

Docker Lab Exercise

By Satyam

Exercise 1: Getting Started with Containers

Objective: Learn how to run and inspect containers.

Run hello-world, nginx, and alpine containers.

Hello-world

docker run hello-world

```
E:\Docker>docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
17eec7bbc9d7: Pull complete
Digest: sha256:a0dfb02aac212703bfc339d77d47ec32c8706ff250850ecc0e19c8737b18567
Status: Downloaded newer image for hello-world:latest
```

Hello from Docker!

This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:

1. The Docker client contacted the Docker daemon.
2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
(amd64)
3. The Docker daemon created a new container from that image which runs the executable that produces the output you are currently reading.
4. The Docker daemon streamed that output to the Docker client, which sent it to your terminal.

To try something more ambitious, you can run an Ubuntu container with:

```
$ docker run -it ubuntu bash
```

Share images, automate workflows, and more with a free Docker ID:

<https://hub.docker.com/>

For more examples and ideas, visit:

<https://docs.docker.com/get-started/>

```
E:\Docker>docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
17eec7bbc9d7: Pull complete
Digest: sha256:a0dfb02aac212703bfc339d77d47ec32c8706ff250850ecc0e19c8737b18567
Status: Downloaded newer image for hello-world:latest
```

Hello from Docker!

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2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
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3. The Docker daemon created a new container from that image which runs the executable that produces the output you are currently reading.
4. The Docker daemon streamed that output to the Docker client, which sent it to your terminal.

docker run -p 8080:80 nginx

```
E:\Docker>docker run -p 8080:80 nginx
Unable to find image 'nginx:latest' locally
latest: Pulling from library/nginx
c3741b707ce6: Pull complete
a2da0c0f2353: Pull complete
14e422fd20a0: Pull complete
14a859b5ba24: Pull complete
b1badc6e5066: Pull complete
716cdf61af59: Pull complete
e5d9bb0b85cc: Pull complete
Digest: sha256:33e0bbc7ca9ecf108140af6288c7c9d1ecc77548cbfd3952fd8466a75edefe57
Status: Downloaded newer image for nginx:latest
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2025/08/22 16:27:38 [notice] 1#1: using the "epoll" event method
2025/08/22 16:27:38 [notice] 1#1: nginx/1.29.1
2025/08/22 16:27:38 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14+deb12u1)
2025/08/22 16:27:38 [notice] 1#1: OS: Linux 6.6.87.2-microsoft-standard-WSL2
2025/08/22 16:27:38 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2025/08/22 16:27:38 [notice] 1#1: start worker processes
2025/08/22 16:27:38 [notice] 1#1: start worker process 29
2025/08/22 16:27:38 [notice] 1#1: start worker process 30
2025/08/22 16:27:38 [notice] 1#1: start worker process 31
2025/08/22 16:27:38 [notice] 1#1: start worker process 32
2025/08/22 16:27:38 [notice] 1#1: start worker process 33
2025/08/22 16:27:38 [notice] 1#1: start worker process 34
2025/08/22 16:27:38 [notice] 1#1: start worker process 35
2025/08/22 16:27:38 [notice] 1#1: start worker process 36
```

```
E:\Docker>docker run -p 8080:80 nginx
Unable to find image 'nginx:latest' locally
latest: Pulling from library/nginx
c3741b707ce6: Pull complete
a2da0c0f2353: Pull complete
14e422fd20a0: Pull complete
14a859b5ba24: Pull complete
b1badc6e5066: Pull complete
716cdf61af59: Pull complete
e5d9bb0b85cc: Pull complete
Digest: sha256:33e0bbc7ca9ecf108140af6288c7c9d1ecc77548cbfd3952fd8466a75edefe57
Status: Downloaded newer image for nginx:latest
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
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2025/08/22 16:27:38 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2025/08/22 16:27:38 [notice] 1#1: start worker processes
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2025/08/22 16:27:38 [notice] 1#1: start worker process 32
2025/08/22 16:27:38 [notice] 1#1: start worker process 33
2025/08/22 16:27:38 [notice] 1#1: start worker process 34
2025/08/22 16:27:38 [notice] 1#1: start worker process 35
```

2025/08/22 16:27:38 [notice] 1#1: start worker process 36

docker run alpine sh

```
E:\Docker>docker run alpine sh
Unable to find image 'alpine:latest' locally
latest: Pulling from library/alpine
9824c27679d3: Pull complete
Digest: sha256:4bcff63911fcb4448bd4fdacec207030997caf25e9bea4045fa6c8c44de311d1
Status: Downloaded newer image for alpine:latest
```

```
E:\Docker>docker run -it alpine sh
/ # ls
bin      etc      lib      mnt      proc     run      srv      tmp      var
dev      home    media    opt      root     sbin     sys      usr
/ # exit
```

```
E:\Docker>docker run alpine sh
Unable to find image 'alpine:latest' locally
latest: Pulling from library/alpine
9824c27679d3: Pull complete
Digest: sha256:4bcff63911fcb4448bd4fdacec207030997caf25e9bea4045fa6c8c44de311d1
Status: Downloaded newer image for alpine:latest
```

```
E:\Docker>docker run -it alpine sh
/ # ls
bin      etc      lib      mnt      proc     run      srv      tmp      var
dev      home    media    opt      root     sbin     sys      usr
/ # exit
```

Use docker ps and docker ps -a to inspect states.

docker ps

docker ps -a

```
E:\Docker>docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED        STATUS        PORTS   NAMES
E:\Docker>docker ps -a
CONTAINER ID   IMAGE     COMMAND                  CREATED        STATUS        PORTS   NAMES
eafc5c8c9057   alpine    "sh"                    About a minute ago    Exited (0)    About a minute ago    sweet_haibt
61dd47dcfdcc   alpine    "sh"                    About a minute ago    Exited (0)    About a minute ago    suspicious_hugle
1136b55874bf   nginx     "/docker-entrypoint...." 3 minutes ago      Exited (0)    2 minutes ago        reverent_noyce
38a838c0b783   hello-world "/hello"                9 minutes ago      Exited (0)    9 minutes ago        practical_herschel
```

```
E:\Docker>docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED        STATUS        PORTS   NAMES
E:\Docker>docker ps -a
CONTAINER ID   IMAGE     COMMAND                  CREATED        STATUS        PORTS   NAMES
eafc5c8c9057   alpine    "sh"                    About a minute ago    Exited (0)    About a
minute ago    sweet_haibt
61dd47dcfdcc   alpine    "sh"                    About a minute ago    Exited (0)    About a
minute ago    suspicious_hugle
1136b55874bf   nginx     "/docker-entrypoint...." 3 minutes ago      Exited (0)    2 minutes
ago          reverent_noyce
38a838c0b783   hello-world "/hello"                9 minutes ago      Exited (0)    9 minutes
ago          practical_herschel
```

Explore docker run flags: --rm, -it, -d, -p.

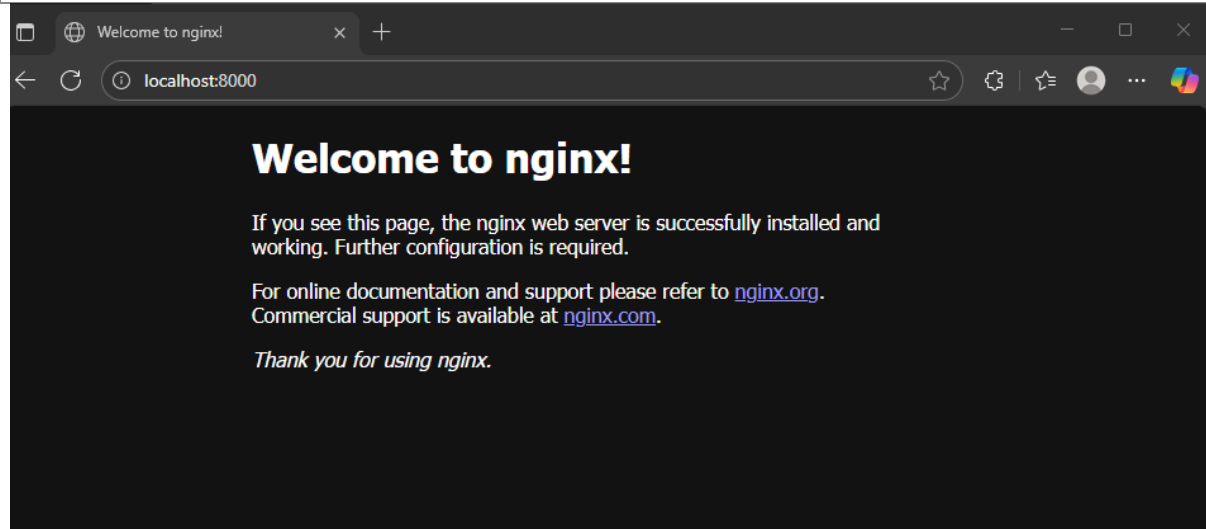
docker run -d -p 8080:80 --name mynginx nginx

```
E:\Docker>docker run -d -p 8080:80 --name mynginx nginx
b3f6d65309901708ea5342dca95caf35bb6cb213422c42fbfd94d022389b4461

E:\Docker>docker exec -it mynginx bash
root@b3f6d6530990:/# ls
bin      dev          docker-entrypoint.sh  home  lib64  mnt  proc  run  srv  tmp  var
boot    docker-entrypoint.d  etc      lib   media  opt  root  sbin sys  usr
root@b3f6d6530990:/# exit
exit
```

```
E:\Docker>docker run -d -p 8080:80 --name mynginx nginx
b3f6d65309901708ea5342dca95caf35bb6cb213422c42fbfd94d022389b4461

E:\Docker>docker exec -it mynginx bash
root@b3f6d6530990:/# ls
bin      dev          docker-entrypoint.sh  home  lib64  mnt  proc  run  srv  tmp  var
boot    docker-entrypoint.d  etc      lib   media  opt  root  sbin sys  usr
root@b3f6d6530990:/# exit
exit
```



Use docker exec and docker logs.

docker exec -it mynginx bash

```
E:\Docker>docker exec -it mynginx bash
root@b3f6d6530990:/# ls
bin      dev          docker-entrypoint.sh  home  lib64  mnt  proc  run  srv  tmp  var
boot    docker-entrypoint.d  etc      lib   media  opt  root  sbin sys  usr
root@b3f6d6530990:/# exit
exit

E:\Docker>docker logs mynginx
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
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2025/08/22 16:32:45 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14+deb12u1)
```

```

2025/08/22 16:32:45 [notice] 1#1: OS: Linux 6.6.87.2-microsoft-standard-WSL2
2025/08/22 16:32:45 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
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2025/08/22 16:32:45 [notice] 1#1: start worker process 36
172.17.0.1 - - [22/Aug/2025:16:34:07 +0000] "GET / HTTP/1.1" 200 615 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:142.0) Gecko/20100101 Firefox/142.0" "-"
172.17.0.1 - - [22/Aug/2025:16:34:07 +0000] "GET /favicon.ico HTTP/1.1" 404 153
"http://localhost:8000/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:142.0) Gecko/20100101 Firefox/142.0" "-"
2025/08/22 16:34:07 [error] 29#29: *1 open() "/usr/share/nginx/html/favicon.ico" failed (2: No such file or directory), client: 172.17.0.1, server: localhost, request: "GET /favicon.ico HTTP/1.1", host: "localhost:8000", referer: "http://localhost:8000/"
172.17.0.1 - - [22/Aug/2025:16:34:14 +0000] "GET / HTTP/1.1" 200 615 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/139.0.0.0 Safari/537.36 Edg/139.0.0.0" "-"
2025/08/22 16:34:16 [error] 32#32: *4 open() "/usr/share/nginx/html/favicon.ico" failed (2: No such file or directory), client: 172.17.0.1, server: localhost, request: "GET /favicon.ico HTTP/1.1", host: "localhost:8000", referer: "http://localhost:8000/"
172.17.0.1 - - [22/Aug/2025:16:34:16 +0000] "GET /favicon.ico HTTP/1.1" 404 555
"http://localhost:8000/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/139.0.0.0 Safari/537.36 Edg/139.0.0.0" "-"

```

```

E:\Docker>docker exec -it mynginx bash
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172.17.0.1 - - [22/Aug/2025:16:34:07 +0000] "GET / HTTP/1.1" 200 615 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:142.0) Gecko/20100101 Firefox/142.0" "-"
172.17.0.1 - - [22/Aug/2025:16:34:07 +0000] "GET /favicon.ico HTTP/1.1" 404 153 "http://localhost:8000/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:142.0) Gecko/20100101 Firefox/142.0" "-"
2025/08/22 16:34:07 [error] 29#29: *1 open() "/usr/share/nginx/html/favicon.ico" failed (2: No such file or directory), client: 172.17.0.1, server: localhost, request: "GET /favicon.ico HTTP/1.1", host: "localhost:8000", referer: "http://localhost:8000/"
172.17.0.1 - - [22/Aug/2025:16:34:14 +0000] "GET / HTTP/1.1" 200 615 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/139.0.0.0 Safari/537.36 Edg/139.0.0.0" "-"
2025/08/22 16:34:16 [error] 32#32: *4 open() "/usr/share/nginx/html/favicon.ico" failed (2: No such file or directory), client: 172.17.0.1, server: localhost, request: "GET /favicon.ico HTTP/1.1", host: "localhost:8000", referer: "http://localhost:8000/"
172.17.0.1 - - [22/Aug/2025:16:34:16 +0000] "GET /favicon.ico HTTP/1.1" 404 555 "http://localhost:8000/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/139.0.0.0 Safari/537.36 Edg/139.0.0.0" "-"

```

Checkpoint: What happens if a container doesn't run in detached mode? What if ports aren't mapped?

If the container doesn't run in **-d** (detached mode), the container runs in the foreground and you won't be able to use the terminal until the process stops / the containers stops.

If the ports aren't mapped using **-p**, the service inside the container will still execute, however it won't be accessible using your machine.

Exercise 2: Working with Container State

Objective: Modify containers and commit custom images.

Run an Ubuntu container, install curl and vim.

`docker run -it --name ubuntu-tools ubuntu:latest bash`

```
C:\Users\satya>docker run -it --name ubuntu-tools ubuntu:latest bash
root@3cf6a8682027:/# apt-get install curl
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
E: Unable to locate package curl
root@3cf6a8682027:/# apt-get update
Get:1 http://archive.ubuntu.com/ubuntu noble InRelease [256 kB]
Get:2 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:5 http://archive.ubuntu.com/ubuntu noble/multiverse amd64 Packages [331 kB]
Get:6 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [2066 kB]
Get:7 http://archive.ubuntu.com/ubuntu noble/universe amd64 Packages [19.3 MB]
Get:8 http://archive.ubuntu.com/ubuntu noble/main amd64 Packages [1808 kB]
Get:9 http://security.ubuntu.com/ubuntu noble/restricted amd64 Packages [117 kB]
Get:10 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1713 kB]
Get:11 http://archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Packages [2193 kB]
Get:12 http://archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Packages [45.2 kB]
Get:13 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1458 kB]
Get:14 http://archive.ubuntu.com/ubuntu noble-backports/universe amd64 Packages [35.6 kB]
Get:15 http://archive.ubuntu.com/ubuntu noble-backports/main amd64 Packages [48.8 kB]
Get:16 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [1137 kB]
Get:17 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1363 kB]
Get:18 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Packages [23.0 kB]
Fetched 32.3 MB in 4s (8027 kB/s)
Reading package lists... Done
root@3cf6a8682027:/# apt-get install curl
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  ca-certificates krb5-locales libbrotli1 libcurl4t64 libgssapi-krb5-2 libk5crypto3 libkeyutils1 libkrb5-3
  libkrb5support0 libldap-common libldap2 libnghttp2-14 libpsl5t64 librtmp1 libsasl2-2 libsasl2-modules
  libsasl2-modules-db libssh-4 openssl publicsuffix
Suggested packages:
  krb5-doc krb5-user libsasl2-modules-gssapi-mit | libsasl2-modules-gssapi-heimdal libsasl2-modules-ldap
  libsasl2-modules-otp libsasl2-modules-sql
The following NEW packages will be installed:
  ca-certificates curl krb5-locales libbrotli1 libcurl4t64 libgssapi-krb5-2 libk5crypto3 libkeyutils1 libkrb5-3
  libkrb5support0 libldap-common libldap2 libnghttp2-14 libpsl5t64 librtmp1 libsasl2-2 libsasl2-modules
  libsasl2-modules-db libssh-4 openssl publicsuffix
0 upgraded, 21 newly installed, 0 to remove and 1 not upgraded.
Need to get 3567 kB of archives.
After this operation, 9212 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 openssl amd64 3.0.13-0ubuntu3.5 [1002 kB]
Get:2 http://archive.ubuntu.com/ubuntu noble/main amd64 ca-certificates all 20240203 [159 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 krb5-locales all 1.20.1-6ubuntu2.6 [14.8 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libkrb5support0 amd64 1.20.1-6ubuntu2.6 [34.4 kB]
Get:5 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libk5crypto3 amd64 1.20.1-6ubuntu2.6 [82.0 kB]
Get:6 http://archive.ubuntu.com/ubuntu noble/main amd64 libkeyutils1 amd64 1.6.3-3build1 [9490 B]
Get:7 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libkrb5-3 amd64 1.20.1-6ubuntu2.6 [348 kB]
Get:8 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libgssapi-krb5-2 amd64 1.20.1-6ubuntu2.6 [143 kB]
Get:9 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libnghttp2-14 amd64 1.59.0-1ubuntu0.2 [74.3 kB]
Get:10 http://archive.ubuntu.com/ubuntu noble/main amd64 libpsl5t64 amd64 0.21.2-1.1build1 [57.1 kB]
Get:11 http://archive.ubuntu.com/ubuntu noble/main amd64 publicsuffix all 20231001.0357-0.1 [129 kB]
Get:12 http://archive.ubuntu.com/ubuntu noble/main amd64 libbrotli1 amd64 1.1.0-2build2 [331 kB]
Get:13 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libsasl2-modules-db amd64 2.1.28+dfsg1-5ubuntu3.1 [20.4 kB]
Get:14 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libsasl2-2 amd64 2.1.28+dfsg1-5ubuntu3.1 [53.2 kB]
```

Full Output is below –

Installing Curl – `apt-get install curl vim -y`

```

C:\Users\satya>docker run -it --name ubuntu-tools ubuntu:latest bash
root@3cf6a8682027:/# apt-get install curl
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
E: Unable to locate package curl
root@3cf6a8682027:/# apt-get update
Get:1 http://archive.ubuntu.com/ubuntu noble InRelease [256 kB]
Get:2 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:5 http://archive.ubuntu.com/ubuntu noble/multiverse amd64 Packages [331 kB]
Get:6 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [2066 kB]
Get:7 http://archive.ubuntu.com/ubuntu noble/universe amd64 Packages [19.3 MB]
Get:8 http://archive.ubuntu.com/ubuntu noble/main amd64 Packages [1808 kB]
Get:9 http://archive.ubuntu.com/ubuntu noble/restricted amd64 Packages [117 kB]
Get:10 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1713 kB]
Get:11 http://archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Packages [2193 kB]
Get:12 http://archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Packages [45.2 kB]
Get:13 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1458 kB]
Get:14 http://archive.ubuntu.com/ubuntu noble-backports/universe amd64 Packages [35.6 kB]
Get:15 http://archive.ubuntu.com/ubuntu noble-backports/main amd64 Packages [48.8 kB]
Get:16 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [1137 kB]
Get:17 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1363 kB]
Get:18 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Packages [23.0 kB]
Fetched 32.3 MB in 4s (8027 kB/s)
Reading package lists... Done
root@3cf6a8682027:/# apt-get install curl
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  ca-certificates krb5-locales libbrotli1 libcurl4t64 libgssapi-krb5-2 libk5crypto3 libkeyutils1
  libkrb5-3
  libkrb5support0 libldap-common libldap2 libnghttp2-14 libpsl5t64 librtmp1 libsas12-2 libsas12-
modules
  libsas12-modules-db libssh-4 openssl publicsuffix
Suggested packages:
  krb5-doc krb5-user libsas12-modules-gssapi-mit | libsas12-modules-gssapi-heimdal libsas12-
modules-ldap
  libsas12-modules-otp libsas12-modules-sql
The following NEW packages will be installed:
  ca-certificates curl krb5-locales libbrotli1 libcurl4t64 libgssapi-krb5-2 libk5crypto3
  libkeyutils1 libkrb5-3
  libkrb5support0 libldap-common libldap2 libnghttp2-14 libpsl5t64 librtmp1 libsas12-2 libsas12-
modules
  libsas12-modules-db libssh-4 openssl publicsuffix
0 upgraded, 21 newly installed, 0 to remove and 1 not upgraded.
Need to get 3567 kB of archives.
After this operation, 9212 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 openssl amd64 3.0.13-0ubuntu3.5
[1002 kB]
Get:2 http://archive.ubuntu.com/ubuntu noble/main amd64 ca-certificates all 20240203 [159 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 krb5-locales all 1.20.1-
6ubuntu2.6 [14.8 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libkrb5support0 amd64 1.20.1-
6ubuntu2.6 [34.4 kB]
Get:5 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libk5crypto3 amd64 1.20.1-
6ubuntu2.6 [82.0 kB]
Get:6 http://archive.ubuntu.com/ubuntu noble/main amd64 libkeyutils1 amd64 1.6.3-3build1 [9490
B]
Get:7 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libkrb5-3 amd64 1.20.1-
6ubuntu2.6 [348 kB]
Get:8 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libgssapi-krb5-2 amd64 1.20.1-
6ubuntu2.6 [143 kB]
Get:9 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libnghttp2-14 amd64 1.59.0-
1ubuntu0.2 [74.3 kB]

```

```
Get:10 http://archive.ubuntu.com/ubuntu noble/main amd64 libpsl5t64 amd64 0.21.2-1.1build1 [57.1 kB]
Get:11 http://archive.ubuntu.com/ubuntu noble/main amd64 publicsuffix all 20231001.0357-0.1 [129 kB]
Get:12 http://archive.ubuntu.com/ubuntu noble/main amd64 libbrotli1 amd64 1.1.0-2build2 [331 kB]
Get:13 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libsasl2-modules-db amd64 2.1.28+dfsg1-5ubuntu3.1 [20.4 kB]
Get:14 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libsasl2-2 amd64 2.1.28+dfsg1-5ubuntu3.1 [53.2 kB]
Get:15 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libldap2 amd64 2.6.7+dfsg-1~exp1ubuntu8.2 [196 kB]
Get:16 http://archive.ubuntu.com/ubuntu noble/main amd64 librtmp1 amd64 2.4+20151223.gitfa8646d.1-2build7 [56.3 kB]
Get:17 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libssh-4 amd64 0.10.6-2ubuntu0.1 [188 kB]
Get:18 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libcurl4t64 amd64 8.5.0-2ubuntu10.6 [341 kB]
Get:19 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 curl amd64 8.5.0-2ubuntu10.6 [226 kB]
Get:20 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libldap-common all 2.6.7+dfsg-1~exp1ubuntu8.2 [31.7 kB]
Get:21 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libsasl2-modules amd64 2.1.28+dfsg1-5ubuntu3.1 [69.9 kB]
Fetched 3567 kB in 6s (596 kB/s)
debconf: delaying package configuration, since apt-utils is not installed
Selecting previously unselected package openssl.
(Reading database ... 4381 files and directories currently installed.)
Preparing to unpack .../00-openssl_3.0.13-0ubuntu3.5_amd64.deb ...
Unpacking openssl (3.0.13-0ubuntu3.5) ...
Selecting previously unselected package ca-certificates.
Preparing to unpack .../01-ca-certificates_20240203_all.deb ...
Unpacking ca-certificates (20240203) ...
Selecting previously unselected package krb5-locales.
Preparing to unpack .../02-krb5-locales_1.20.1-6ubuntu2.6_all.deb ...
Unpacking krb5-locales (1.20.1-6ubuntu2.6) ...
Selecting previously unselected package libkrb5support0:amd64.
Preparing to unpack .../03-libkrb5support0_1.20.1-6ubuntu2.6_amd64.deb ...
Unpacking libkrb5support0:amd64 (1.20.1-6ubuntu2.6) ...
Selecting previously unselected package libk5crypto3:amd64.
Preparing to unpack .../04-libk5crypto3_1.20.1-6ubuntu2.6_amd64.deb ...
Unpacking libk5crypto3:amd64 (1.20.1-6ubuntu2.6) ...
Selecting previously unselected package libkeyutils1:amd64.
Preparing to unpack .../05-libkeyutils1_1.6.3-3build1_amd64.deb ...
Unpacking libkeyutils1:amd64 (1.6.3-3build1) ...
Selecting previously unselected package libkrb5-3:amd64.
Preparing to unpack .../06-libkrb5-3_1.20.1-6ubuntu2.6_amd64.deb ...
Unpacking libkrb5-3:amd64 (1.20.1-6ubuntu2.6) ...
Selecting previously unselected package libgssapi-krb5-2:amd64.
Preparing to unpack .../07-libgssapi-krb5-2_1.20.1-6ubuntu2.6_amd64.deb ...
Unpacking libgssapi-krb5-2:amd64 (1.20.1-6ubuntu2.6) ...
Selecting previously unselected package libnghttp2-14:amd64.
Preparing to unpack .../08-libnghttp2-14_1.59.0-1ubuntu0.2_amd64.deb ...
Unpacking libnghttp2-14:amd64 (1.59.0-1ubuntu0.2) ...
Selecting previously unselected package libpsl5t64:amd64.
Preparing to unpack .../09-libpsl5t64_0.21.2-1.1build1_amd64.deb ...
Unpacking libpsl5t64:amd64 (0.21.2-1.1build1) ...
Selecting previously unselected package publicsuffix.
Preparing to unpack .../10-publicsuffix_20231001.0357-0.1_all.deb ...
Unpacking publicsuffix (20231001.0357-0.1) ...
Selecting previously unselected package libbrotli1:amd64.
Preparing to unpack .../11-libbrotli1_1.1.0-2build2_amd64.deb ...
Unpacking libbrotli1:amd64 (1.1.0-2build2) ...
Selecting previously unselected package libsasl2-modules-db:amd64.
Preparing to unpack .../12-libsasl2-modules-db_2.1.28+dfsg1-5ubuntu3.1_amd64.deb ...
Unpacking libsasl2-modules-db:amd64 (2.1.28+dfsg1-5ubuntu3.1) ...
Selecting previously unselected package libsasl2-2:amd64.
Preparing to unpack .../13-libsasl2-2_2.1.28+dfsg1-5ubuntu3.1_amd64.deb ...
Unpacking libsasl2-2:amd64 (2.1.28+dfsg1-5ubuntu3.1) ...
Selecting previously unselected package libldap2:amd64.
Preparing to unpack .../14-libldap2_2.6.7+dfsg-1~exp1ubuntu8.2_amd64.deb ...
Unpacking libldap2:amd64 (2.6.7+dfsg-1~exp1ubuntu8.2) ...
```



```

Selecting previously unselected package librtmp1:amd64.
Preparing to unpack .../15-librtmp1_2.4+20151223.gitfa8646d.1-2build7_amd64.deb ...
Unpacking librtmp1:amd64 (2.4+20151223.gitfa8646d.1-2build7) ...
Selecting previously unselected package libssh-4:amd64.
Preparing to unpack .../16-libssh-4_0.10.6-2ubuntu0.1_amd64.deb ...
Unpacking libssh-4:amd64 (0.10.6-2ubuntu0.1) ...
Selecting previously unselected package libcurl4t64:amd64.
Preparing to unpack .../17-libcurl4t64_8.5.0-2ubuntu10.6_amd64.deb ...
Unpacking libcurl4t64:amd64 (8.5.0-2ubuntu10.6) ...
Selecting previously unselected package curl.
Preparing to unpack .../18-curl_8.5.0-2ubuntu10.6_amd64.deb ...
Unpacking curl (8.5.0-2ubuntu10.6) ...
Selecting previously unselected package libldap-common.
Preparing to unpack .../19-libldap-common_2.6.7+dfsg-1~exp1ubuntu8.2_all.deb ...
Unpacking libldap-common (2.6.7+dfsg-1~exp1ubuntu8.2) ...
Selecting previously unselected package libsasl2-modules:amd64.
Preparing to unpack .../20-libsasl2-modules_2.1.28+dfsg1-5ubuntu3.1_amd64.deb ...
Unpacking libsasl2-modules:amd64 (2.1.28+dfsg1-5ubuntu3.1) ...
Setting up libkeyutils1:amd64 (1.6.3-3build1) ...
Setting up libbrotli1:amd64 (1.1.0-2build2) ...
Setting up libsasl2-modules:amd64 (2.1.28+dfsg1-5ubuntu3.1) ...
Setting up libpsl5t64:amd64 (0.21.2-1.1build1) ...
Setting up libnghttp2-14:amd64 (1.59.0-1ubuntu0.2) ...
Setting up krb5-locales (1.20.1-6ubuntu2.6) ...
Setting up libldap-common (2.6.7+dfsg-1~exp1ubuntu8.2) ...
Setting up libkrb5support0:amd64 (1.20.1-6ubuntu2.6) ...
Setting up libsasl2-modules-db:amd64 (2.1.28+dfsg1-5ubuntu3.1) ...
Setting up librtmp1:amd64 (2.4+20151223.gitfa8646d.1-2build7) ...
Setting up libk5crypto3:amd64 (1.20.1-6ubuntu2.6) ...
Setting up libsasl2-2:amd64 (2.1.28+dfsg1-5ubuntu3.1) ...
Setting up libkrb5-3:amd64 (1.20.1-6ubuntu2.6) ...
Setting up openssl (3.0.13-0ubuntu3.5) ...
Setting up publicsuffix (20231001.0357-0.1) ...
Setting up libldap2:amd64 (2.6.7+dfsg-1~exp1ubuntu8.2) ...
Setting up ca-certificates (20240203) ...
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based frontend cannot be
used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line 79.)
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (Can't locate Term/ReadLine.pm in @INC (you may need to install the Term::ReadLine
module) (@INC entries checked: /etc/perl /usr/local/lib/x86_64-linux-gnu/perl/5.38.2
/usr/local/share/perl/5.38.2 /usr/lib/x86_64-linux-gnu/perl5/5.38 /usr/share/perl5
/usr/lib/x86_64-linux-gnu/perl-base /usr/lib/x86_64-linux-gnu/perl/5.38 /usr/share/perl/5.38
/usr/local/lib/site_perl) at /usr/share/perl5/Debconf/FrontEnd/Readline.pm line 8.)
debconf: falling back to frontend: Teletype
Updating certificates in /etc/ssl/certs...
146 added, 0 removed; done.
Setting up libgssapi-krb5-2:amd64 (1.20.1-6ubuntu2.6) ...
Setting up libssh-4:amd64 (0.10.6-2ubuntu0.1) ...
Setting up libcurl4t64:amd64 (8.5.0-2ubuntu10.6) ...
Setting up curl (8.5.0-2ubuntu10.6) ...
Processing triggers for libc-bin (2.39-0ubuntu8.5) ...
Processing triggers for ca-certificates (20240203) ...
Updating certificates in /etc/ssl/certs...
0 added, 0 removed; done.
Running hooks in /etc/ca-certificates/update.d...
done.

```

Installing VIM – apt-get install vim -y

```

root@3cf6a8682027:/# apt-get install vim
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libexpat1 libgpm2 libpython3.12-minimal libpython3.12-stdlib libpython3.12t64 libreadline8t64
  libsodium23

```

```

    libsqlite3-0 media-types netbase readline-common tzdata vim-common vim-runtime xxd
Suggested packages:
    gpm readline-doc ctags vim-doc vim-scripts
The following NEW packages will be installed:
    libexpat1 libgpm2 libpython3.12-minimal libpython3.12-stdlib libpython3.12t64 libreadline8t64
    libsodium23
    libsqlite3-0 media-types netbase readline-common tzdata vim vim-common vim-runtime xxd
0 upgraded, 16 newly installed, 0 to remove and 1 not upgraded.
Need to get 16.4 MB of archives.
After this operation, 72.1 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libexpat1 amd64 2.6.1-2ubuntu0.3
[88.0 kB]
Get:2 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libpython3.12-minimal amd64
3.12.3-1ubuntu0.8 [836 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble/main amd64 media-types all 10.1.0 [27.5 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble/main amd64 netbase all 6.4 [13.1 kB]
Get:5 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 tzdata all 2025b-
0ubuntu0.24.04.1 [276 kB]
Get:6 http://archive.ubuntu.com/ubuntu noble/main amd64 readline-common all 8.2-4build1 [56.5
kB]
Get:7 http://archive.ubuntu.com/ubuntu noble/main amd64 libreadline8t64 amd64 8.2-4build1 [153
kB]
Get:8 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libsqlite3-0 amd64 3.45.1-
1ubuntu2.4 [701 kB]
Get:9 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libpython3.12-stdlib amd64
3.12.3-1ubuntu0.8 [2068 kB]
Get:10 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 vim-common all 2:9.1.0016-
1ubuntu7.8 [386 kB]
Get:11 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 xxd amd64 2:9.1.0016-1ubuntu7.8
[63.6 kB]
Get:12 http://archive.ubuntu.com/ubuntu noble/main amd64 libgpm2 amd64 1.20.7-11 [14.1 kB]
Get:13 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 libpython3.12t64 amd64 3.12.3-
1ubuntu0.8 [2355 kB]
Get:14 http://archive.ubuntu.com/ubuntu noble/main amd64 libsodium23 amd64 1.0.18-1build3 [161
kB]
Get:15 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 vim-runtime all 2:9.1.0016-
1ubuntu7.8 [7281 kB]
Get:16 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 vim amd64 2:9.1.0016-1ubuntu7.8
[1881 kB]
Fetched 16.4 MB in 2s (7945 kB/s)
debconf: delaying package configuration, since apt-utils is not installed
Selecting previously unselected package libexpat1:amd64.
(Reading database ... 5014 files and directories currently installed.)
Preparing to unpack .../00-libexpat1_2.6.1-2ubuntu0.3_amd64.deb ...
Unpacking libexpat1:amd64 (2.6.1-2ubuntu0.3) ...
Selecting previously unselected package libpython3.12-minimal:amd64.
Preparing to unpack .../01-libpython3.12-minimal_3.12.3-1ubuntu0.8_amd64.deb ...
Unpacking libpython3.12-minimal:amd64 (3.12.3-1ubuntu0.8) ...
Selecting previously unselected package media-types.
Preparing to unpack .../02-media-types_10.1.0_all.deb ...
Unpacking media-types (10.1.0) ...
Selecting previously unselected package netbase.
Preparing to unpack .../03-netbase_6.4_all.deb ...
Unpacking netbase (6.4) ...
Selecting previously unselected package tzdata.
Preparing to unpack .../04-tzdata_2025b-0ubuntu0.24.04.1_all.deb ...
Unpacking tzdata (2025b-0ubuntu0.24.04.1) ...
Selecting previously unselected package readline-common.
Preparing to unpack .../05-readline-common_8.2-4build1_all.deb ...
Unpacking readline-common (8.2-4build1) ...
Selecting previously unselected package libreadline8t64:amd64.
Preparing to unpack .../06-libreadline8t64_8.2-4build1_amd64.deb ...
Adding 'diversion of /lib/x86_64-linux-gnu/libhistory.so.8 to /lib/x86_64-linux-
gnu/libhistory.so.8.usr-is-merged by libreadline8t64'
Adding 'diversion of /lib/x86_64-linux-gnu/libhistory.so.8.2 to /lib/x86_64-linux-
gnu/libhistory.so.8.2.usr-is-merged by libreadline8t64'
Adding 'diversion of /lib/x86_64-linux-gnu/libreadline.so.8 to /lib/x86_64-linux-
gnu/libreadline.so.8.usr-is-merged by libreadline8t64'

```

```

Adding 'diversion of /lib/x86_64-linux-gnu/libreadline.so.8.2 to /lib/x86_64-linux-
gnu/libreadline.so.8.2.usr-is-merged by libreadline8t64'
Unpacking libreadline8t64:amd64 (8.2-4build1) ...
Selecting previously unselected package libsqlite3-0:amd64.
Preparing to unpack .../07-libsqlite3-0_3.45.1-1ubuntu2.4_amd64.deb ...
Unpacking libsqlite3-0:amd64 (3.45.1-1ubuntu2.4) ...
Selecting previously unselected package libpython3.12-stdlib:amd64.
Preparing to unpack .../08-libpython3.12-stdlib_3.12.3-1ubuntu0.8_amd64.deb ...
Unpacking libpython3.12-stdlib:amd64 (3.12.3-1ubuntu0.8) ...
Selecting previously unselected package vim-common.
Preparing to unpack .../09-vim-common_2%3a9.1.0016-1ubuntu7.8_all.deb ...
Unpacking vim-common (2:9.1.0016-1ubuntu7.8) ...
Selecting previously unselected package xxd.
Preparing to unpack .../10-xxd_2%3a9.1.0016-1ubuntu7.8_amd64.deb ...
Unpacking xxd (2:9.1.0016-1ubuntu7.8) ...
Selecting previously unselected package libgpm2:amd64.
Preparing to unpack .../11-libgpm2_1.20.7-11_amd64.deb ...
Unpacking libgpm2:amd64 (1.20.7-11) ...
Selecting previously unselected package libpython3.12t64:amd64.
Preparing to unpack .../12-libpython3.12t64_3.12.3-1ubuntu0.8_amd64.deb ...
Unpacking libpython3.12t64:amd64 (3.12.3-1ubuntu0.8) ...
Selecting previously unselected package libsodium23:amd64.
Preparing to unpack .../13-libsodium23_1.0.18-1build3_amd64.deb ...
Unpacking libsodium23:amd64 (1.0.18-1build3) ...
Selecting previously unselected package vim-runtime.
Preparing to unpack .../14-vim-runtime_2%3a9.1.0016-1ubuntu7.8_all.deb ...
Adding 'diversion of /usr/share/vim/vim91/doc/help.txt to /usr/share/vim/vim91/doc/help.txt.vim-
tiny by vim-runtime'
Adding 'diversion of /usr/share/vim/vim91/doc/tags to /usr/share/vim/vim91/doc/tags.vim-tiny by
vim-runtime'
Unpacking vim-runtime (2:9.1.0016-1ubuntu7.8) ...
Selecting previously unselected package vim.
Preparing to unpack .../15-vim_2%3a9.1.0016-1ubuntu7.8_amd64.deb ...
Unpacking vim (2:9.1.0016-1ubuntu7.8) ...
Setting up libexpat1:amd64 (2.6.1-2ubuntu0.3) ...
Setting up media-types (10.1.0) ...
Setting up libsodium23:amd64 (1.0.18-1build3) ...
Setting up libgpm2:amd64 (1.20.7-11) ...
Setting up libsqlite3-0:amd64 (3.45.1-1ubuntu2.4) ...
Setting up libpython3.12-minimal:amd64 (3.12.3-1ubuntu0.8) ...
Setting up xxd (2:9.1.0016-1ubuntu7.8) ...
Setting up tzdata (2025b-0ubuntu0.24.04.1) ...
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based frontend cannot be
used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line 79.)
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (Can't locate Term/ReadLine.pm in @INC (you may need to install the Term::ReadLine
module) (@INC entries checked: /etc/perl /usr/local/lib/x86_64-linux-gnu/perl/5.38.2
/usr/local/share/perl/5.38.2 /usr/lib/x86_64-linux-gnu/perl5/5.38 /usr/share/perl5
/usr/lib/x86_64-linux-gnu/perl-base /usr/lib/x86_64-linux-gnu/perl/5.38 /usr/share/lib/x86_64-linux-gnu/perl/5.38
/usr/local/lib/site_perl) at /usr/share/perl5/Debconf/FrontEnd/Readline.pm line 8.)
debconf: falling back to frontend: Teletype
Configuring tzdata
-----

```

Please select the geographic area in which you live. Subsequent configuration questions will narrow this down by presenting a list of cities, representing the time zones in which they are located.

```

1. Africa    3. Antarctica  5. Asia      7. Australia  9. Indian    11. Etc
2. America  4. Arctic     6. Atlantic  8. Europe     10. Pacific  12. Legacy
Geographic area: 9

```

Please select the city or region corresponding to your time zone.

```

1. Antananarivo  3. Christmas  5. Comoro    7. Mahe      9. Mauritius  11. Reunion
2. Chagos        4. Cocos      6. Kerguelen 8. Maldives  10. Mayotte
Time zone:

```

Time zone: 1

Current default time zone: 'Indian/Antananarivo'
Local time is now: Sat Aug 23 07:39:44 EAT 2025.
Universal Time is now: Sat Aug 23 04:39:44 UTC 2025.
Run 'dpkg-reconfigure tzdata' if you wish to change it.

Setting up vim-common (2:9.1.0016-1ubuntu7.8) ...
Setting up netbase (6.4) ...
Setting up vim-runtime (2:9.1.0016-1ubuntu7.8) ...
Setting up readline-common (8.2-4build1) ...
Setting up libreadline8t64:amd64 (8.2-4build1) ...
Setting up libpython3.12-stdlib:amd64 (3.12.3-1ubuntu0.8) ...
Setting up libpython3.12t64:amd64 (3.12.3-1ubuntu0.8) ...
Setting up vim (2:9.1.0016-1ubuntu7.8) ...
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/editor (editor) in auto mode
update-alternatives: warning: skip creation of /usr/share/man/man1/editor.1.gz because associated file /usr/share/man/man1/vim.1.gz (of link group editor) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/da/man1/editor.1.gz because associated file /usr/share/man/da/man1/vim.1.gz (of link group editor) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/de/man1/editor.1.gz because associated file /usr/share/man/de/man1/vim.1.gz (of link group editor) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/fr/man1/editor.1.gz because associated file /usr/share/man/fr/man1/vim.1.gz (of link group editor) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/it/man1/editor.1.gz because associated file /usr/share/man/it/man1/vim.1.gz (of link group editor) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/ja/man1/editor.1.gz because associated file /usr/share/man/ja/man1/vim.1.gz (of link group editor) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/pl/man1/editor.1.gz because associated file /usr/share/man/pl/man1/vim.1.gz (of link group editor) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/ru/man1/editor.1.gz because associated file /usr/share/man/ru/man1/vim.1.gz (of link group editor) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/tr/man1/editor.1.gz because associated file /usr/share/man/tr/man1/vim.1.gz (of link group editor) doesn't exist
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/ex (ex) in auto mode
update-alternatives: warning: skip creation of /usr/share/man/man1/ex.1.gz because associated file /usr/share/man/man1/vim.1.gz (of link group ex) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/da/man1/ex.1.gz because associated file /usr/share/man/da/man1/vim.1.gz (of link group ex) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/de/man1/ex.1.gz because associated file /usr/share/man/de/man1/vim.1.gz (of link group ex) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/fr/man1/ex.1.gz because associated file /usr/share/man/fr/man1/vim.1.gz (of link group ex) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/it/man1/ex.1.gz because associated file /usr/share/man/it/man1/vim.1.gz (of link group ex) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/ja/man1/ex.1.gz because associated file /usr/share/man/ja/man1/vim.1.gz (of link group ex) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/pl/man1/ex.1.gz because associated file /usr/share/man/pl/man1/vim.1.gz (of link group ex) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/ru/man1/ex.1.gz because associated file /usr/share/man/ru/man1/vim.1.gz (of link group ex) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/tr/man1/ex.1.gz because associated file /usr/share/man/tr/man1/vim.1.gz (of link group ex) doesn't exist
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/rview (rview) in auto mode
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/rvim (rvim) in auto mode
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/vi (vi) in auto mode
update-alternatives: warning: skip creation of /usr/share/man/man1/vi.1.gz because associated file /usr/share/man/man1/vim.1.gz (of link group vi) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/da/man1/vi.1.gz because associated file /usr/share/man/da/man1/vim.1.gz (of link group vi) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/de/man1/vi.1.gz because associated file /usr/share/man/de/man1/vim.1.gz (of link group vi) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/fr/man1/vi.1.gz because associated file /usr/share/man/fr/man1/vim.1.gz (of link group vi) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/it/man1/vi.1.gz because associated file /usr/share/man/it/man1/vim.1.gz (of link group vi) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/ja/man1/vi.1.gz because associated file /usr/share/man/ja/man1/vim.1.gz (of link group vi) doesn't exist

```

update-alternatives: warning: skip creation of /usr/share/man/pl/man1/vi.1.gz because associated
file /usr/share/man/pl/man1/vim.1.gz (of link group vi) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/ru/man1/vi.1.gz because associated
file /usr/share/man/ru/man1/vim.1.gz (of link group vi) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/tr/man1/vi.1.gz because associated
file /usr/share/man/tr/man1/vim.1.gz (of link group vi) doesn't exist
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/view (view) in auto mode
update-alternatives: warning: skip creation of /usr/share/man/man1/view.1.gz because associated
file /usr/share/man/man1/vim.1.gz (of link group view) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/da/man1/view.1.gz because
associated file /usr/share/man/da/man1/vim.1.gz (of link group view) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/de/man1/view.1.gz because
associated file /usr/share/man/de/man1/vim.1.gz (of link group view) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/fr/man1/view.1.gz because
associated file /usr/share/man/fr/man1/vim.1.gz (of link group view) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/it/man1/view.1.gz because
associated file /usr/share/man/it/man1/vim.1.gz (of link group view) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/ja/man1/view.1.gz because
associated file /usr/share/man/ja/man1/vim.1.gz (of link group view) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/pl/man1/view.1.gz because
associated file /usr/share/man/pl/man1/vim.1.gz (of link group view) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/ru/man1/view.1.gz because
associated file /usr/share/man/ru/man1/vim.1.gz (of link group view) doesn't exist
update-alternatives: warning: skip creation of /usr/share/man/tr/man1/view.1.gz because
associated file /usr/share/man/tr/man1/vim.1.gz (of link group view) doesn't exist
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/vim (vim) in auto mode
update-alternatives: using /usr/bin/vim.basic to provide /usr/bin/vimdiff (vimdiff) in auto mode
Processing triggers for libc-bin (2.39-0ubuntu8.5) ...

```

Exit and commit the image as ubuntu-tools.

Exit

docker commit ubuntu-tools ubuntu-tools

```

root@3cf6a8682027:/# exit
exit

C:\Users\satya>docker commit ubuntu-tools ubuntu-tools
sha256:f7ed201a9c46c57ba83ae1f0faf45f067998cdd9448555e0595fdc685cc543b7

C:\Users\satya>

```

```

root@3cf6a8682027:/# exit
exit

```

```

C:\Users\satya>docker commit ubuntu-tools ubuntu-tools
sha256:f7ed201a9c46c57ba83ae1f0faf45f067998cdd9448555e0595fdc685cc543b7

```

Run a new container from the committed image.

docker run -it --rm ubuntu-tools bash

```

C:\Users\satya>docker commit ubuntu-tools ubuntu-tools
sha256:f7ed201a9c46c57ba83ae1f0faf45f067998cdd9448555e0595fdc685cc543b7

C:\Users\satya>docker run -it --rm ubuntu-tools bash
root@2a3368b250ed:/# ls
bin boot dev etc home lib lib64 media mnt opt proc root run sbin srv sys tmp usr var
root@2a3368b250ed:/# cd mnt
root@2a3368b250ed:/mnt# ls
root@2a3368b250ed:/mnt# exit
exit

```



```

C:\Users\satya>docker run -it --rm ubuntu-tools bash
root@2a3368b250ed:/# ls
bin boot dev etc home lib lib64 media mnt opt proc root run sbin srv sys tmp
usr var
root@2a3368b250ed:/# cd mnt
root@2a3368b250ed:/mnt# ls
root@2a3368b250ed:/mnt# exit
exit

```

Tag the image and list it with docker images.

`docker tag ubuntu-tools vsatyamesc/ubuntu-tools:1.0`

```

C:\Users\satya>docker tag ubuntu-tools vsatyamesc/ubuntu-tools:1.0

```

```

C:\Users\satya>docker images

```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
ubuntu-tools	latest	f7ed201a9c46	20 minutes ago	323MB
vsatyamesc/ubuntu-tools	1.0	f7ed201a9c46	20 minutes ago	323MB
nginx	latest	33e0bbc7ca9e	9 days ago	279MB
hello-world	latest	a0dfb02aac21	2 weeks ago	20.3kB
ubuntu	latest	7c06e91f61fa	3 weeks ago	117MB
alpine	latest	4bcff63911fc	5 weeks ago	12.8MB

```

C:\Users\satya>docker tag ubuntu-tools vsatyamesc/ubuntu-tools:1.0

```

```

C:\Users\satya>docker images

```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
ubuntu-tools	latest	f7ed201a9c46	20 minutes ago	323MB
vsatyamesc/ubuntu-tools	1.0	f7ed201a9c46	20 minutes ago	323MB
nginx	latest	33e0bbc7ca9e	9 days ago	279MB
hello-world	latest	a0dfb02aac21	2 weeks ago	20.3kB
ubuntu	latest	7c06e91f61fa	3 weeks ago	117MB
alpine	latest	4bcff63911fc	5 weeks ago	12.8MB

Exercise 3: Build Custom Images Using Dockerfile

Objective: Write Dockerfiles and build your own image.

Create a simple Node or Python web server.

```
from fastapi import FastAPI
app = FastAPI()

@app.get("/")
def root():
    return {"message": "Running Fastapi Application in Docker"}
```

Write a Dockerfile to copy the code and expose a port.

Add metadata using LABEL and set CMD or ENTRYPOINT.

```
FROM python:3.10-slim

LABEL maintainer="satyamverma.8.b@gmail.com" \
      version="1.0"
WORKDIR /app
COPY requirements.txt .
RUN pip install --no-cache-dir -r requirements.txt

COPY . .
EXPOSE 8000

CMD ["uvicorn", "app:app", "--host", "0.0.0.0", "--port", "8000"]
```

Build and run the image. Test with curl.

`docker build -t my-fastapi-app .`

```
E:\Docker>docker build -t my-fastapi-app .
[+] Building 2.6s (11/11) FINISHED                                docker:desktop-linux
=> [internal] load build definition from Dockerfile              0.0s
=> => transferring dockerfile: 316B                             0.0s
=> [internal] load metadata for docker.io/library/python:3.10-slim 1.7s
=> [auth] library/python:pull token for registry-1.docker.io    0.0s
=> [internal] load .dockerignore                                 0.0s
=> => transferring context: 108B                                  0.0s
=> [1/5] FROM docker.io/library/python:3.10-slim@sha256:420fbb0e468d3eaf0f7e93ea6f7a48792cbcad39d43ac95b96bee2a 0.0s
=> => resolve docker.io/library/python:3.10-slim@sha256:420fbb0e468d3eaf0f7e93ea6f7a48792cbcad39d43ac95b96bee2a 0.0s
=> [internal] load build context                                0.0s
=> => transferring context: 413B                                  0.0s
=> CACHED [2/5] WORKDIR /app                                    0.0s
=> CACHED [3/5] COPY requirements.txt .                          0.0s
=> CACHED [4/5] RUN pip install --no-cache-dir -r requirements.txt 0.0s
=> [5/5] COPY . .                                              0.0s
=> exporting to image                                           0.6s
=> => exporting layers                                           0.1s
=> => exporting manifest sha256:f2d0c617b8804ae5ecb3bcb05cb0c99d2686c9f05beae37c80ba80c0f5fc1ad3 0.0s
=> => exporting config sha256:fa77659f112a97b7f7a231bd414fd17c72bc2fe6d0e53c3a6ebfe78c60a79b82 0.0s
=> => exporting attestation manifest sha256:1f8a28e83447acae346f113545d616d7a054ae1599f7acc2fece5bf39d32d6a2 0.0s
=> => exporting manifest list sha256:1ed8ae47af3c36c89ce415a1b3360398718d3f21884faefa56beedde392aa885 0.0s
=> => naming to docker.io/library/my-fastapi-app:latest         0.0s
=> => unpacking to docker.io/library/my-fastapi-app:latest      0.4s
E:\Docker>
```

`docker run -d -p 8000:8000 --name myfapi my-fastapi-app`

```
E:\Docker>docker run -d -p 8000:8000 --name myfapi my-fastapi-app
298ca24fc4898efcb634183a5223adf1c8dfdf80ff41eafabc7c6642efa60514d
E:\Docker>
```

```
C:\Users\satya>curl http://localhost:8000
{"message":"Running Fastapi Application in Docker"}
C:\Users\satya>
```

Exercise 4: Sharing Images

Objective: Push images to Docker Hub.

Create a Docker Hub account.

docker login

```
E:\Docker>docker login
Authenticating with existing credentials... [Username: vsatyamesc]

Info → To login with a different account, run 'docker logout' followed by 'docker login'

Login Succeeded
E:\Docker>
```

Tag your custom image.

docker tag my-fastapi-app vsatyamesc/my-fastapi-app:1.0

```
E:\Docker>docker tag my-fastapi-app vsatyamesc/my-fastapi-app:1.0
```

Push it to Docker Hub.

docker push vsatyamesc/my-fastapi-app:1.0

```
E:\Docker>docker push vsatyamesc/my-fastapi-app:1.0
The push refers to repository [docker.io/vsatyamesc/my-fastapi-app]
3089f05ad65c: Pushed
1c5d734de657: Pushed
79ec4d9b1aee: Mounted from vsatyamesc/my-fastapi-app
3a195ff1e161: Mounted from vsatyamesc/my-fastapi-app
72e8e193aa94: Mounted from vsatyamesc/my-fastapi-app
f1292944e9f5: Mounted from vsatyamesc/my-fastapi-app
396b1da7636e: Mounted from vsatyamesc/my-fastapi-app
aaca6c90868c: Mounted from vsatyamesc/my-fastapi-app
7732878f45d9: Mounted from vsatyamesc/my-fastapi-app
1.0: digest:
sha256:1ed8ae47af3c36c89ce415a1b3360398718d3f21884faefa56be
edde392aa885 size: 856
```

```
E:\Docker>docker push vsatyamesc/my-fastapi-app:1.0
The push refers to repository [docker.io/vsatyamesc/my-fastapi-app]
3089f05ad65c: Pushed
1c5d734de657: Pushed
79ec4d9b1aee: Mounted from vsatyamesc/my-fastapi-app
3a195ff1e161: Mounted from vsatyamesc/my-fastapi-app
72e8e193aa94: Mounted from vsatyamesc/my-fastapi-app
f1292944e9f5: Mounted from vsatyamesc/my-fastapi-app
```

```
396b1da7636e: Mounted from vsatyamesc/my-fastapi-app
aaca6c90868c: Mounted from vsatyamesc/my-fastapi-app
7732878f45d9: Mounted from vsatyamesc/my-fastapi-app
1.0: digest: sha256:1ed8ae47af3c36c89ce415a1b3360398718d3f21884faefa56beedde392aa885 size:
856
```

Pull it from Docker Hub.

```
docker pull vsatyamesc/my-fastapi-app:1.0
```

```
E:\Docker>docker pull vsatyamesc/my-fastapi-app:1.0
1.0: Pulling from vsatyamesc/my-fastapi-app
Digest: sha256:1ed8ae47af3c36c89ce415a1b3360398718d3f21884faefa56beedde392aa885
Status: Downloaded newer image for vsatyamesc/my-fastapi-app:1.0
docker.io/vsatyamesc/my-fastapi-app:1.0
```

Reflection: Why is image tagging important, and what sort of tagging strategy can we use?

Image tagging is crucial for version control. It allows to differentiate between versions e.g. app:1.0, app:1.1, app:latest.

Exercise 5: Data Persistence with Volumes

Objective: Use volumes to persist container data.

Launch a busybox container with a named volume.

```
docker volume create myvol
```

Insert sample data.

Stop, remove, and relaunch to verify persistence.

The below screenshot contains the answer for the above 3 objective points.

```
E:\Docker>docker volume create myvol
myvol

E:\Docker>docker run -it --rm -v myvol:/data busybox sh
Unable to find image 'busybox:latest' locally
latest: Pulling from library/busybox
80bfbb8a41a2: Pull complete
Digest: sha256:ab33eacc8251e3807b85bb6dba570e4698c3998eca6f0fc2ccb60575a563ea74
Status: Downloaded newer image for busybox:latest
/ # ls
bin    data   dev    etc    home   lib    lib64  proc   root   sys    tmp    usr    var
/ # cd data
/data # echo "My first volume data" > log.txt
/data # ls
log.txt
/data # cat log.txt
My first volume data
/data # exit

E:\Docker>docker run -it --rm -v myvol:/data busybox sh
/ # ls
bin    data   dev    etc    home   lib    lib64  proc   root   sys    tmp    usr    var
/ # cd data
/data # cat log.txt
My first volume data
/data #
```

```

E:\Docker>docker volume create myvol
myvol

E:\Docker>docker run -it --rm -v myvol:/data busybox sh
Unable to find image 'busybox:latest' locally
latest: Pulling from library/busybox
80bfbb8a41a2: Pull complete
Digest: sha256:ab33eacc8251e3807b85bb6dba570e4698c3998eca6f0fc2ccb60575a563ea74
Status: Downloaded newer image for busybox:latest
/ # ls
bin    data    dev      etc      home    lib      lib64   proc    root    sys      tmp      usr      var
/ # cd data
/data # echo "My first volume data" > log.txt
/data # ls
log.txt
/data # cat log.txt
My first volume data
/data # exit

E:\Docker>docker run -it --rm -v myvol:/data busybox sh
/ # ls
bin    data    dev      etc      home    lib      lib64   proc    root    sys      tmp      usr      var
/ # cd data
/data # cat log.txt
My first volume data
/data #

```

Try bind mount using -v \$(pwd)/data:/data.

```

E:\Docker>mkdir myDockerData

E:\Docker>cd myDockerData

E:\Docker\myDockerData>echo "This is not contained in Docker" > logs.txt

E:\Docker\myDockerData>cd ..

E:\Docker>docker run -it --rm -v "%cd%\myDockerData:/data" busybox sh
/ # ls
bin    data    dev      etc      home    lib      lib64   proc    root    sys      tmp      usr      var
/ # cd data
/data # ls
logs.txt
/data # cat logs.txt
"This is not contained in Docker"
/data # exit

E:\Docker>

```

```

E:\Docker>mkdir myDockerData

E:\Docker>cd myDockerData

E:\Docker\myDockerData>echo "This is not contained in Docker" > logs.txt

E:\Docker\myDockerData>cd ..

E:\Docker>docker run -it --rm -v "%cd%\myDockerData:/data" busybox sh
/ # ls
bin    data    dev      etc      home    lib      lib64   proc    root    sys      tmp      usr      var
/ # cd data
/data # ls
logs.txt
/data # cat logs.txt
"This is not contained in Docker"
/data # exit

```


Compare: Named volume vs bind mount. Pros/cons?

Named Volume – Named volume are created and managed by docker itself. The actual data is stored in docker's dedicated system.

Pros:

- Fully managed by docker
- Platform independent
- Safe and secure
- Easier to backup and migrate

Cons: Harder to edit directly

Bind Volume – A bind volume directly maps a specific file or folder from host machine into a container. You need to provide full directory path on your computer though.

Pros –

- Easy to edit files
- Simple to understand
- Good for configuration

Cons – Platform Independent and Potential Security Risk

Exercise 6: Container Network Basics

Objective: Set up communication between containers.

Start a nginx container and a busybox container.

```
docker run -d --name webNginx --network ex7 nginx
```

```
E:\Docker>docker run -d --name webNginx --network ex7 nginx
0408e23f5fcec81e98d9c00a2650988794dbbe057cbafdb5da0878a11aae87
```

```
docker run -it --rm --network ex7 busybox sh
```

```
E:\Docker>docker run -it --rm --network ex7 busybox sh
/ #
```

Create a user-defined bridge network.

```
docker network create ex7
```

```
E:\Docker>docker network create ex7
a05db945a4a517c3c9ed227aa7bdfcfe3316e6314071f167ae434e112f4ca2e5
```

Attach both containers to the network.

```
docker run -it --rm --network ex7 busybox sh
```

```
E:\Docker>docker run -it --rm --network ex7 busybox sh
/ #
```

```
docker run -d --name webNginx --network ex7 nginx
```

```
E:\Docker>docker run -d --name webNginx --network ex7 nginx
0408e23f5fcec81e98d9c00a2650988794dbbe057cbafdb5da0878a11aae87
```

From busybox, use wget or curl to access nginx.

```
E:\Docker>docker run -it --rm --network ex7 busybox sh
/ # wget -qO- webNginx
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
html { color-scheme: light dark; }
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial, sans-serif; }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>

<p>For online documentation and support please refer to
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>

<p><em>Thank you for using nginx.</em></p>
</body>
</html>
/ #
```

Exercise 7: Building a Two-Tier App

Objective: Deploy a small web + DB stack without Compose.

Manually run a Python/Flask app container and a Postgres container **with Persistent DB data**

```
docker run -d --name postgres_db --network twoTierApp -e POSTGRES_PASSWORD=12345678 -v db-data:/var/lib/postgresql/data postgres:17-alpine
```

```
E:\Docker>docker run -d --name postgres_db --network twoTierApp -e POSTGRES_PASSWORD=12345678 -v db-data:/var/lib/postgresql/data postgres:17-alpine
Unable to find image 'postgres:17-alpine' locally
17-alpine: Pulling from library/postgres
8a522c167628: Pull complete
b371728df847: Pull complete
3adc8244e815: Pull complete
8b2ebe280d1d: Pull complete
19b7158d0417: Pull complete
2f0a42db08e5: Pull complete
5e8b0a3e4d41: Pull complete
b0d2c35748e9: Pull complete
505d15b87a28: Pull complete
Digest: sha256:3406990b6e4c7192317b6fdc5680498744f6142f01f0287f4ee0420d8c74063c
Status: Downloaded newer image for postgres:17-alpine
9c26d4975c5977bdc7529a609cfe222ce12317aa42b70dc4e64b95c745988d5b

E:\Docker>
```

```
docker run -d --name postgres_db --network twoTierApp -e POSTGRES_PASSWORD=12345678 -v db-data:/var/lib/postgresql/data postgres:17-alpine
```

```
E:\Docker>docker build -t exercise7 .
[+] Building 3.3s (10/10) FINISHED
=> [internal] load build definition from Dockerfile
=> => transferring dockerfile: 303B
=> [internal] load metadata for docker.io/library/python:3.10-slim
=> [internal] load .dockerignore
=> => transferring context: 122B
=> [1/5] FROM docker.io/library/python:3.10-slim@sha256:420fbb0e468d3eaf0f7e93ea6f7a48792cbcad39d43ac95b96bee2afe4367da
=> => resolve docker.io/library/python:3.10-slim@sha256:420fbb0e468d3eaf0f7e93ea6f7a48792cbcad39d43ac95b96bee2afe4367da
=> [internal] load build context
=> => transferring context: 923B
=> CACHED [2/5] WORKDIR /app
=> CACHED [3/5] COPY requirements.txt .
=> CACHED [4/5] RUN pip install --no-cache-dir -r requirements.txt
=> [5/5] COPY . .
=> exporting to image
=> => exporting layers
=> => exporting manifest sha256:a3ba9aebe95ecf0b5e6def7b8bd4489caac78594a3639e433a8649c29d0dc710
=> => exporting config sha256:d19396708aae437d8a448b8feca6a29dd39ed266fc651e698b4f327c685055f2
=> => exporting attestation manifest sha256:199feb78156243f853fc5f7414ef0bba8899d62a01639ac48c501ae47ff3ff49
=> => exporting manifest list sha256:0c3916fa0e8c06d01377512505665d78022dd5c9573f5f04eddc165f6385f241
=> => naming to docker.io/library/exercise7:latest
=> => unpacking to docker.io/library/exercise7:latest
```

```
E:\Docker>docker run -d --name exec7app --network twoTierApp -p 8000:8000 -e DB_PASSWORD=12345678 exercise7
5d0edd2c58a8b1d55d2fd67a25f20f5b15fd93894766a5877339a9a8ab4811f0
```

App.py

```
from fastapi import FastAPI, Response
import os
import psycopg2

app = FastAPI()

def get_db():
    try:
        conn = psycopg2.connect(
            host="postgres_db",
            database="postgres",
            user="postgres",
            password=os.environ.get('DB_PASSWORD')
        )
        return conn
    except psycopg2.OperationalError as e:
        print(e)
        return str(e)
```

```

@app.get("/")
def root():
    return {"message": "Running Fastapi Application in Docker"}

@app.get("/db")
def db_status(response: Response):
    conn = get_db()
    if isinstance(conn, str):
        response.status_code = 500
        return {"message": "Error connecting to DB"}

    conn.close()
    return {"message": "Connected to DB successfully"}

```

Use environment variables to configure the connection.

```

E:\Docker>docker run -d --name exec7app --network twoTierApp -p 8000:8000 -e DB_PASSWORD=12345678 exercise7
5d0edd2c58a8b1d55d2fd67a25f20f5b15fd93894766a5877339a9a8ab4811f0

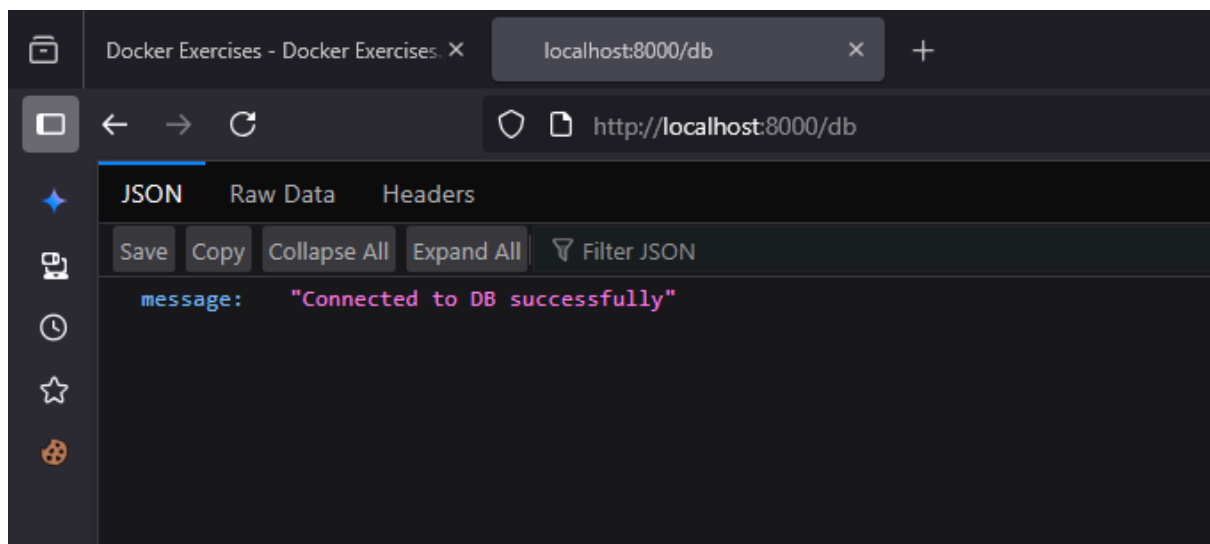
```

```

E:\Docker>docker run -d --name exec7app --network twoTierApp -p 8000:8000 -e
DB_PASSWORD=12345678 exercise7
5d0edd2c58a8b1d55d2fd67a25f20f5b15fd93894766a5877339a9a8ab4811f0

```

Verify the app connects to the DB and serves content.



Exercise 8: Docker Compose Basics

Objective: Use Compose to simplify multi-container apps.

Write a docker-compose.yml for FastAPI + Postgres.

```
version: "3.8"

services:
  api:
    build: .
    ports:
      - "8000:8000"
    environment:
      - DATABASE_URL=postgresql://postgres:12345678@db/postgres
    depends_on:
      db:
        condition: service_healthy
    restart: unless-stopped

  db:
    image: postgres:17-alpine
    volumes:
      - postgres_data:/var/lib/postgresql/data/
    environment:
      - POSTGRES_USER=postgres
      - POSTGRES_PASSWORD=12345678
      - POSTGRES_DB=postgres
    healthcheck:
      test: ["CMD-SHELL", "pg_isready -U user -d mydatabase"]
      interval: 10s
      timeout: 5s
      retries: 5
      restart: always

volumes:
  postgres_data:
```

Use docker compose up, inspect logs and containers.

```
E:\Docker>docker compose up -d --build
time="2025-08-23T15:45:54+05:30" level=warning msg="E:\\Docker\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion"
#1 [internal] load local bake definitions
#1 reading from stdin 460B done
#1 DONE 0.0s

#2 [internal] load build definition from Dockerfile
#2 transferring dockerfile: 303B done
#2 DONE 0.0s

#3 [internal] load metadata for docker.io/library/python:3.10-slim
#3 ...

#4 [auth] library/python:pull token for registry-1.docker.io
#4 DONE 0.0s

#3 [internal] load metadata for docker.io/library/python:3.10-slim
#3 DONE 3.5s

#5 [internal] load .dockerignore
#5 transferring context: 122B done
#5 DONE 0.0s

#6 [internal] load build context
```

```
#6 transferring context: 1.64kB done
#6 DONE 0.0s

#7 [1/5] FROM docker.io/library/python:3.10-
slim@sha256:420fbb0e468d3eaf0f7e93ea6f7a48792cbcad39d43ac95b96bee2afe4367da
#7 resolve docker.io/library/python:3.10-
slim@sha256:420fbb0e468d3eaf0f7e93ea6f7a48792cbcad39d43ac95b96bee2afe4367da 0.0s done#7 DONE
0.0s

#8 [2/5] WORKDIR /app
#8 CACHED

#9 [3/5] COPY requirements.txt .
#9 CACHED

#10 [4/5] RUN pip install --no-cache-dir -r requirements.txt
#10 CACHED

#11 [5/5] COPY . .
#11 DONE 0.0s

#12 exporting to image
#12 exporting layers 0.1s done
#12 exporting manifest sha256:626e636e6ff9f324585a7d7a1374a505eb54eaa5187ae28d5dc8983ef137e153
0.0s done
#12 exporting config sha256:e8ed0391a1ef19e591ba3ad584f777bf4c24cf70c3aacd97a4e5d55ca734dba4
0.0s done
#12 exporting attestation manifest
sha256:56ba69e9f22fb593a59eafcc298274550f8c264621d308dc1e612a06f369743d 0.0s done
#12 exporting manifest list
sha256:165d0a754bb78c7efacc868ba12fa8b9ac9ef6a988abb12c0672f73f1de0abda 0.0s done
#12 naming to docker.io/library/docker-api:latest done
#12 unpacking to docker.io/library/docker-api:latest
#12 unpacking to docker.io/library/docker-api:latest 0.4s done
#12 DONE 0.6s

#13 resolving provenance for metadata file
#13 DONE 0.0s
[+] Running 5/5
  ✓ docker-api Built
0.0s
  ✓ Network docker_default Created
0.0s
  ✓ Volume "docker_postgres_data" Created
0.0s
  ✓ Container docker-db-1 Healthy
11.0s
  ✓ Container docker-api-1 Started
11.1s
```

Docker compose up -d --build

```
E:\Docker>docker compose up -d --build
time="2025-08-23T15:45:54+05:30" level=warning msg="E:\\Docker\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion"
#1 [internal] load local bake definitions
#1 reading from stdin 460B done
#1 DONE 0.0s

#2 [internal] load build definition from Dockerfile
#2 transferring dockerfile: 303B done
#2 DONE 0.0s

#3 [internal] load metadata for docker.io/library/python:3.10-slim
#3 ...

#4 [auth] library/python:pull token for registry-1.docker.io
#4 DONE 0.0s

#3 [internal] load metadata for docker.io/library/python:3.10-slim
#3 DONE 3.5s

#5 [internal] load .dockerignore
#5 transferring context: 122B done
#5 DONE 0.0s

#6 [internal] load build context
#6 transferring context: 1.64kB done
#6 DONE 0.0s

#7 [1/5] FROM docker.io/library/python:3.10-slim@sha256:420fbb0e468d3eaf0f7e93ea6f7a48792cbcadc39d43ac95b96bee2afe4367da
#7 resolve docker.io/library/python:3.10-slim@sha256:420fbb0e468d3eaf0f7e93ea6f7a48792cbcadc39d43ac95b96bee2afe4367da 0.0s done#7 DONE 0.0s

#8 [2/5] WORKDIR /app
#8 CACHED

#9 [3/5] COPY requirements.txt .
#9 CACHED

#10 [4/5] RUN pip install --no-cache-dir -r requirements.txt
#10 CACHED

#11 [5/5] COPY . .
#11 DONE 0.0s

#12 exporting to image
#12 exporting layers 0.1s done
#12 exporting manifest sha256:626e636e6ff9f324585a7d7a1374a505eb54eaa5187ae28d5dc8983ef137e153 0.0s done
#12 exporting config sha256:e8ed0391a1ef19e591ba3ad584f777bf4c24cf70c3aacd97a4e5d55ca734dba4 0.0s done
#12 exporting attestation manifest sha256:56ba69e9f22fb593a59eafcc298274550f8c264621d308dc1e612a06f369743d 0.0s done
#12 exporting manifest list sha256:165d0a754bb78c7efacc868ba12fa8b9ac9ef6a988abb12c0672f73f1de0abda 0.0s done
#12 naming to docker.io/library/docker-api:latest done
#12 unpacking to docker.io/library/docker-api:latest
#12 unpacking to docker.io/library/docker-api:latest 0.4s done
#12 DONE 0.6s

#13 resolving provenance for metadata file
#13 DONE 0.0s

[*] Running 5/5
  docker-api Built 0.0s
  Network docker_default Created 0.0s
  Volume "docker_postgres_data" Created 0.0s
  Container docker-db-1 Healthy 11.0s
  Container docker-api-1 Started 11.1s
```

```
E:\Docker>docker compose ps
time="2025-08-23T15:47:51+05:30" level=warning msg="E:\\Docker\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion"
NAME                IMAGE              COMMAND                  SERVICE     CREATED      STATUS      PORTS
docker-api-1        docker-api         "uvicorn app:app --h..." api          About a minute ago Up About a minute 0.0.0.0:8000->8000/tcp, [::]:8000->8000/tcp
docker-db-1         postgres:17-alpine "docker-entrypoint.s..." db           About a minute ago Up About a minute (healthy) 5432/tcp
```

docker compose ps

```
E:\Docker>docker compose ps
time="2025-08-23T15:48:58+05:30" level=warning msg="E:\\Docker\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion"
NAME                IMAGE              COMMAND                  SERVICE     CREATED      STATUS      PORTS
docker-api-1        docker-api         "uvicorn app:app --h..." api          About a minute ago Up About a minute 0.0.0.0:8000->8000/tcp, [::]:8000->8000/tcp
docker-db-1         postgres:17-alpine "docker-entrypoint.s..." db           About a minute ago Up About a minute (healthy) 5432/tcp

E:\Docker>docker compose logs api
time="2025-08-23T15:48:58+05:30" level=warning msg="E:\\Docker\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion"
api-1 | INFO: Started server process [1]
api-1 | INFO: Waiting for application startup.
api-1 | INFO: Application startup complete.
api-1 | INFO: Uvicorn running on http://0.0.0.0:8000 (Press CTRL+C to quit)
```

```
E:\Docker>docker compose logs api
time="2025-08-23T15:48:58+05:30" level=warning msg="E:\\Docker\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion"
api-1 | INFO:      Started server process [1]
api-1 | INFO:      Waiting for application startup.
api-1 | INFO:      Application startup complete.
api-1 | INFO:      Uvicorn running on http://0.0.0.0:8000 (Press CTRL+C to quit)
```

Add health checks and environment variables.

Use depends_on, restart policies.

```
docker-compose.yml
1  version: "3.8"
2
3  services:
4    api:
5      build: .
6      ports:
7        - "8000:8000"
8      environment:
9        - DATABASE_URL=postgresql://postgres:12345678@db/postgres
10     depends_on:
11       db:
12         condition: service_healthy
13     restart: unless-stopped
14
15     db:
16       image: postgres:17-alpine
17       volumes:
18         - postgres_data:/var/lib/postgresql/data/
19       environment:
20         - POSTGRES_USER=postgres
21         - POSTGRES_PASSWORD=12345678
22         - POSTGRES_DB=postgres
23       healthcheck:
24         test: ["CMD-SHELL", "pg_isready -U user -d mydatabase"]
25         interval: 10s
26         timeout: 5s
27         retries: 5
28         restart: always
29
30     volumes:
31       postgres_data:
32
```

Exercise 9: Health checks and Best Practices

Objective: Make robust, production-like Dockerfiles.

Add HEALTHCHECK instruction to your Dockerfile.

```
HEALTHCHECK --interval=15s --timeout=3s --start-period=5s --retries=3 \ CMD curl -f  
http://localhost:8000/health || exit 1
```

Use ENTRYPOINT vs CMD appropriately.

```
CMD ["uvicorn", "app:app", "--host", "0.0.0.0", "--port", "8000"]
```

Minimize layers and image size (e.g., using alpine).

Dockerfile:

```
FROM python:3.10-slim
```

Docker-compose

```
image: postgres:17-alpine
```

Exercise 10: Debugging, Cleanup & Troubleshooting

Objective: Learn to manage resources and solve issues.

Run containers with bad commands or missing ports.

```
E:\Docker>docker run --name badcontainer alpine asdasda  
docker: Error response from daemon: failed to create task for container: failed to create shim task: OCI runtime create failed: runc creat  
d: unable to start container process: error during container init: exec: "asdasda": executable file not found in $PATH: unknown  
  
Run 'docker run --help' for more information
```

```
E:\Docker>docker run --name -p badcontainer nginx --d asdas  
Unable to find image 'badcontainer:latest' locally  
docker: Error response from daemon: pull access denied for badcontainer, repository does not exist or may require 'docker login'  
  
Run 'docker run --help' for more information
```

Clean up unused images, containers, volumes with

```
E:\Docker>docker container prune  
WARNING! This will remove all stopped containers.  
Are you sure you want to continue? [y/N] y  
Deleted Containers:  
b004ffd4122b6e54107b77ad01c6e76984821ccf0a4b31e6e751799f355f4d66  
  
Total reclaimed space: 4.096kB
```

```
E:\Docker>docker image prune  
WARNING! This will remove all dangling images.  
Are you sure you want to continue? [y/N] y  
Total reclaimed space: 0B
```