server
- b. managed domain
- c. clustered domain
- d. integrated server

There is no difference between the standalone server and the managed domain in this scenery

5. A single Java EE application is deployed to an EAP server instance. What EAP 8 operating mode can evolve in a cluster with two server instances? (Choose two options.)

- a. standalone server
- b. managed domain
- c. clustered domain
- d. integrated server

6. You have 12 EAP servers that need to be configured identically. Which EAP 8 operating mode would allow for the fastest install time for this scenario? (Choose only one option).

- a. standalone server
- b. managed domain
- c. clustered domain
- d. integrated server

It is. Both standalone server and managed domain would be the same

# Solution

Choose the correct answer to the following questions:

1. A developer uses his computer to develop Jakarta EE applications with JBoss Developer Studio and tests his code on the same computer. What would be the most appropriate operating mode for EAP 8? (Choose only one option).

- a. standalone server
- b. managed domain
- c. integrated server
- d. EAP 7 cannot be integrated into current versions of JBDS

2. You must implement a two-node cluster for the purposes of failover. mistake. What operating modes can be implemented with this requirement? (Choose two options.)

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- b. managed domain
- c. clustered domain
- d. integrated server

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Stand-alone server together with external clustering middleware, for example, the Red Hat RHEL7 High Availability Plug-in

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- b. managed domain
- c. clustered domain
- d. integrated server
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It is.

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- b. managed domain
- c. clustered domain
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- c. clustered domain
- d. integrated server

It is. Both standalone server and managed domain would be the same