Pump up the Volumes: Data in Docker

Part 6 of Learn Enough Docker to be Useful

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This article is about using data with Docker. In it, we'll focus on Docker volumes. Check out the previous articles in the series if you haven't yet. We covered Docker concepts, the ecosystem, Dockerfiles, slimming down images, and popular commands.

Spices

Pushing the food metaphor running through these articles to the breaking point, let's compare data in Docker to spices. Just as there are many spices in the world, there are many ways to save data with Docker.

Quick FYI: this guide is current for Docker Engine Version 18.09.1 and API version 1.39.

Data in Docker can either be temporary or persistent. Let's check out temporary data first.

Temporary Data

Data can be kept temporarily inside a Docker container in two ways.

By default, files created by an application inside a container are stored in the writable layer of the container. You don't have to set anything up. This is the quick and dirty way. Just save a file and go about your business. However, when you container ceases to exist, so will your data.

You have another option if you want better performance for saving temporary data with Docker. If you don't need your data to persist beyond the life of the container, a *tmpfs* mount is a temporary mount that uses the host's memory. A tmpfs mount has the benefit of faster read and write operations.

Many times you will want your data to exist even after the container is long gone. You need to persist your data.

Persistent Data

There are two ways to persist data beyond the life of the container. One way is to *bind mount* a file system to the container. With a bind mount, processes outside Docker also can modify the data.

From the Docker Docs

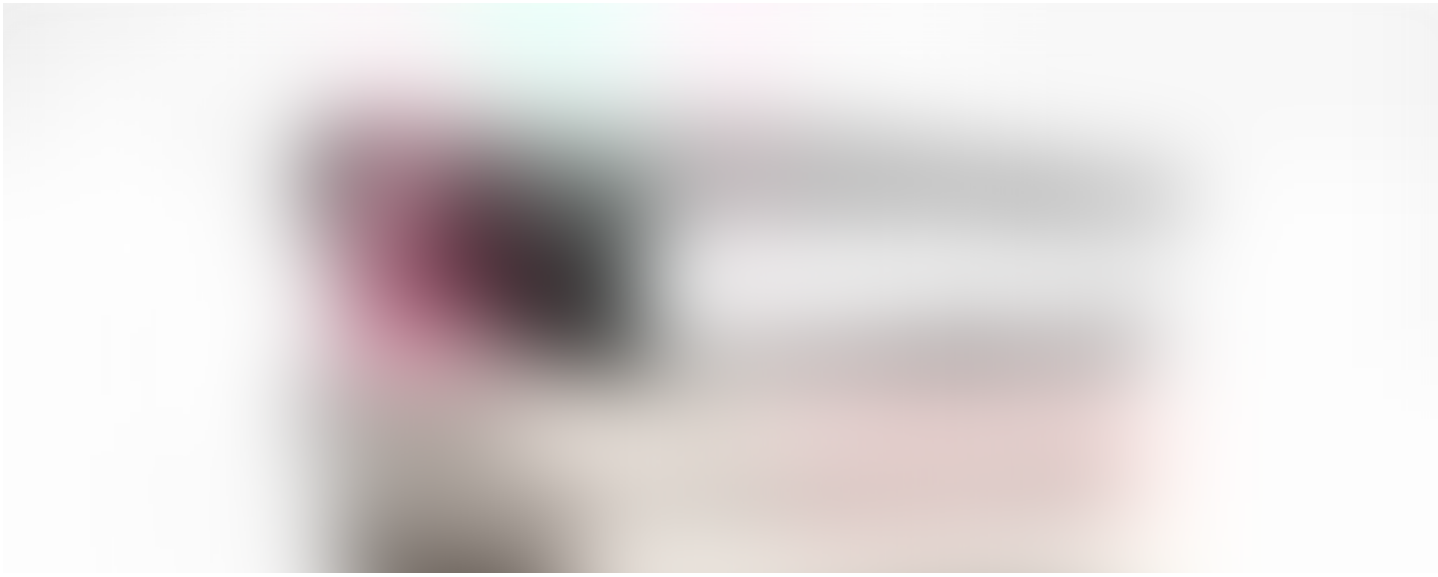
Bind mounts are difficult to back up, migrate, or share with other Containers. Volumes are a better way to persist data.

Volumes

A Volume is a a file system that lives on a host machine outside of any container. Volumes are created and managed by Docker. Volumes are:

- persistent
- free-floating filesystems, separate from any one container
- sharable with other containers
- efficient for input and output
- able to be hosted on remote cloud providers
- encryptable
- nameable
- able to have their content pre-populated by a container
- handy for testing

That's a lot of useful functionality! Now let's look at how you make a Volume.



Volumes

Creating Volumes

Volumes can be created via a Dockerfile or an API request.

Here's a Dockerfile instruction that creates a volume at run time:

```
VOLUME /my_volume
```

Then, when the container is created, Docker will create the volume with any data that already exists at the specified location. Note that if you create a volume using a Dockerfile, you still need to declare the mountpoint for the volume at run time.

You can also create a volume in a Dockerfile using JSON array formatting. See this earlier article in this series for more on Dockerfiles.

Volumes also can be instantiated at run time from the command line.

Volume CLI Commands

Create

You can create a stand-alone volume with `docker volume create —-name my_volume`.

Inspect

List Docker volumes with `docker volume ls`.

Volumes can be inspected with `docker volume inspect my_volume`.

Remove

Then you can delete the volume with `docker volume rm my_volume`.

Dangling volumes are volumes not used by a container. You can remove all dangling volumes with `docker volume prune`. Docker will warn you and ask for confirmation before deletion.

If the volume is associated with any containers, you cannot remove it until the containers are deleted. Even then, Docker sometimes doesn't realize that the containers are gone. If this occurs, you can use `docker system prune` to clean up all your Docker resources. Then you should should be able to delete the volume.

Where your data might be stored

Working with `--mount` vs. `--volume`

You will often use flags to refer to your volumes. For example, to create a volume at the same time you create a container use the following:

```
docker container run --mount source=my_volume, target=/container/path/for/volume
my_image
```

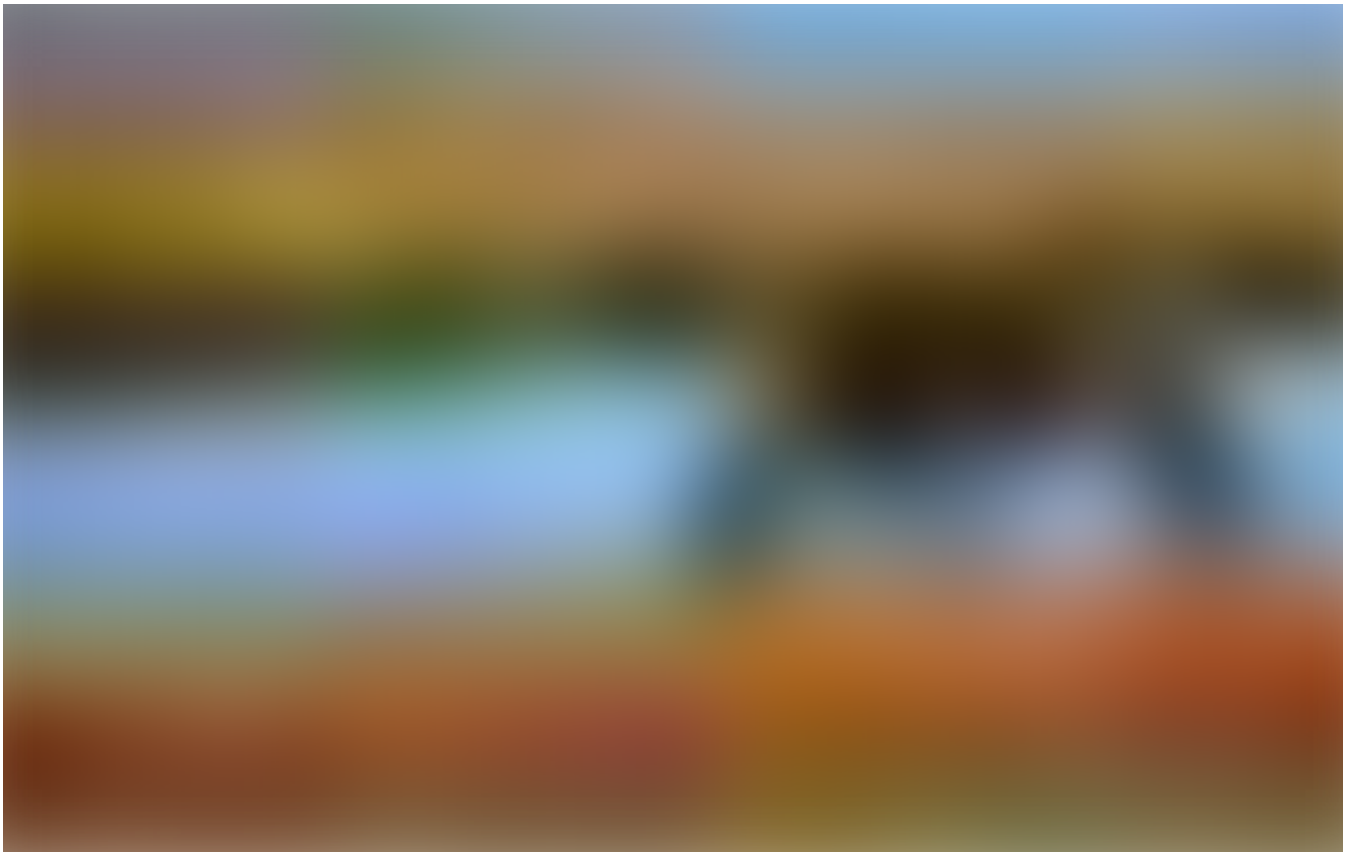
In the old days (i.e. pre-2017) 😉the `--volume` flag was popular. Originally, the `-v` or `--volume` flag was used for standalone containers and the `--mount` flag was used with Docker Swarms. However, beginning with Docker 17.06, you can use `--mount` in all cases.

The syntax for `--mount` is a bit more verbose, but it's preferred over `--volume` for several reasons. `--mount` is the only way you can work with services or specify volume

driver options. It's also simpler to use.

You'll see a lot of `-v`'s in existing code. Beware that the format for the options is different for `--mount` and `--volume`. You often can't just replace a `-v` in your existing code with a `--mount` and be done with it.

The biggest difference is that the `-v` syntax combines all the options together in one field, while the `--mount` syntax separates them. Let's see `--mount` in action!



Easy enough to mount

`--mount` — options are key-value pairs. Each pair is formatted like this: `key=value`, with a comma between one pair and the next. Common options:

- `type` — mount type. Options are `bind`, `volume`, or `tmpfs`. We're all about the `volume`.
- `source` — source of the mount. For named volumes, this is the name of the volume. For unnamed volumes, this option is omitted. The key can be shortened to `src`.

- `destination` — the path where the file or directory is mounted in the container. The key can be shortened to `dst` or `target`.
- `readonly` —mounts the volume as read-only. Optional. Takes no value.

Here's an example with lots of options:

```
docker run --mount
type=volume,source=volume_name,destination=/path/in/container,readon
ly my_image
```

Volumes are like spices — they make most things better.

Wrap

Recap of Key Volume Commands

- `docker volume create`
- `docker volume ls`
- `docker volume inspect`

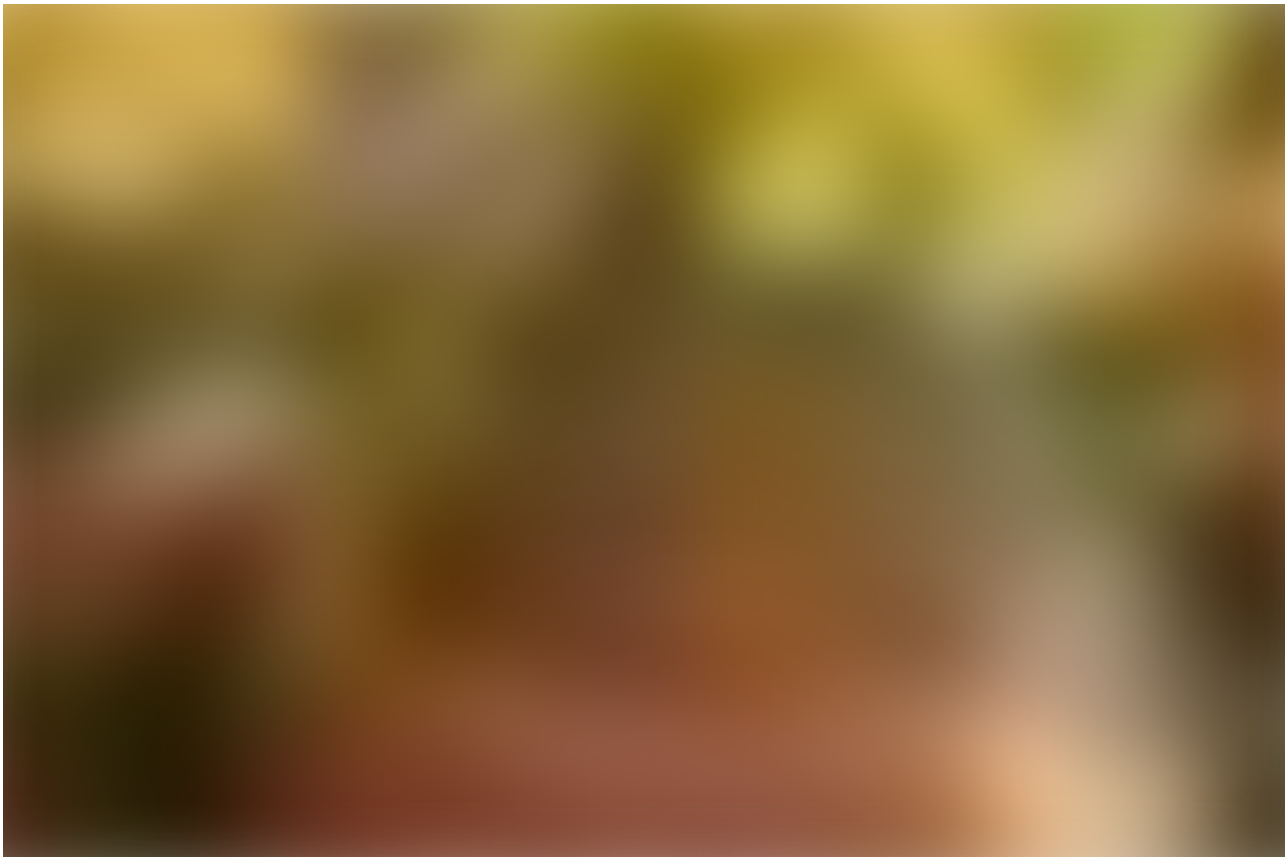
- `docker volume rm`
- `docker volume prune`

Common options for the `--mount` flag in `docker run --mount my_options my_image`:

- `type=volume`
- `source=volume_name`
- `destination=/path/in/container`
- `readonly`

. . .

Now that you've familiarized yourself with data storage in Docker let's look at possible next steps for your Docker journey.



Next steps

Update, I recently published an article on Docker security. Check it out and learn how to keep your containers safe. 😃

If you haven't read the articles in this series on Docker concepts, the Docker ecosystem, Dockerfiles, slim images, and commands, check those out, too.

If you're looking for another article on Docker concepts to help cement your understanding, check out Preethi Kasireddy's great article here.

If you want to go deeper, check out Nigel Poulton's book *Docker Deep Dive (*make sure to get the most recent version).

If you want to do a lot of building while you learn, check out James Turnbull's The Docker Book.

I hope you found this series to be a helpful intro to Docker. If you did, please share it with others on your favorite forums or social media channels so your friends can find it, too! 😃

I've written some articles on orchestrating containers with Kubernetes you can read here. I write about articles about Python, data science, AI, and other tech topics. Check them out follow me if you're into that stuff.

Thanks for reading! 👋

Thanks to Kathleen Hale.

Docker Software Development Towards Data Science Software Engineering DevOps