

Introduction to Docker

Yong Zhuang

Agenda

- ❖ **What is Docker**
- ❖ **Virtual Machines vs Containers**
- ❖ **Docker Architecture and Workflow**
- ❖ **Installing Docker**
- ❖ **Development Workflow**

What is Docker?

A platform for building, running, and shipping applications.

What is Docker?

Situation: Your application works on your development machine but doesn't somewhere else. Why?

What is Docker?

Situation: Your application works on your development machine but doesn't somewhere else. Why?

- **One or more files missing**

What is Docker?

Situation: Your application works on your development machine but doesn't somewhere else. Why?

- **One or more files missing**
- **Software version mismatch**

What is Docker?

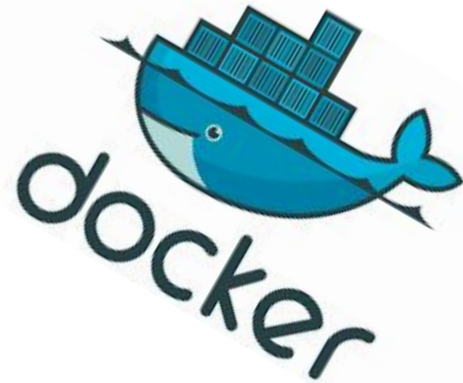
Situation: Your application works on your development machine but doesn't somewhere else. Why?

- **One or more files missing**
- **Software version mismatch**
- **Different configuration settings**

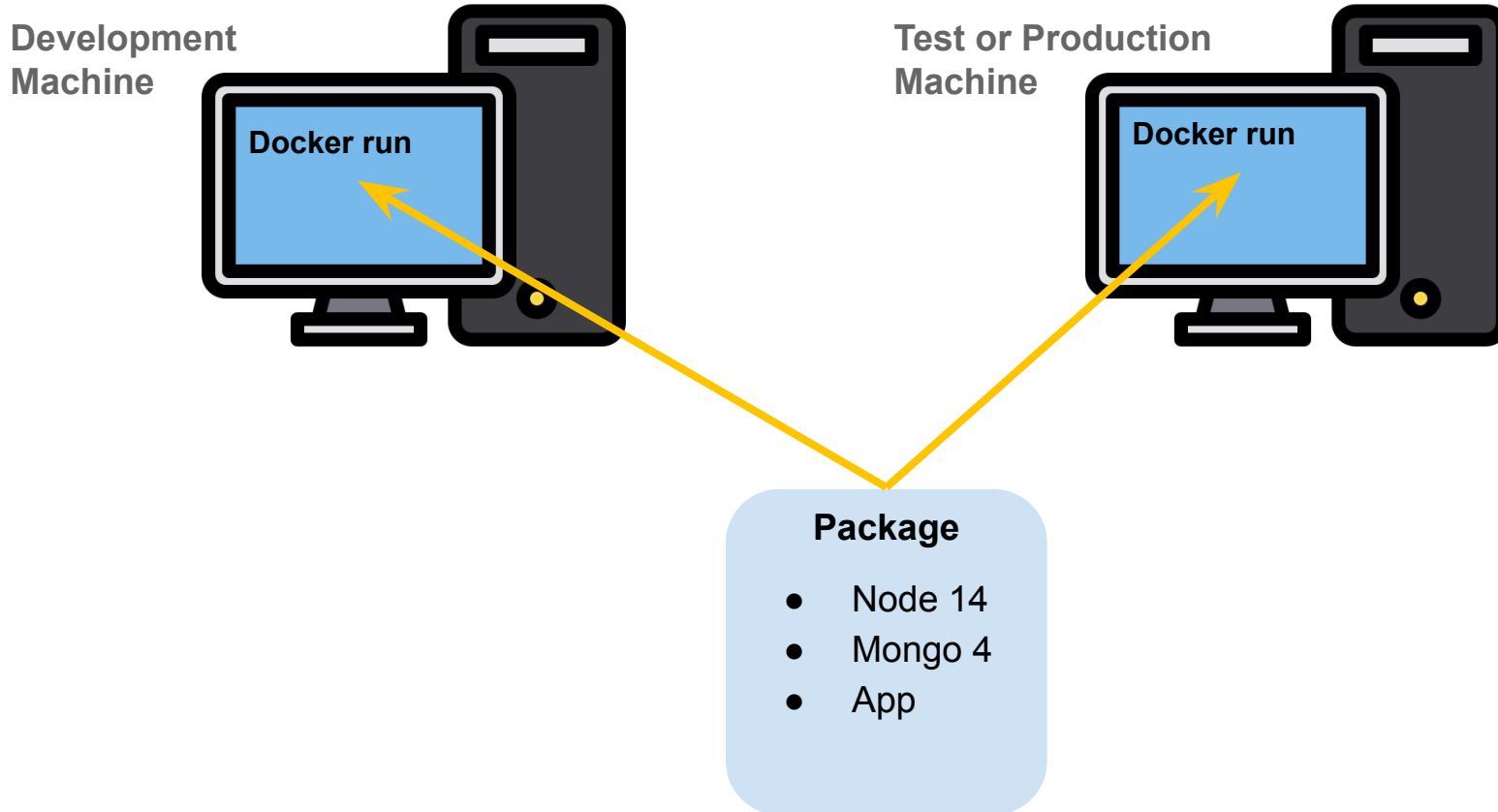
What is Docker?

Situation: Your application works on your development machine but doesn't somewhere else. Why?

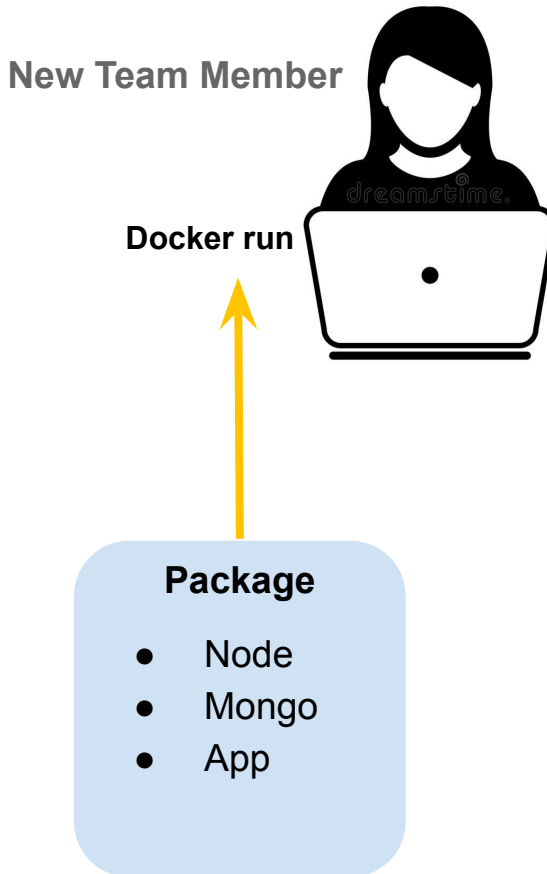
- **One or more files missing**
- **Software version mismatch**
- **Different configuration settings**



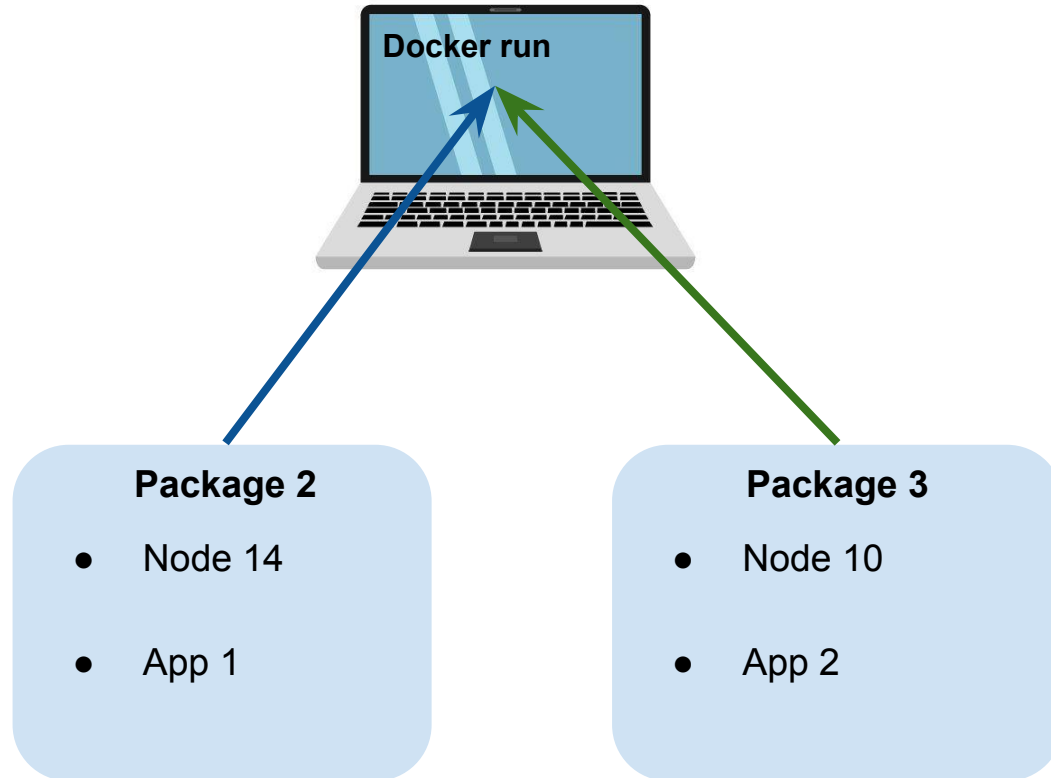
Advantage: Portability & Faster Deployments



Advantage: Sharing & Simplified dependency



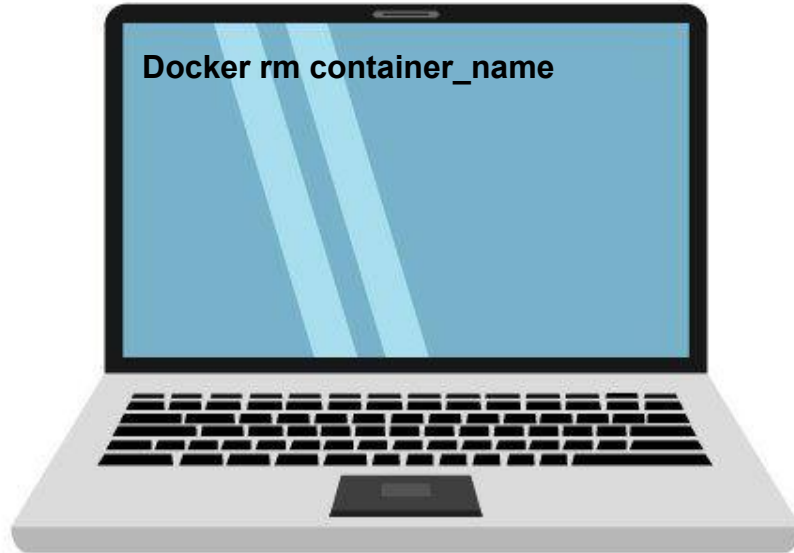
Advantage: Isolation & Security Sandbox



What is Docker?



What is Docker?



What is Docker?

A platform for
Consistently
building, running, and shipping applications.



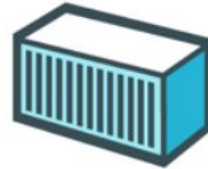
Build

Develop an app using Docker containers with any language and any toolchain.



Run

Scale to 1000s of nodes, move between data centers and clouds, update with zero downtime and more.



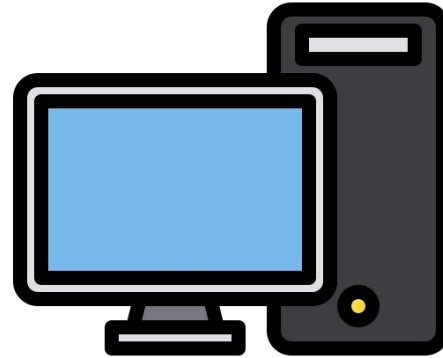
Ship

Ship the “Dockerized” app and dependencies anywhere - to QA, teammates, or the cloud - without breaking anything.

Virtual Machines

Virtual Machine

An abstraction of a machine
(physical hardware)



Virtual Machine 1

- Node 14
- App 1

Virtual Machine 2

- Node 10
- App 2

Virtual Machines

VM 1

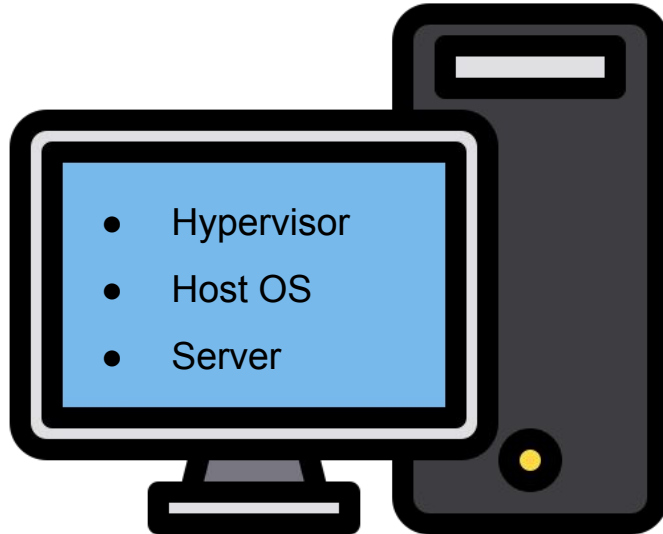
- App 2
- Bins/Libs
- Guest OS

VM 2

- App 2
- Bins/Libs
- Guest OS

Problems

- Each VM needs a OS
- Slow to start
- Resource intensive



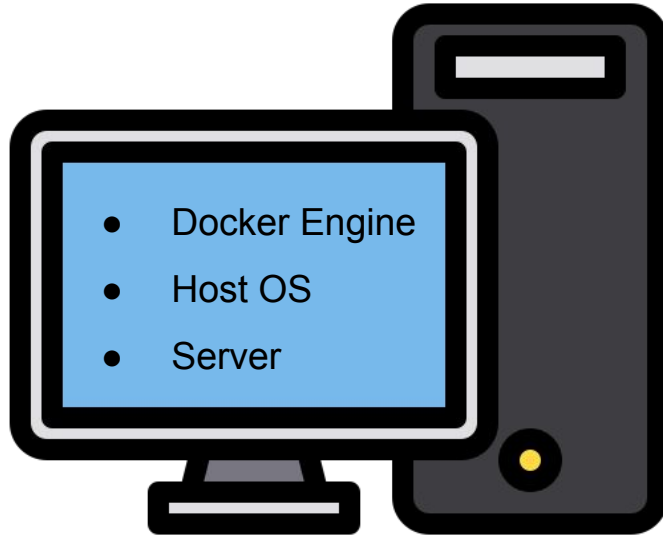
Docker Containers

Container 1

- App 2
- Bins/Libs

Container 2

- App 2
- Bins/Libs

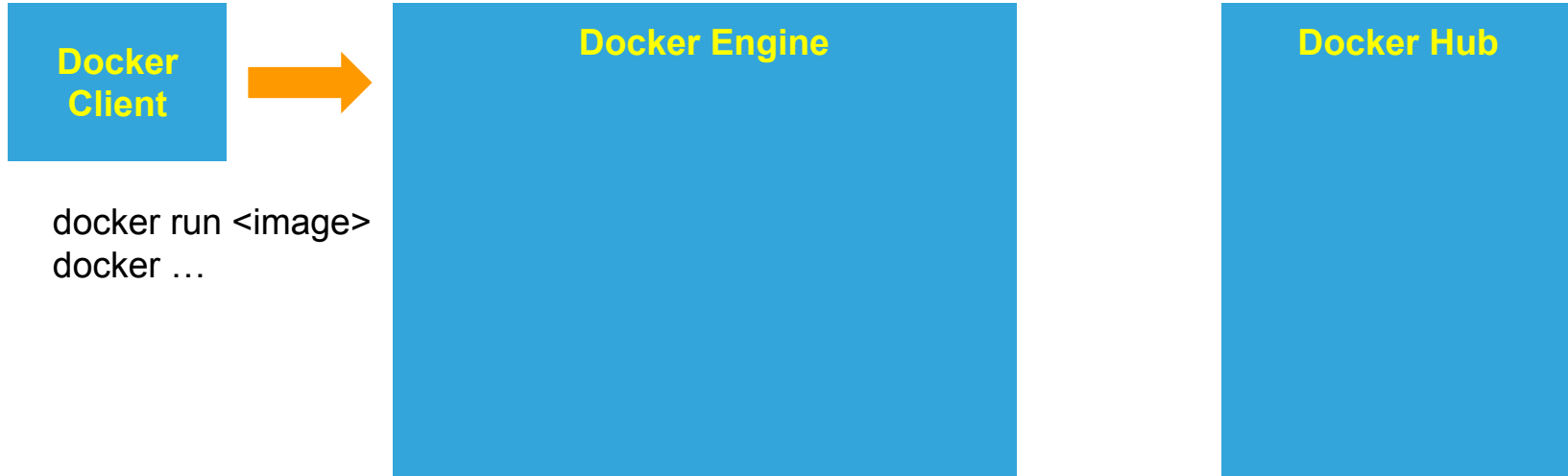


Docker Container

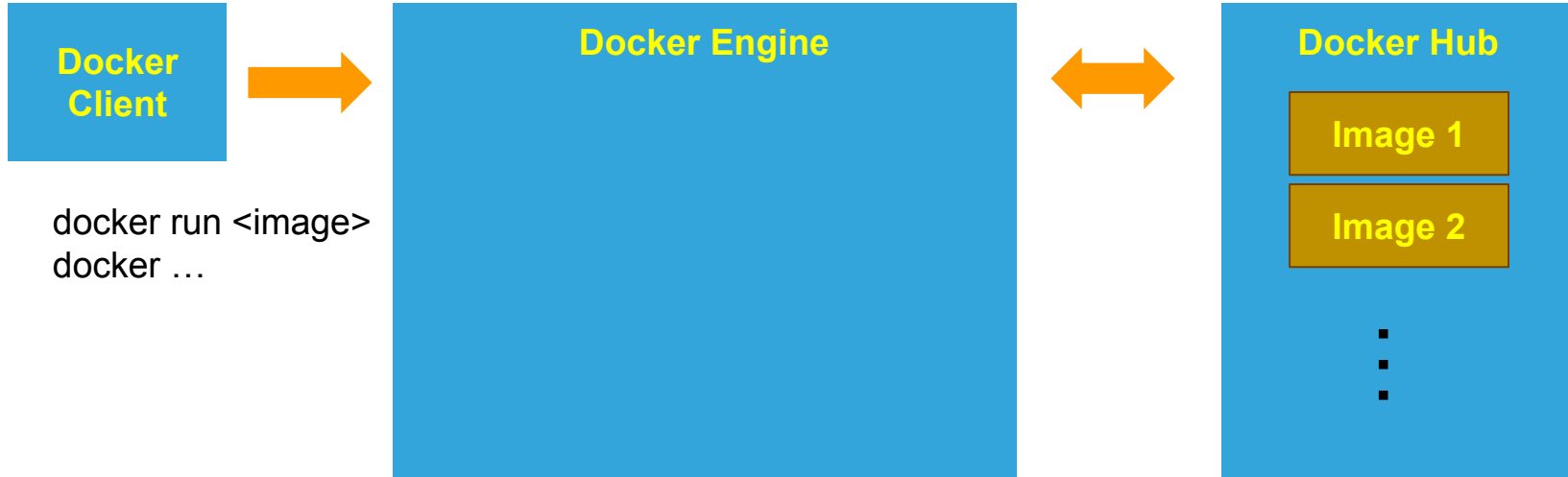
An isolated environment for running an application

- **Allow running multiple apps in isolation**
- **Are lightweight**
- **Use OS of the host**
- **Start quickly**
- **Need less hardware resources**

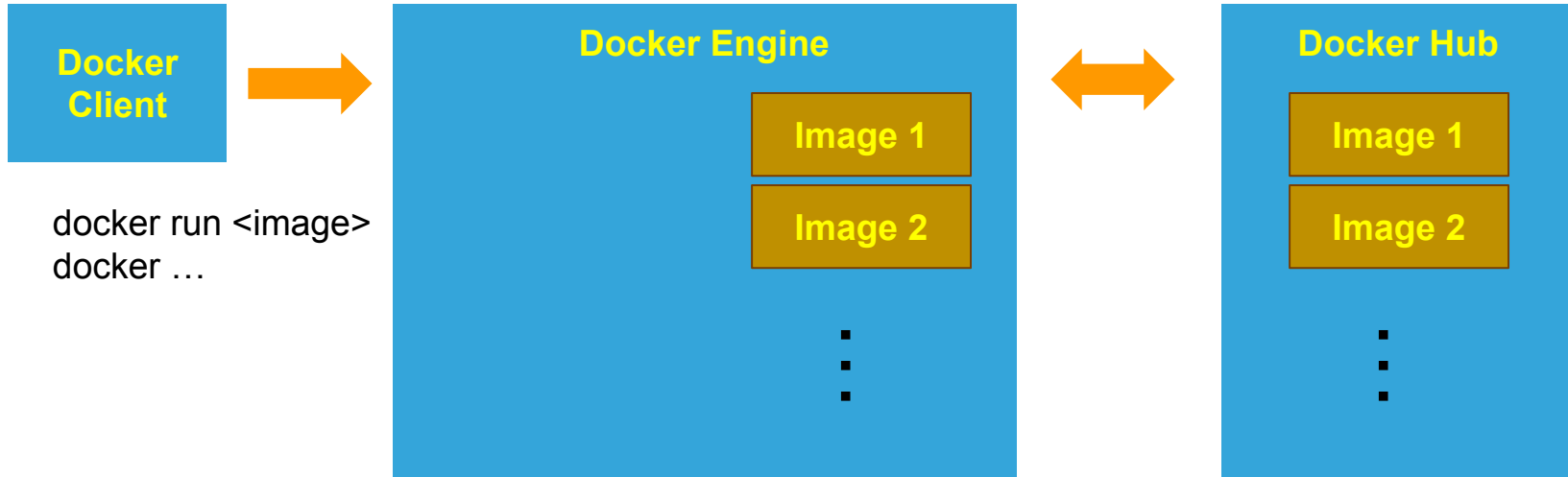
Docker Architecture and Workflow



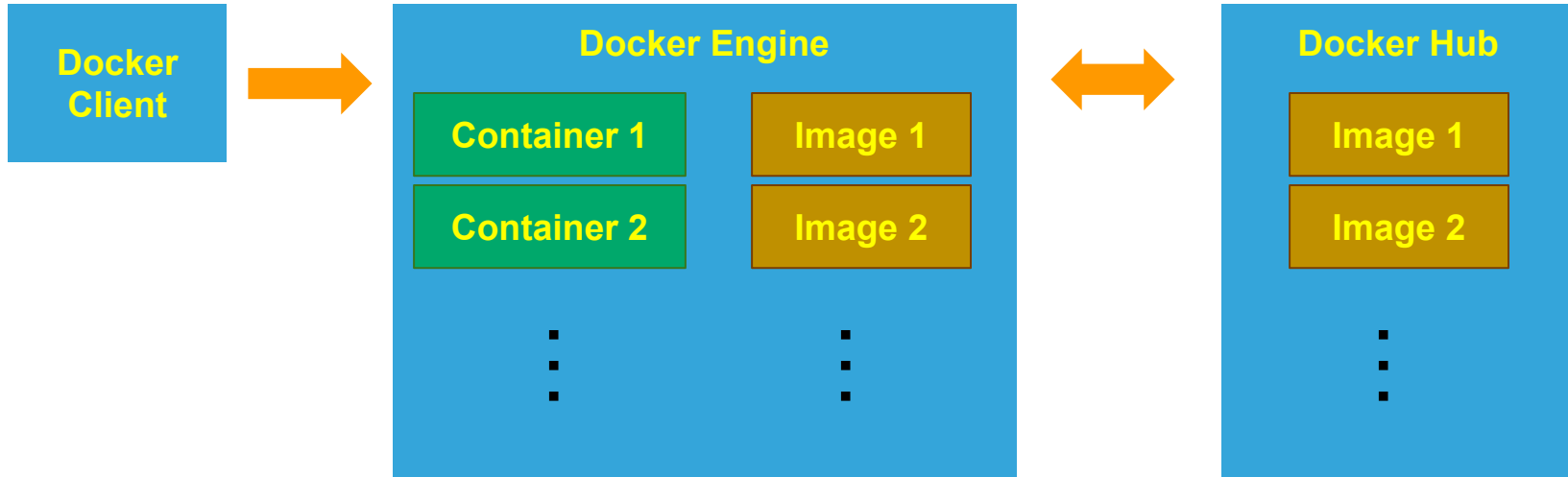
Docker Architecture and Workflow



Docker Architecture and Workflow




Docker Architecture and Workflow



Installing Docker

docker.com


Wasm is a fast, light alternative to Linux containers – try it out today with the [Docker+Wasm Beta](#).




 Products ▾ Developers ▾ Pricing Blog About Us ▾ Partners ▾ [Sign In](#) [Get Started](#)

Develop faster. Run anywhere.

The most-loved Tool in Stack Overflow's 2022 Developer Survey.

[Download Docker Desktop](#)

 Windows

 Apple Chip  Linux  Intel Chip

Installing Docker

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

 docker docs

[Home](#) [Guides](#) [Manuals](#) [Reference](#) [Samples](#) [Contribute](#)

[Home](#) / [Guides](#) / [Get Docker](#)

[Docker overview](#)

[Get Docker](#)

[Get started](#)

[Language-specific guides](#)

[Develop with Docker](#)

[Deploy your app to the cloud](#)


[Run your app in production](#)

[Educational resources](#)

Get Docker

Docker is an open platform for developing, shipping, and running applications. Docker enables you to separate your applications from your infrastructure so you can deliver software quickly. With Docker, you can manage your infrastructure in the same ways you manage your applications. By taking advantage of Docker's methodologies for shipping, testing, and deploying code quickly, you can significantly reduce the delay between writing code and running it in production.

You can download and install Docker on multiple platforms. Refer to the following section and choose the best installation path for you.



Docker Desktop for Mac

A native application using the macOS sandbox security model which delivers all Docker tools to your Mac.



Docker Desktop for Windows

A native Windows application which delivers all Docker tools to your Windows computer.




Docker Desktop for Linux

A native Linux application which delivers all Docker tools to your Linux computer.

Docker Hub

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

 dockerhub


[Explore](#) [Pricing](#) [Sign In](#) [Register](#)

Build and Ship any Application Anywhere

Docker Hub is the world's easiest way to create, manage, and deliver your team's container applications.


Get Started Today for Free

Already have an account? [Sign In](#)



☐ Send me occasional product updates and announcements.

☐ I agree to the [Subscription Service Agreement](#), [Privacy Policy](#), and [Data Processing Terms](#).


☐ I'm not a robot 

reCAPTCHA
Privacy - Terms

[Sign Up](#)

Visualstudio Code

<https://code.visualstudio.com/>

 Visual Studio Code

Docs Updates Blog API Extensions FAQ Learn

Search Docs

Download

Version 1.75 is now available! Read about the new features and fixes from January.

Code editing. Redefined.

Free. Built on open source. Runs everywhere.

Download for Windows










Stable Build

Web, Insiders edition, or other platforms

By using VS Code, you agree to its [license and privacy statement](#).

EXTENSIONS: MARKETPLACE

@sortinstalls

| | | | | |
|---|---|--------|---------|---------|
|  | Python 2019.6.24221 | 54.9M | 4.5 | |
| | Linting, Debugging (multi-threaded, ... | | | |
| | Microsoft | | Install | |
|  | GitLens — Git sup... | 23.1M | 5 | |
| | Supercharge the Git capabilities built... | | | |
| | Eric Amodio | | Install | |
|  | C/C++ 0.24.0 | 23M | 3.5 | |
| | C/C++ IntelliSense, debugging, and ... | | | |
| | Microsoft | | Install | |
|  | ESLint 1.9.0 | 21.9M | 4.5 | |
| | Integrates ESLint JavaScript into VS ... | | | |
| | Dirk Baesmer | | Install | |
|  | Debugger for Ch... | 4.11.6 | 20.6M | 4 |
| | Debug your JavaScript code in the C... | | | |
| | Microsoft | | | Install |
|  | Language Supp... | 0.47.0 | 18.7M | 4.5 |
| | Java Linting, Intellisense, formatting, ... | | | |
| | Red Hat | | | Install |
|  | vscode-icons 8.8.0 | 17.2M | 5 | |
| | Icons for Visual Studio Code | | | |
| | VSCode Icons Team | | | Install |
|  | Vetur 0.21.1 | 17M | 4.5 | |
| | Vue tooling for VS Code | | | |
| | Pine Wu | | | Install |
|  | C# 1.21.0 | 15.6M | 4 | |
| | C# for Visual Studio Code (powered ... | | | |
| | Microsoft | | | Install |

JS App.js

JS index.js

JS serviceWorker.js X

```
src > JS serviceWorker.js > register > window.addEventListener('load') callback
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
function registerValidSW(swUrl, config) {
  navigator.serviceWorker
    .register(swUrl)
    .then(registration => {
      checkValidServiceWorker(swUrl, config);
      // Add some additional logging to localhost, p...
      // service worker/PWA documentation.
      navigator.serviceWorker.ready.then(() => {
        product
        productSub
        removeSiteSpecificTrackingException
        removeWebWideTrackingException
        requestMediaKeySystemAccess
        sendBeacon
        serviceWorker (property) Navigator.serviceWork...
        storage
        storeSiteSpecificTrackingException
        storeWebWideTrackingException
        userAgent
        vendor
      })
    })
}
```

TERMINAL

1: node

You can now view **create-react-app** in the browser.

Local: <http://localhost:3000/>
On Your Network: <http://10.211.55.3:3000/>

Note that the development build is not optimized.

Ln 43, Col 19 Spaces: 2 UTF-8 LF JavaScript

Visualstudio Code: Install Docker Extension

The screenshot shows the Visual Studio Code interface with the Docker extension installed. The top bar indicates the extension is active: "Extension: Docker - node_hello_world - Visual Studio Code". The left sidebar shows the "EXTENSIONS" view with a search for "docker". The main panel displays the Docker extension details.

EXTENSIONS: Search:

- Docker** (768ms) **Microsoft** **Install**
- Docker Ex...** (519K) ★ 4.5 **Manage Docker Contain...** **Jun Han** **Install**
- Docker Co...** (280K) ★ 2 **Manage Docker Compos...** **p1c2u** **Install**
- Docker Linter** (185K) ★ 2 **Lint perl, python and/or r...** **Henrik Sjööh** **Install**
- Docker Ext...** (131K) ★ 5

Docker v1.24.0
Microsoft | 21,545,576 | ★★★★★ (79)
Makes it easy to create, manage, and debug containerized applications.
Disable **Uninstall**
This extension is enabled globally.

DETAILS | **FEATURE CONTRIBUTIONS** | **CHANGELOG** | **DEPENDENCIES** | **RUNTIME STATUS**

Docker for Visual Studio Code | **version** v1.24.0 | **installs** 22M | **Azure Pipelines** succeeded

The Docker extension makes it easy to build, manage, and deploy containerized applications from Visual Studio Code. provides one-click debugging of Node.js, Python, and .NET inside a container.

Dockerfile — web1

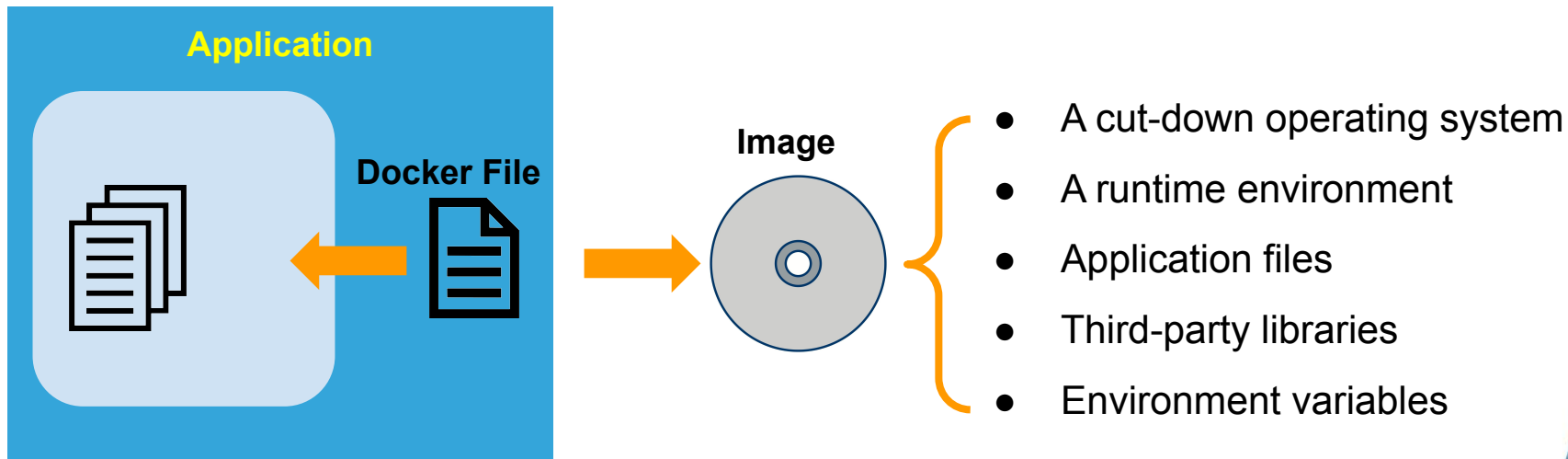
Version of Docker

Open a terminal and run: `docker version`

```
C:\Users\jazz1>docker version
Client:
 Cloud integration: v1.0.29
 Version:          20.10.22
 API version:      1.41
 Go version:       go1.18.9
 Git commit:       3a2c30b
 Built:            Thu Dec 15 22:36:18 2022
 OS/Arch:          windows/amd64
 Context:          default
 Experimental:     true

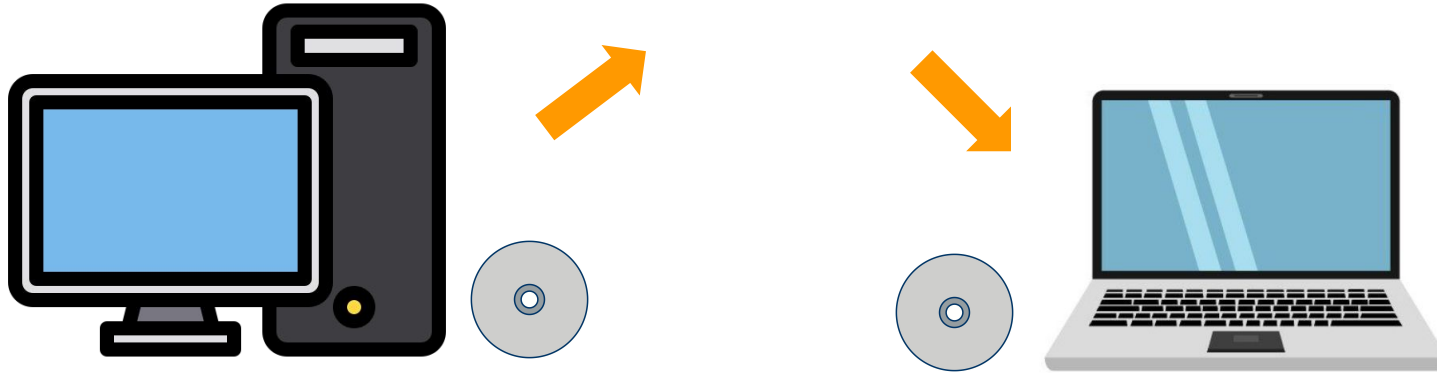
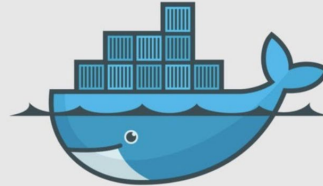
Server: Docker Desktop 4.16.3 (96739)
Engine:
 Version:          20.10.22
 API version:      1.41 (minimum version 1.12)
 Go version:       go1.18.9
 Git commit:       42c8b31
 Built:            Thu Dec 15 22:26:14 2022
 OS/Arch:          linux/amd64
 Experimental:     false
containerd:
 Version:          1.6.14
 GitCommit:        9ba4b250366a5ddde94bb7c9d1def331423aa323
runc:
 Version:          1.1.4
 GitCommit:        v1.1.4-0-g5fd4c4d
docker-init:
 Version:          0.19.0
 GitCommit:        de40ad0
```

Development Workflow




Development Workflow

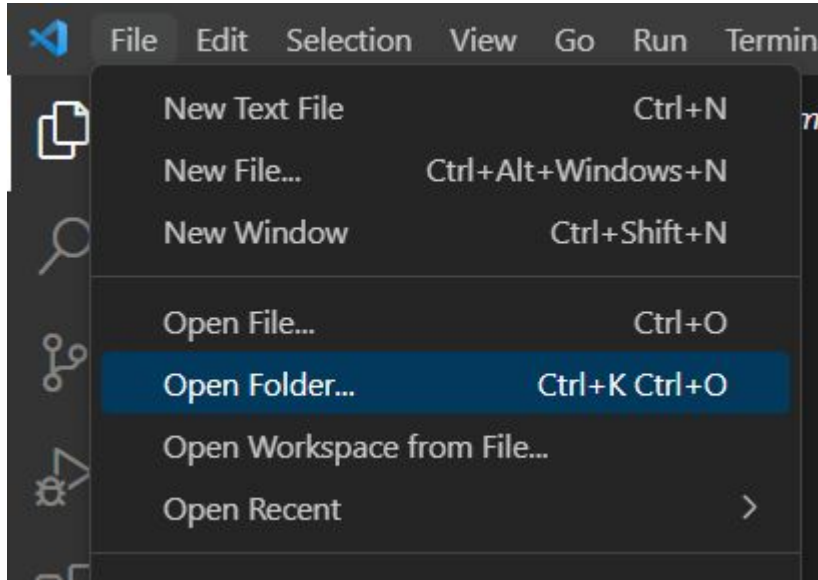
Docker Hub



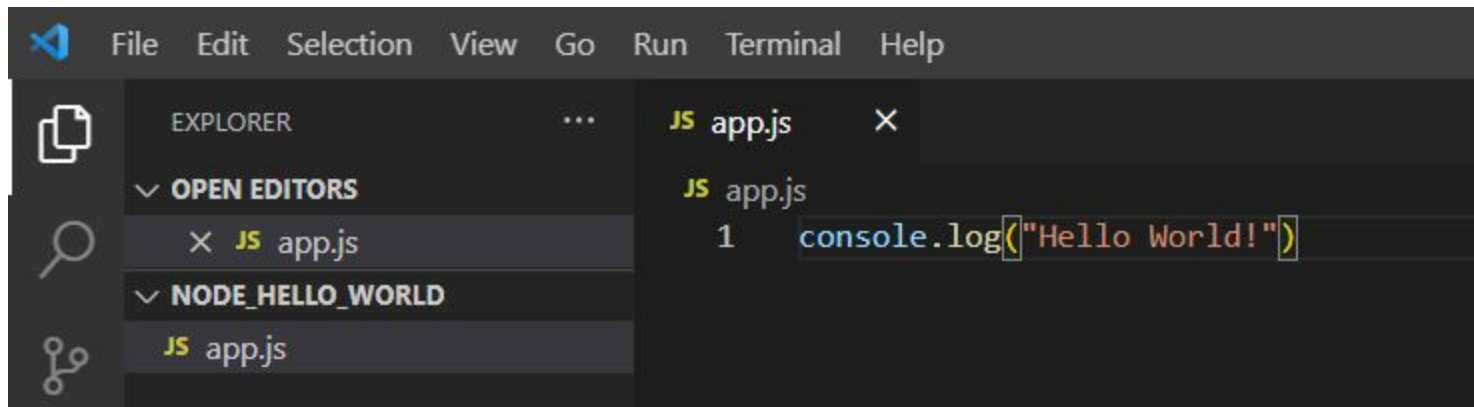
Example

| <input type="checkbox"/> | Name ^ | Date modified | Type |
|-------------------------------------|--|-------------------|-------------|
| <input checked="" type="checkbox"/> |  node_hello_world | 2/25/2023 1:58 PM | File folder |

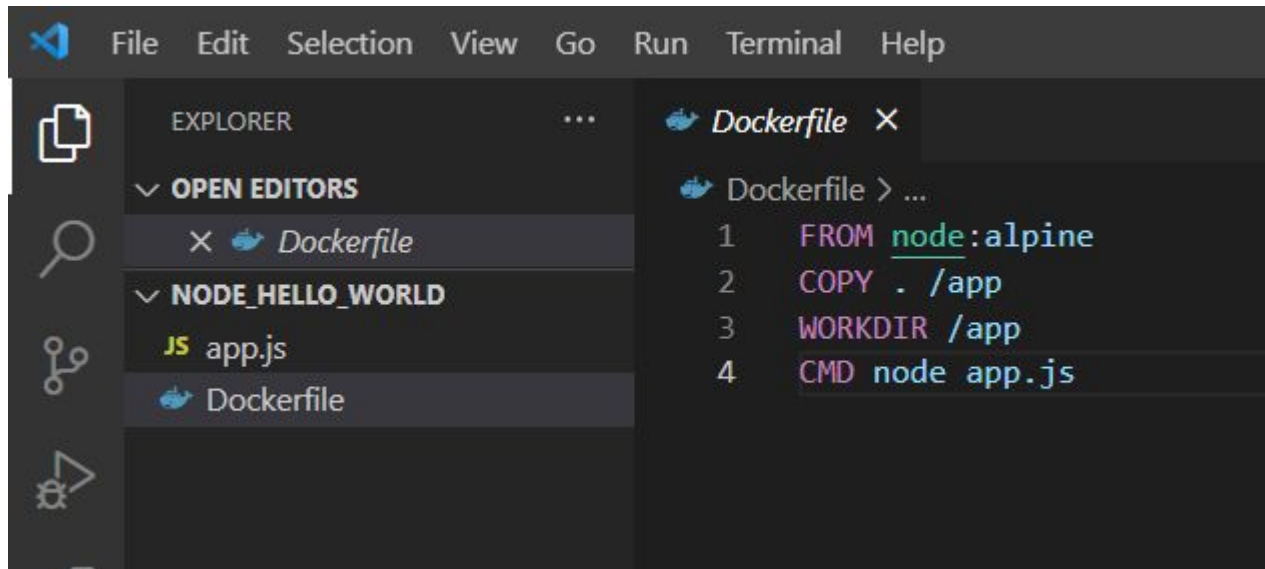
Create a hello world app



Create a hello world app



Write Dockerfile



The screenshot shows the Visual Studio Code interface with a dark theme. The Explorer sidebar on the left shows a project named 'NODE_HELLO_WORLD' containing two files: 'app.js' (JavaScript) and 'Dockerfile' (Dockerfile). The 'Dockerfile' is selected and open in the main editor. The editor shows the following content:

```
Dockerfile
```

```
1 FROM node:alpine
2 COPY . /app
3 WORKDIR /app
4 CMD node app.js
```

Build Image

CA Command Prompt

```
C:\Users\jazz1\Documents\My_Code\node_hello_world>docker build -t jazz14jazz/node-hello-world .  
[+] Building 1.0s (9/9) FINISHED  
=> [internal] load build definition from Dockerfile  
=> => transferring dockerfile: 31B  
=> [internal] load .dockerignore  
=> => transferring context: 2B  
=> [internal] load metadata for docker.io/library/node:alpine  
=> [auth] library/node:pull token for registry-1.docker.io  
=> [internal] load build context  
=> => transferring context: 56B  
=> [1/3] FROM docker.io/library/node:alpine@sha256:667dc6ed8fc6623ccd21cb5fa355c90f848daaf5d6df96bc940869bdfd91c19a  
=> CACHED [2/3] COPY . /app  
=> CACHED [3/3] WORKDIR /app  
=> exporting to image  
=> => exporting layers  
=> => writing image sha256:4ce9ffd8cc33f93973d662d399d14a92a14ab530e171aba2c8540bc9f8df562f  
=> => naming to docker.io/jazz14jazz/node-hello-world
```

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them

```
C:\Users\jazz1\Documents\My_Code\node_hello_world>docker images  
REPOSITORY          TAG          IMAGE ID      CREATED       SIZE  
jazz14jazz/node-hello-world  latest      4ce9ffd8cc33  4 minutes ago  177MB
```



Images in Docker Desktop




Docker Desktop


Upgrade plan


Search


Ctrl+K


jazz14...




Containers

Images

Volumes

Dev Environments BETA

Extensions

Add Extensions

Images

[Give feedback](#)

An image is a read-only template with instructions for creating a Docker container. [Learn more](#)




Local


Hub

998.26 MB / 998.26 MB in use 2 images

Last refresh: about 9 hours ago

Search

| <input type="checkbox"/> | Name | Tag | Status | Created | Size | Actions |
|--------------------------|---|--------|--------|---------------|----------|---|
| <input type="checkbox"/> | jazz14jazz/node-hello-world 4ce9ffd8cc33 | latest | Unused | 4 minutes ago | 176.5 MB |    |



Run app in Docker

❏ Select Command Prompt

```
C:\Users\jazz1\Documents\My_Code\node_hello_world>docker run jazz14jazz/node-hello-world
Hello World!
```

```
C:\Users\jazz1\Documents\My_Code\node_hello_world>docker ps -a
```


| CONTAINER ID | IMAGE | COMMAND | CREATED | STATUS | PORTS | NAMES |
|--------------|-----------------------------|--------------------------|----------------|---------------------------|-------|--------------|
| 3d85817053a1 | jazz14jazz/node-hello-world | "docker-entrypoint.s..." | 31 seconds ago | Exited (0) 29 seconds ago | | cool_swanson |


Push Docker Image to Dockerhub

Command Prompt

```
C:\Users\jazz1\Documents\My_Code\node_hello_world>docker push jazz1jazz/node-hello-world
Using default tag: latest
The push refers to repository [docker.io/jazz1jazz/node-hello-world]
5f70bf18a086: Layer already exists
d4e21369188e: Pushed
12e09510884d: Layer already exists
1194a4b7d675: Layer already exists
25927219b4b7: Layer already exists
7cd52847ad77: Layer already exists
latest: digest: sha256:c23cd62d78e8a57e257de8ccfde4398192042cef6735dcf3d74a1df48c231db3 size: 1571
```

Image in Dockhub



[Explore](#) [Repositories](#) [Organizations](#) [Help](#) 

jazz14jazz 

Search by repository name 


All Content 

Create repository

jazz14jazz / node-hello-world
Contains: Image | Last pushed: a minute ago

 Inactive  0  4  Public


Pull image

 **dockerhub**

Search Docker Hub

ExploreRepositoriesOrganizationsHelp

Upgrade

 jazz14jazz

jazz14jazz > Repositories > node-hello-world > Tags

Using 0 of 1 private repositories. [Get more](#)

GeneralTagsBuildsCollaboratorsWebhooksSettings

☐ Sort by Newest Filter Tags [Go to Advanced Image Management](#) Delete

☐

TAG

[latest](#)

Last pushed 4 minutes ago by [jazz14jazz](#)

| DIGEST | OS/ARCH | SCANNED | LAST PULL | COMPRESSED SIZE |
|------------------------------|-------------|---------|-----------|-----------------|
| c23cd62d78e8 | linux/amd64 | --- | --- | 51.4 MB |

docker pull jazz14jazz/node- ...

Pull image in Docker Desktop

Docker Desktop

Upgrade plan

Search

Ctrl+K

jazz14...

Containers

Images

Volumes

Dev Environments BETA

Extensions

Add Extensions

Images

Give feedback

An image is a read-only template with instructions for creating a Docker container. [Learn more](#)

LocalHub

jazz14jazz

| | TAGS | OS | VULNERABILITIES | LAST PUSHED | SIZE |
|-----------------------------|------------|-------|-----------------|------------------|----------|
| jazz14jazz/morn | latest | linux | Not available | over 2 years ago | 1.78 GB |
| jazz14jazz/tutoring | tf.latest | linux | Not available | over 1 year ago | 2.97 GB |
| | tf.2.0 | linux | Not available | over 1 year ago | 2.23 GB |
| | tf.nightly | linux | Not available | over 1 year ago | 2.97 GB |
| See more | | | | | |
| jazz14jazz/node-hello-world | latest | linux | Not available | 2 minutes ago | 53.89 MB |

View in Hub

Pull

Repositories per page 5 6-8 of 8

Docker commands

<https://docs.docker.com/engine/reference/commandline/docker/>

Thank You!
Questions &
Answers