Section 9 - Persistent Data and Volumes

1 Persistent Data

Section Overview

- Defining the problem of persistent data
- Key concepts of containers: immutable, ephemeral
- Data Volumes
- Bind Mounts
- LAB

Container Lifetime & Persistent Data

- Containers are usually immutable and ephemeral
- immutable infrastructure: only re-deploy containers, never change
- This is the ideal scenario but what about databases or unique data?
- Docker gives us features to ensure these "separation of concerns".
  - It is known as "persistent data"
- Two ways: Volumes and Bind Mounts
  - Volumes: make special location outside of container UFS
  - Bind Mounts: link container path to host path

Containers: immutable & ephemeral (1)

- Containers are usually immutable and ephemeral =>
- immutable => Containers do not change (e.g. we usually don't update the binaries included)
- ephemeral => Containers are temporary/disposable (e.g. to use an updated version of the application we delete the old container and we re-create a new one from an updated image)
- This is not a limitation of the containers but a design goal, a best best practice.

Containers: immutable & ephemeral (2)

- This is the concept of the immutable infrastructure, where we do not change the application components once they are running. If an upgrade operation must be performed, then new container are re-created.
- The main benefits of the immutable infrastructure are:
  - Reliability
  - Consistency
  - Changes are reproducible

What about unique data?

- What about the unique data produced by an application?
  - Databases or
  - Anything else that an application will store to a file
- The containers should not contain *unique data* mixed with the application binaries.
  - This is known as separation of concerns
- Docker provides us with two solutions to preserve *unique data*:
  1. Data Volumes
  2. Bind Mounts

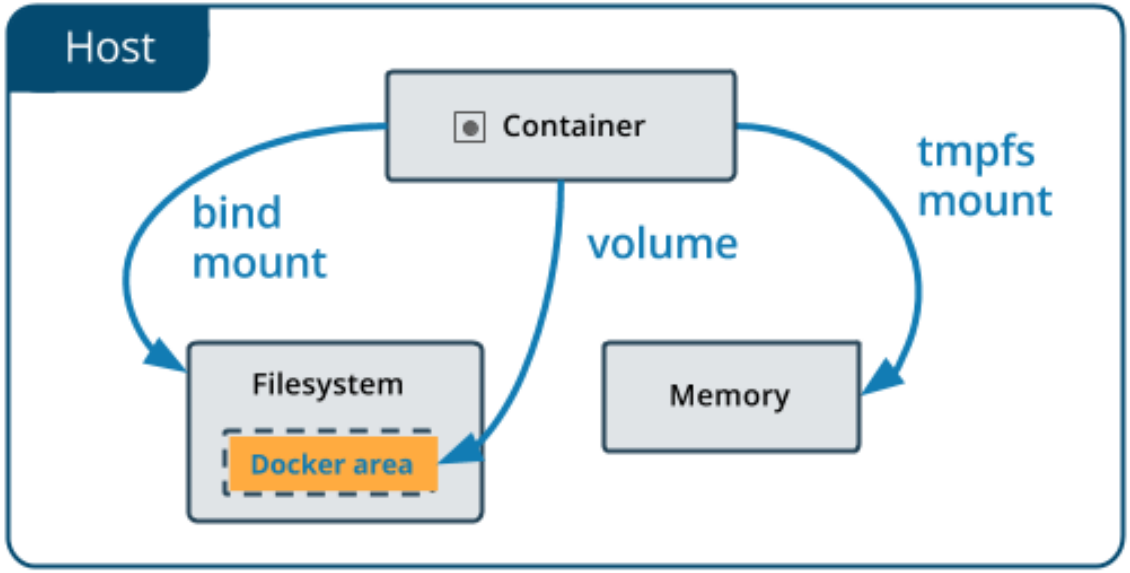
Data Volumes

- Volumes are created and managed from Docker
- Volumes are the preferred mechanism for persisting data generated by containers.
- Volumes contents exist outside the lifecycle of a given container.
- When a Docker container is destroyed, it's entire file system is destroyed too. So if we want to keep this data, it is necessary to use Docker volumes.
- The container sees it like a local file path.
- Docker volumes are attached to containers during a `docker run` command by using the `-v` option.

Bind Mounts

- A bind mount is a file or folder created by the user.
- A bind mount is a file or folder available on the Docker host filesystem, mounted into a running container.
- The main difference a *bind mount* has from a *volume* is that since it can exist anywhere on the host filesystem, processes outside of Docker can also modify it.
- Bind mounts have limited functionality compared to volumes.
- The container sees it like a local file path.
- Docker volumes are attached to containers during a `docker run` command by using the `-v` option.

Volumes


Host
Container
bind
mount
volume
tmpfs
mount
Filesystem
Docker area
Memory

Container data

- Because we stopped the container or restarted the host, it doesn't mean that the container's file changes are lost
- Only when we remove the container, the container's data are deleted.