

# Managing Multi-Container Applications Using docker-compose

## WHAT?

docker-compose enables you to define and manage a multi-container application. The tool simplifies the deployment of such an application stack by using an easy-to-use definition file.

## WHY?

The article describes how to create a multi-container application by using docker-compose.

## EFFORT

It takes approx. 20 minutes to read the article.

## GOAL

You will be able to create your own container-based application stack.

## REQUIREMENTS

Application container images or the associated source files that are used to build the application.

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# 1 Tools involved in management of multi-container applications

`docker-compose` is the tool responsible for creating the multi-container application. By default, it uses Docker, which is not present on SLE Micro. To bypass Docker and use Podman instead, the `podman-docker` script is used. Therefore, you do not need to change your existing scripts from using Docker to Podman. The following sections provide detailed descriptions of the tools.

## 1.1 About Podman

Podman is a short name for Pod Manager Tool. It is a daemonless container engine that enables you to run and deploy applications using containers and container images. Podman provides a command-line interface to manage containers.

As Podman does not have a daemon, it provides integration with `systemd`. This makes it possible to control containers via `systemd` units. You can create these units for existing containers as well as generate units that can start containers if they do not exist in the system. Podman can run `systemd` inside containers.

Podman enables you to organize your containers into pods. Pods share the same network interface and resources. A typical use case for organizing a group of containers into a pod is a container that runs a database and a container with a client that accesses the database.

### 1.1.1 Installation of Podman

Podman is included in SLE Micro by default. However, if Podman is missing, you can install it as described below:

1. Run the command:

```
> sudo transactional-update pkg install podman
```

2. Restart your system to boot into the new snapshot.

## 1.2 About podman-docker

`podman-docker` is a bash script that changes any **docker** command you run into a corresponding **podman** command with the same passed arguments. Therefore, you can use all your Docker scripts without any modifications.

### 1.2.1 Installation of podman-docker

The `podman-docker` is not installed on SLE Micro by default. To install it, proceed as follows:

1. Install the package `podman-docker` by running:

```
transactional-update pkg install podman-docker
```

2. Reboot the system to switch to the latest snapshot.

## 1.3 About docker-compose

`docker-compose` is a tool for managing multi-container applications. `docker-compose` enables you to have multiple isolated environments on a single host, while it supports using variables between environments. Using `docker-compose`, you can recreate only those containers that have changed without destroying the whole multi-container application.



**Important:** **docker** replaced with the **podman** command

On SLE Micro, the `podman-docker` script is used to call Podman whenever you run `docker-compose`, as Docker is not present on SLE Micro by default.

### 1.3.1 Installing docker-compose

If `docker-compose` is not present on your system, you can install it by following the steps:

1. Run the command:

```
> sudo transactional-update pkg install docker-compose
```

2. After the installation is complete, reboot your system to boot into the new snapshot.

## 2 Creating a multi-container application

To create a multi-container application, proceed as follows:

1. Create the configuration file `compose.yml`. For details, refer to [Section 2.1, “Creating compose.yml”](#).
2. Prepare the required directory structure. We recommend placing the `compose.yml` file at the top of your working directory.
3. If needed, write your own container files specific to services used by the containerized application. For example, to deploy a Go application, create a container file for the Go application with the required configuration and dependencies.  
We recommend creating a subdirectory per service in the working directory and placing the service-specific files there.
4. Deploy the multi-container application. For details, refer to [Section 2.2, “Deploying multi-container applications”](#).

### 2.1 Creating `compose.yml`

To create the multi-container application, you need to create a `compose.yml` file preferably placed in the working directory. It can be a single file, or you can use a more granular approach by utilizing fragments and extensions. Multiple docker-compose files can be also merged to define the whole application model.

The file `compose.yml` defines your application. You can include the following parts.

#### service

A service is a computing component of the application. For details regarding the definition, refer to [Section 2.1.1, “Services definition”](#).

#### networks

You can use the `network` statement to define custom networks and assign particular services to custom networks. For details, refer to [Section 2.1.2, “Networks definition”](#).

## volumes

A directory managed by the container engine where services store and share data.

## Environment variables

You may also need to use a list of environment variables that will be passed to your services. For details, refer to the [environment variables reference \(https://docs.docker.com/compose/environment-variables/\)](https://docs.docker.com/compose/environment-variables/).

## configs

All configuration files required by the services must be declared in the `configs` section. For details, refer to the [configs definition \(https://docs.docker.com/compose/compose-file/08-configs/\)](https://docs.docker.com/compose/compose-file/08-configs/).

### 2.1.1 Services definition

When defining services, you either need to specify a container image to use, or provide source files to build the service from them.

To create the service container from an image, use the `image` statement:

```
services:
  db:
    image: database
```

Podman checks if the image name declared in the `compose.yml` file is available in the local container storage. If it is not, Podman pulls the image from one of the configured registries.

To build a service from source files, provide the source files and create a container file, both in the same directory. In the `compose.yml` file then use the `build` statement:

```
services:
  db:
    build: PATH_TO_SOURCE_FILES
```

If a particular service must be started after another, you can use the `depends_on` statement:

```
services:
  db:
    image: database
    depends_on:
      system:
        condition: SERVICE_CONDITION
```

The `SERVICE_CONDITION` can be one of the following: `service_started`, `service_healthy` or `service_completed_successfully`.

For more information regarding the `services` definition, refer to the [services specification \(https://docs.docker.com/compose/compose-file/05-services/\)](https://docs.docker.com/compose/compose-file/05-services/).

### 2.1.2 Networks definition

By default, docker-compose creates a default network, and each container in the application stack is included in the network. The default network does not have to be declared in the `compose.yml` file as docker-compose creates it automatically.

You can also define custom networks and assign particular services to them. For example, to create two networks, `network1` and `network2`, add the following snippet:

```
networks:
  network1:
    # Use a custom driver
    driver: custom-driver-1
  network2:
    # Use a custom driver and name the network
    driver: custom-driver-2
    name: custom_network
```

You can also use an existing network. In this case, mark the network as external:

```
networks:
  network1:
    name: network1
    external: true
```

For a complete `networks` specification, refer to the [networks specification \(https://docs.docker.com/compose/compose-file/06-networks/\)](https://docs.docker.com/compose/compose-file/06-networks/).

### 2.1.3 Example of `compose.yml`

The following example of `compose.yml` defines an application stack that uses the Prometheus monitoring system and the Grafana analytics system.

```
services:
  prometheus:
    image: prom/prometheus
    container_name: prometheus
```

```

command:
  - '--config.file=/etc/prometheus/prometheus.yml'
ports:
  - 9090:9090
restart: unless-stopped
volumes:
  - ./prometheus:/etc/prometheus
  - prom_data:/prometheus
grafana:
  image: grafana/grafana
  container_name: grafana
  ports:
    - 3000:3000
  restart: unless-stopped
  environment:
    - GF_SECURITY_ADMIN_USER=admin
    - GF_SECURITY_ADMIN_PASSWORD=grafana
  volumes:
    - ./grafana:/etc/grafana/provisioning/datasources
volumes:
  prom_data:

```

The project structure in this example must look as follows:

```

.
├── compose.yaml
├── grafana
│   └── datasource.yml
├── prometheus
│   └── prometheus.yml
└── README.md

```

## 2.2 Deploying multi-container applications

After you create the proper directory structure and the `compose.yml` file, you can deploy the multi-container application:

1. Verify that the container you intend to run doesn't already exist:

```
> podman ps --all
```

If needed, remove the particular container:

```
> podman rm -f CONTAINER_ID
```



2. Start the multi-container application by running the following command from the directory where `compose.yml` is located:

```
> docker compose up -d
```

`docker-compose` creates a separate network for the multi-container application.

3. You can verify that containers are running and ports are mapped by listing running containers:

```
> podman ps
```

### 3 Management of a multi-container application

After you create your multi-container application, you can use the `docker-compose` command to perform management operations. The command syntax is the following:

```
> docker compose [OPTIONS]
    COMMAND
```

Run the command from the same directory where the `compose.yml` file of the multi-container application you want to manage is located. Alternatively, provide a path to the `compose.yml` file using the `-f, --file` option. For example, to exit and remove the multi-container application:

```
> docker compose -f ./test/compose.yml down
```

Other useful commands:

#### images

To list all images used by the containers in the multi-container application.

```
> docker compose images
```

#### pause

To pause all containers.

```
> docker compose pause [SERVICE]
```

#### ps

To list containers in the multi-container application.

```
> docker compose ps
```

**rm**

To remove stopped containers.

```
> docker compose rm
```

**start/stop**

To start or stop containers.

```
> docker compose stop [SERVICE]
```

For a complete list of options and commands, run:

```
> docker-compose --help
```

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