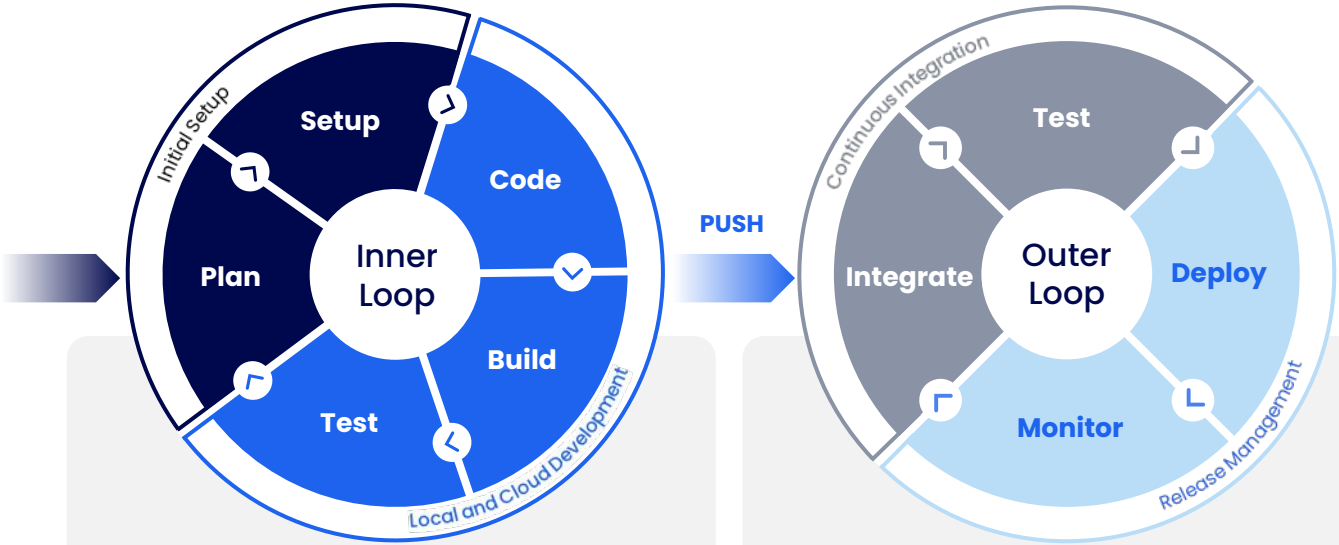
Module Three

Docker Desktop: Developer Focused

Inner Loop
Outer Loop

Development with Docker



Initial Setup

Docker Desktop
- IDE Extensions
- Tilt.dev
- Compose
- Dockerfile
- Autobuild

Docker Hub
- Trusted Content
- Private Registries
- Public Registries
- Extensions

Docker Scout
- Policy Evaluation

Local & Cloud Development

Docker Desktop
- Engine
- Buildkit
- Compose
- Kubernetes
- Debug
- Extensions

Docker Hub
- Trusted Content
- Extensions

Docker Scout
- Image Analysis

Docker Build Cloud
- Builders

Docker Testcontainers
- Cloud

Continuous Integration

Docker Desktop
- Engine
- Autobuild
- Buildkit
- Compose
- Github Action
- Github Copilot

Docker Hub
- Trusted Content
- Extensions

Docker Scout
- Image Analysis

Release Management

Docker Hub

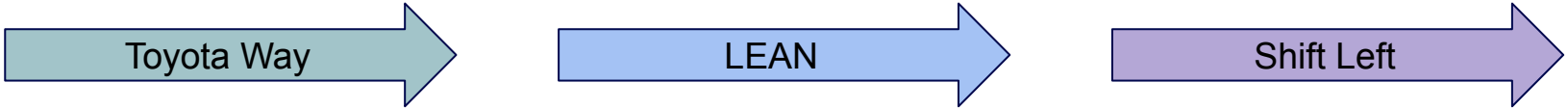
Docker Scout

Shift Left?

Me: Circa 2003

“Shift Left” originates from the idea of moving tasks earlier on a timeline that reads left to right

Following a Trend



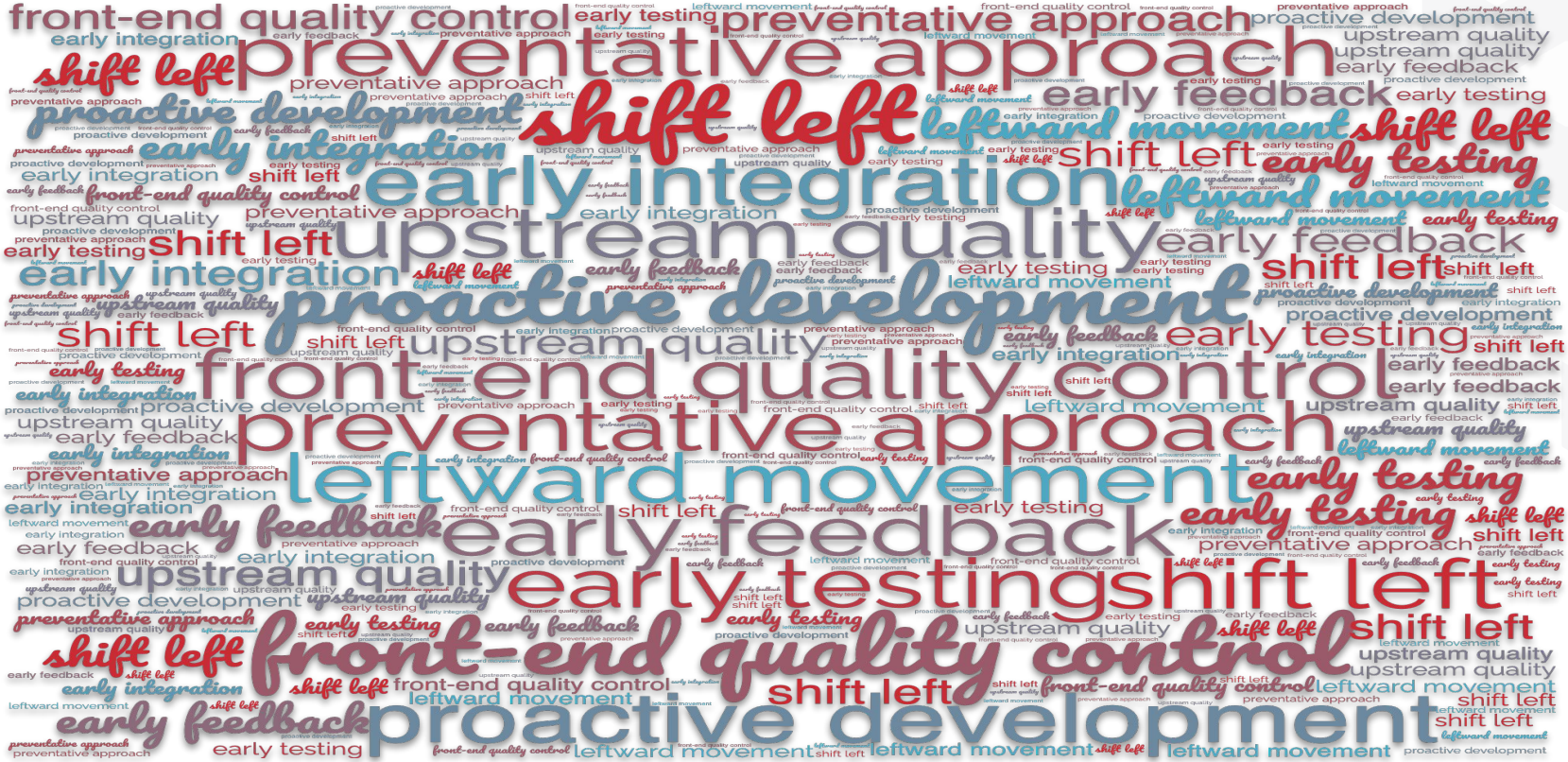
- Continuous Improvement
- Respect for People
- Long-Term Philosophy
- The Right Process Will Produce the Right Results
- Add Value to the Organization by Developing People

- Value Focus
- Lean Principles
- Waste Elimination
- Empowerment of Teams
- Continuous Flow and Pull

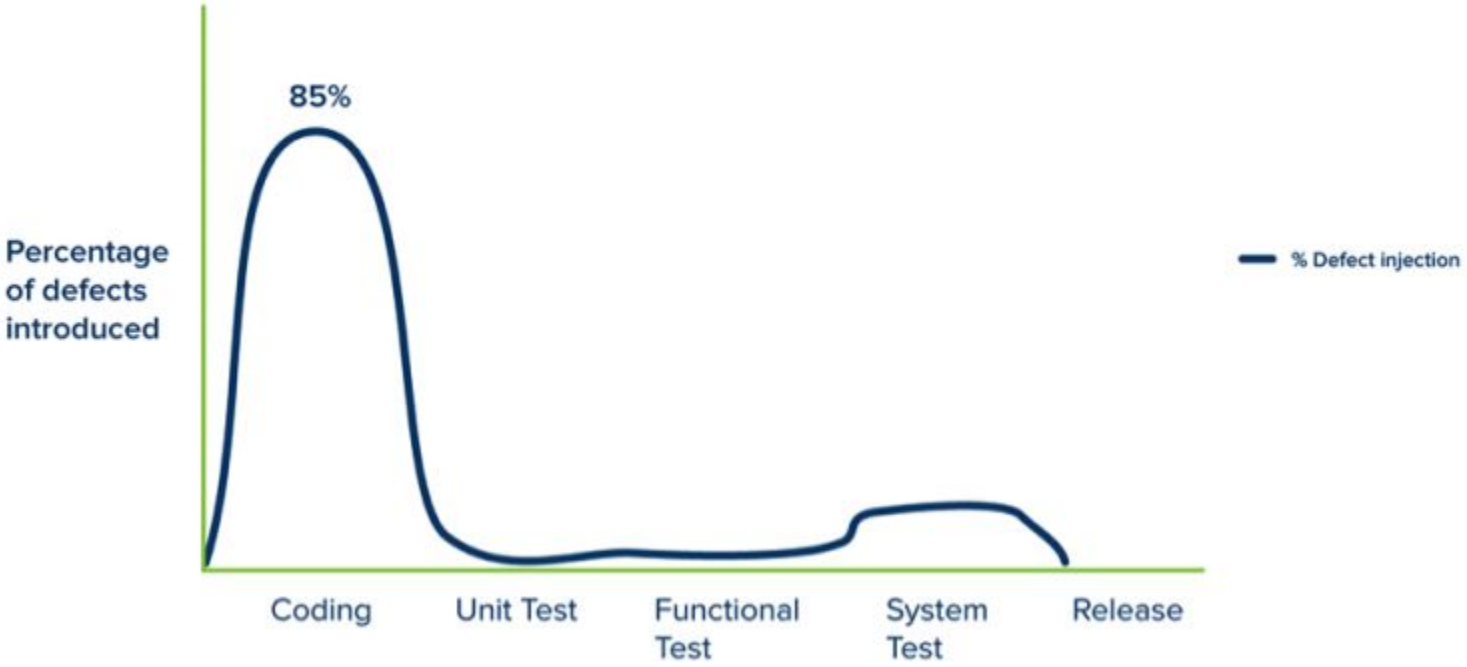
- Early Integration
- Proactive Problem-Solving
- Faster Feedback Loops
- Collaboration and Communication
- Automation and Efficiency

efficiency
continuous improvement
value optimization

Many Names, Similar Goals



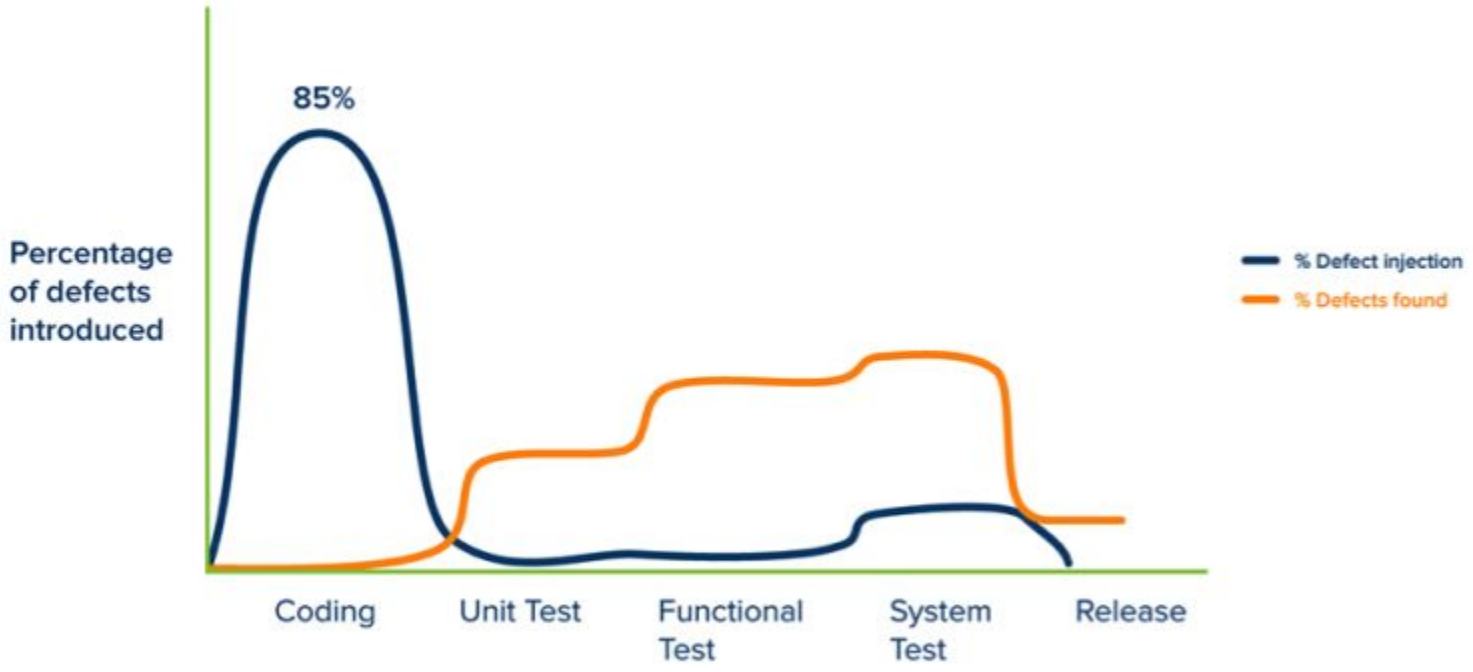
When do Defects Happen?



Jones, Capers. *Applied Software Measurement: Global Analysis of Productivity and Quality.*

Source: https://www.oreilly.com/library/view/applied-software-measurement/9780071502443/

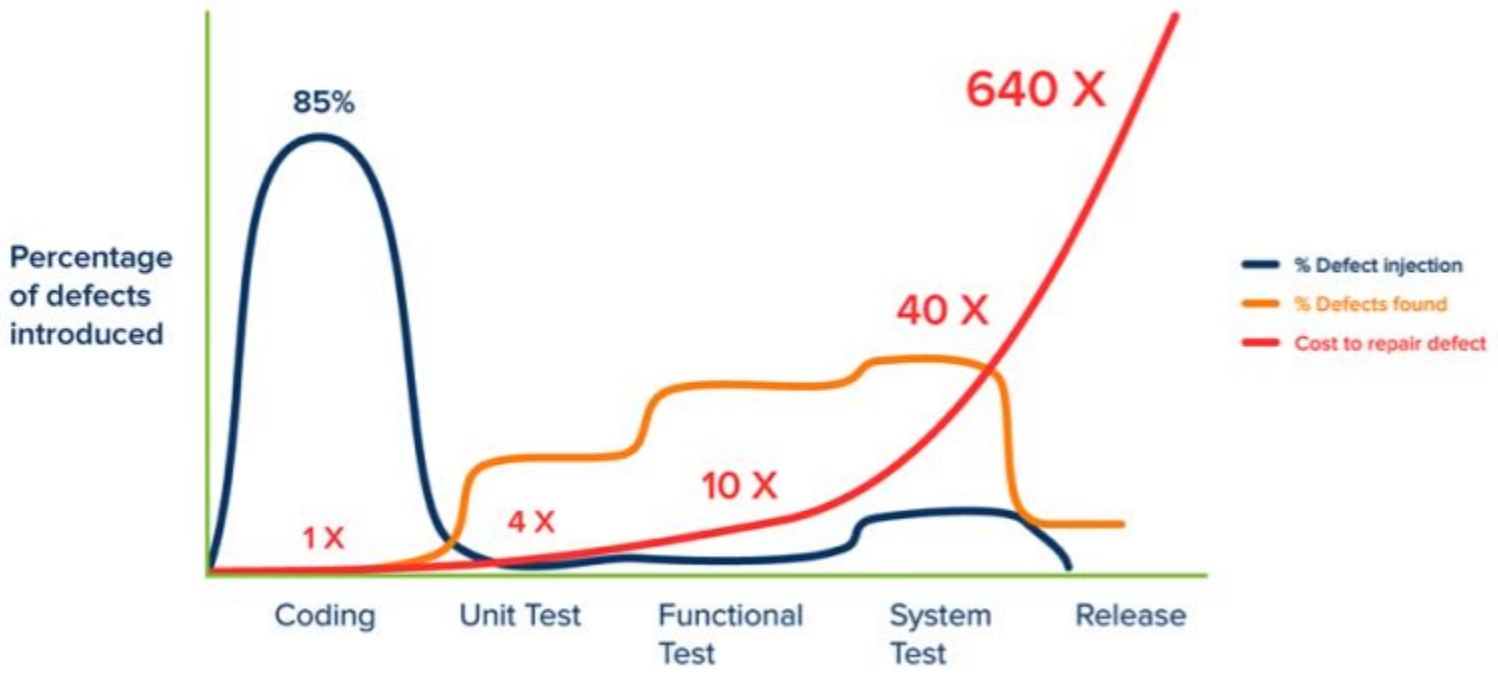
When are Defects Detected?



Jones, Capers. *Applied Software Measurement: Global Analysis of Productivity and Quality.*

Source: https://www.oreilly.com/library/view/applied-software-measurement/9780071502443/

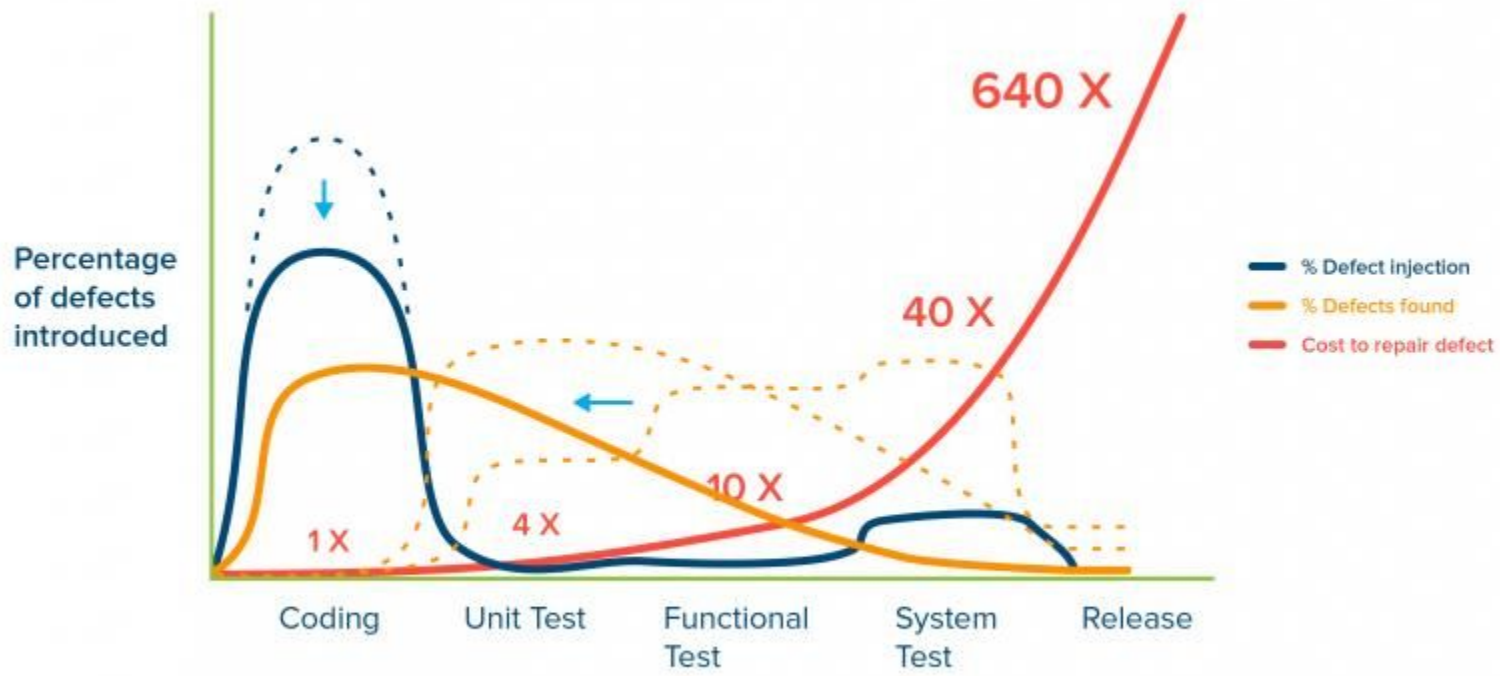
When are Defects Fixed…and at What Cost?



Jones, Capers. *Applied Software Measurement: Global Analysis of Productivity and Quality.*

Source: https://www.oreilly.com/library/view/applied-software-measurement/9780071502443/

What Does “Shift Left” Look Like?



Jones, Capers. *Applied Software Measurement: Global Analysis of Productivity and Quality.*

Source: https://www.oreilly.com/library/view/applied-software-measurement/9780071502443/

Important Notes

Shift Left....

- Increases cognitive load on developers
- Front-loads responsibilities
- Requires careful implementation
- Carries risk of overwhelming teams
- Potential to compromise development quality
- Can lead to rushed or superficial testing if not managed properly

Supporting Shift Left

Dockerfiles
“Features and Enhancements”

Dockerfile: HEREDOC support

- Multiple line builds, now more easily formatted
- Can even specify an interpreter

```
# syntax=docker/dockerfile:1
FROM debian
RUN <<EOT bash
  set -ex
  apt-get update
  apt-get install -y vim
EOT
```

```
# syntax=docker/dockerfile:1
FROM python:3.6
RUN <<EOT
#!/usr/bin/env python
print("hello world")
EOT
```

Dockerfile: Using mounts with RUN

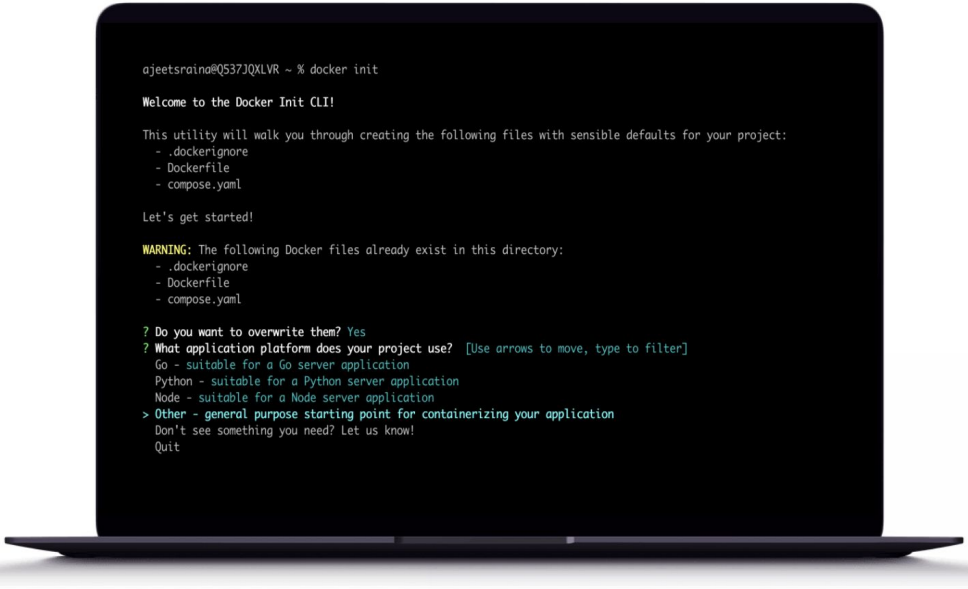
- Mounts allow you to modify the filesystem when building
- Supports several types
  - Bind - share a host directory into the build
  - Cache - temporary directory for compilers, package managers, etc.
  - Secret - allow container to access private files
  - SSH - allow build container to access SSH keys via SSH agents

```
FROM node
COPY package.json yarn.lock ./
RUN --mount=type=secret,id=npm-creds,target=/root/.npmrc \
    --mount=type=cache,id=yarn,target=/root/.yarn \
    yarn install
```

Docker Init
“Accelerate App to Container”

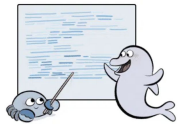
$ docker init

- Generates Docker assets for projects
- Allows you to choose application platform
- Makes it easier to create Docker images and containers

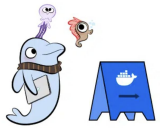


$ docker init

Simplified Docker Assets Creation



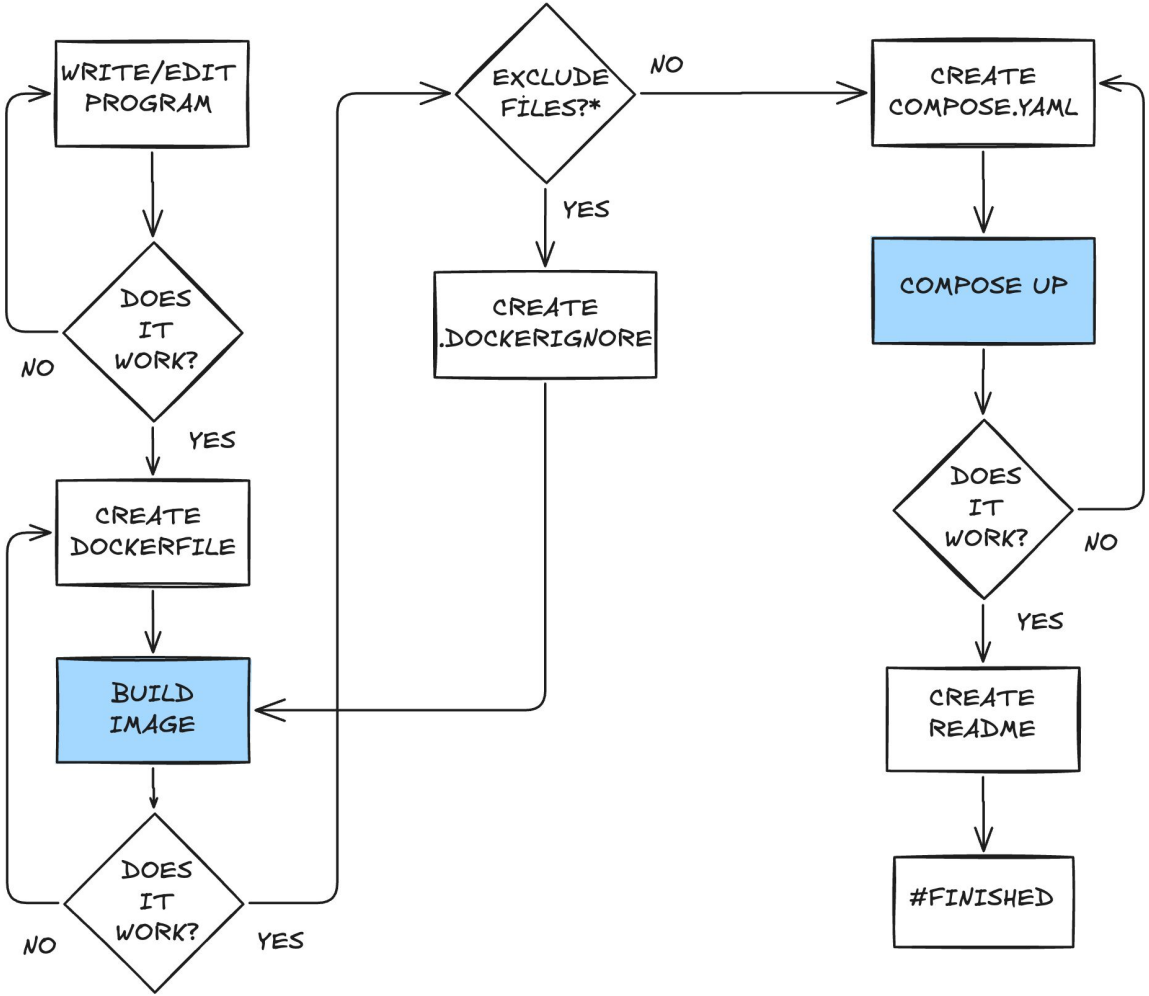
Saves Time and Effort



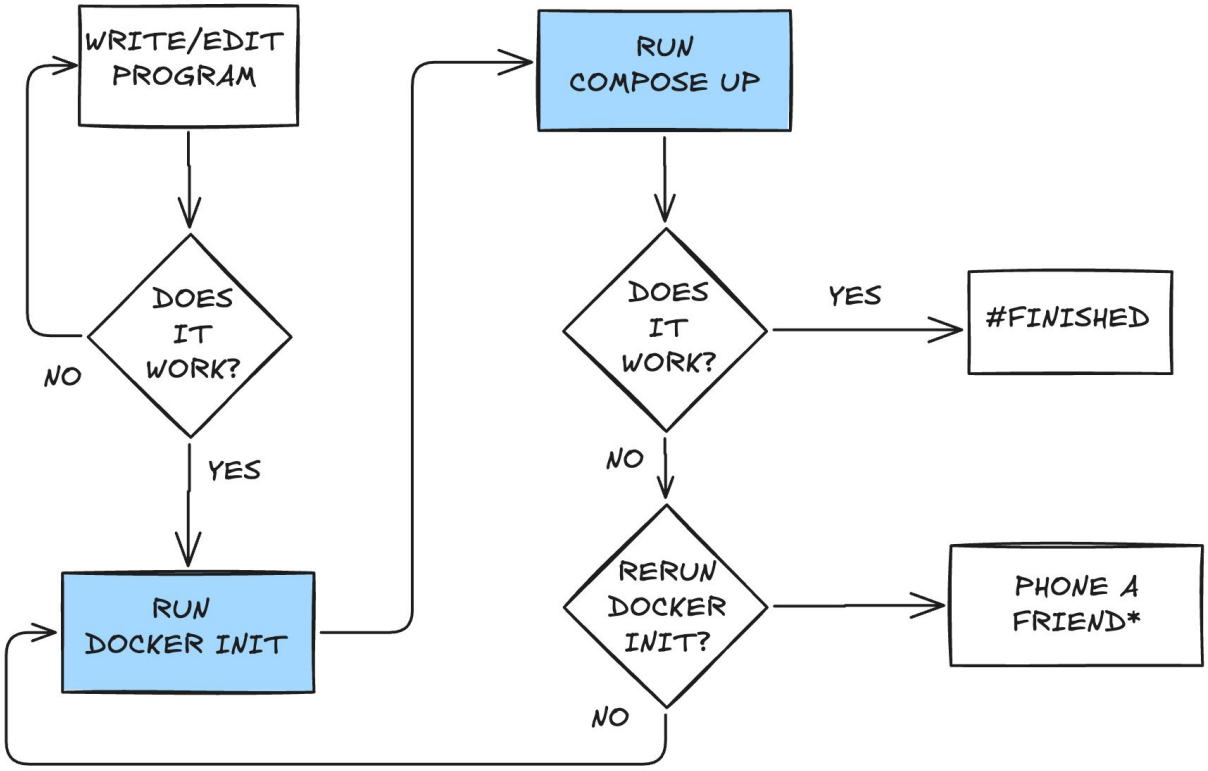
Better Project Organization

Enhanced Portability

RUNNING YOUR FIRST CONTAINER



RUNNING YOUR FIRST CONTAINER WITH DOCKER INIT



* OR REVIEW DOCUMENTATION OR EXAMPLES
(WE KNOW THINGS DON'T WORK 100% ALL THE TIME)

Compose Include / Watch “Cleanup and Speedup Workflows”

Compose Include

- Include Compose files from other locations for composable apps
  - Reference local files
  - Pull from remote git repos (as of v2.21.0)
- Each Compose file can reference their own relative paths

```
include:
  - another-compose.yaml
  - git@github.com:namespace/repo.git
services:
  ...
volumes:
  ...
```

Compose Watch

- Automatically updates your compose service containers while you work
- Blazing-fast file synchronization supporting live update

```yaml
services:
  web:
    build: .
    command: npm start
    x-develop:
      watch:
        - action: sync
          path: ./web
          target: /src/web
          ignore:
            - node_modules/
        - action: rebuild
          path: package.json
```

How it works?

- Automatically builds a new image with BuildKit and replaces the running service container
- Add a `develop` section to your services in the `compose.yaml` file
- Configure it with a list of paths to watch and actions to take
- Watch rules allow ignoring specific files or entire directories within the watched tree.

Compose Watch Actions

Sync

Specifies a path to watch for changes in the host file system, and a corresponding target path inside the container to synchronize changes to.

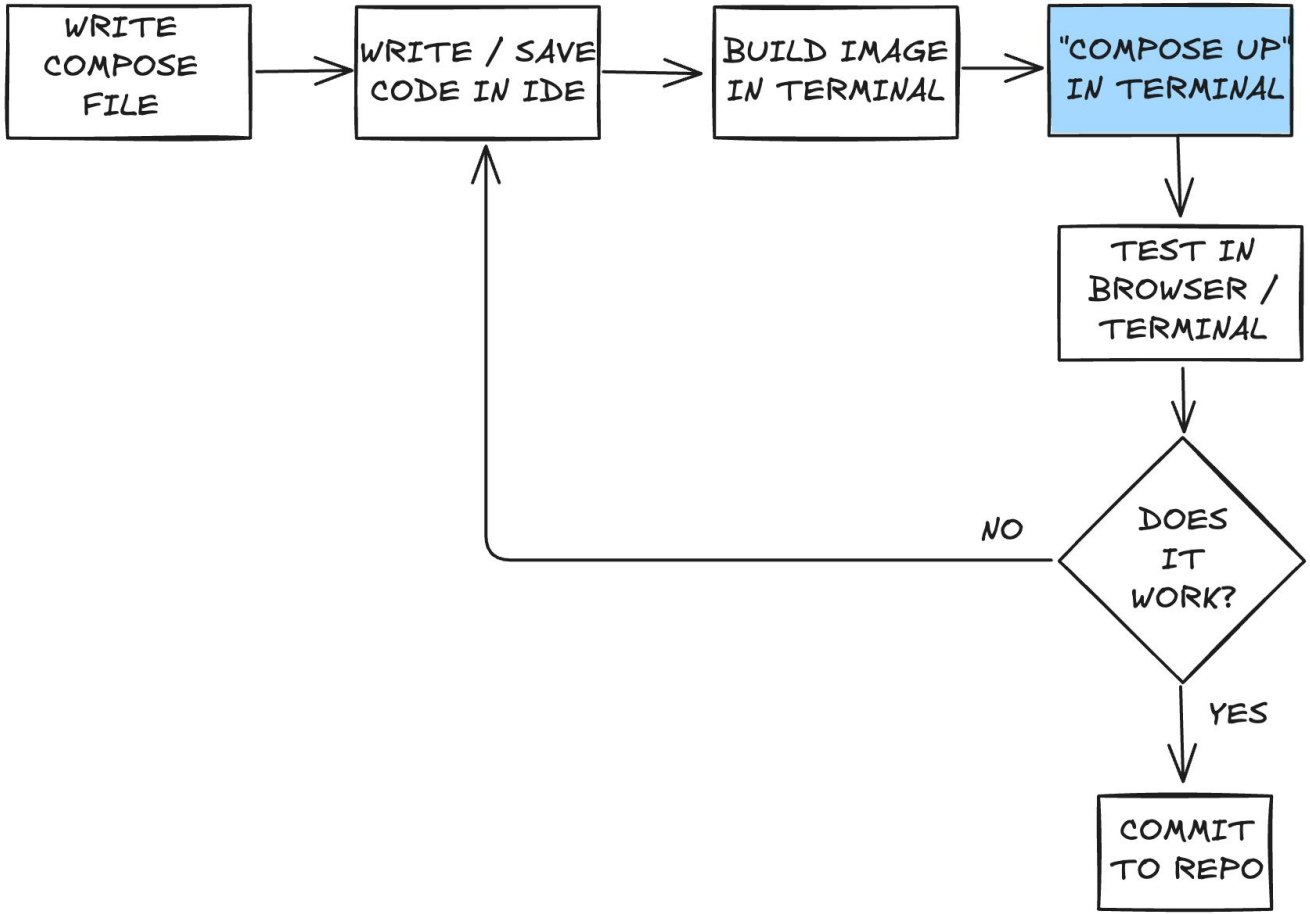
Rebuild

The "rebuild" action specifies a path to watch for changes in the host file system, and triggers a rebuild of the container when changes are detected.

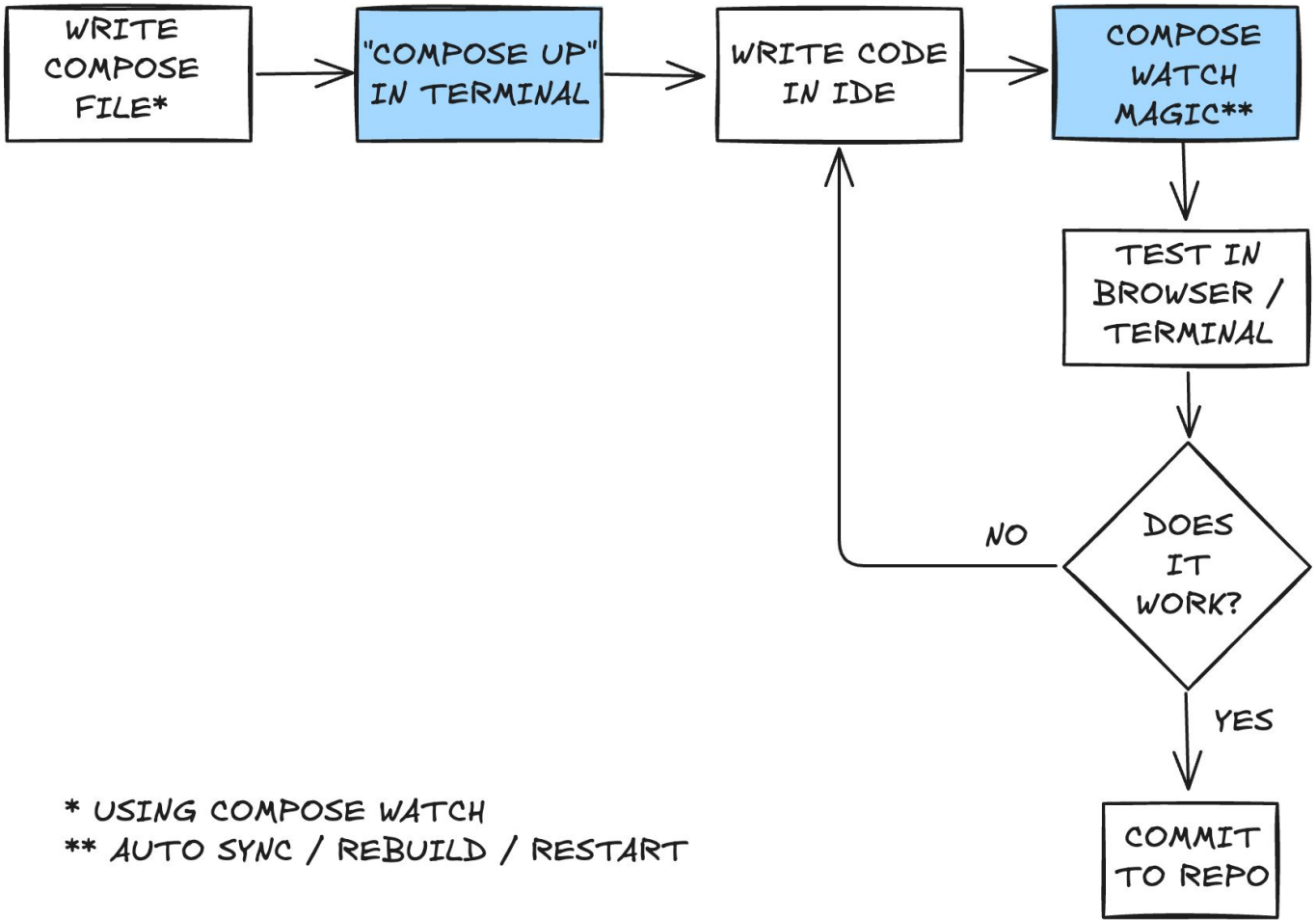
sync+restart

The "sync+restart" action specifies a path to watch for changes in the host file system, and a corresponding target path inside a container to first synchronize changes to and then restart the container

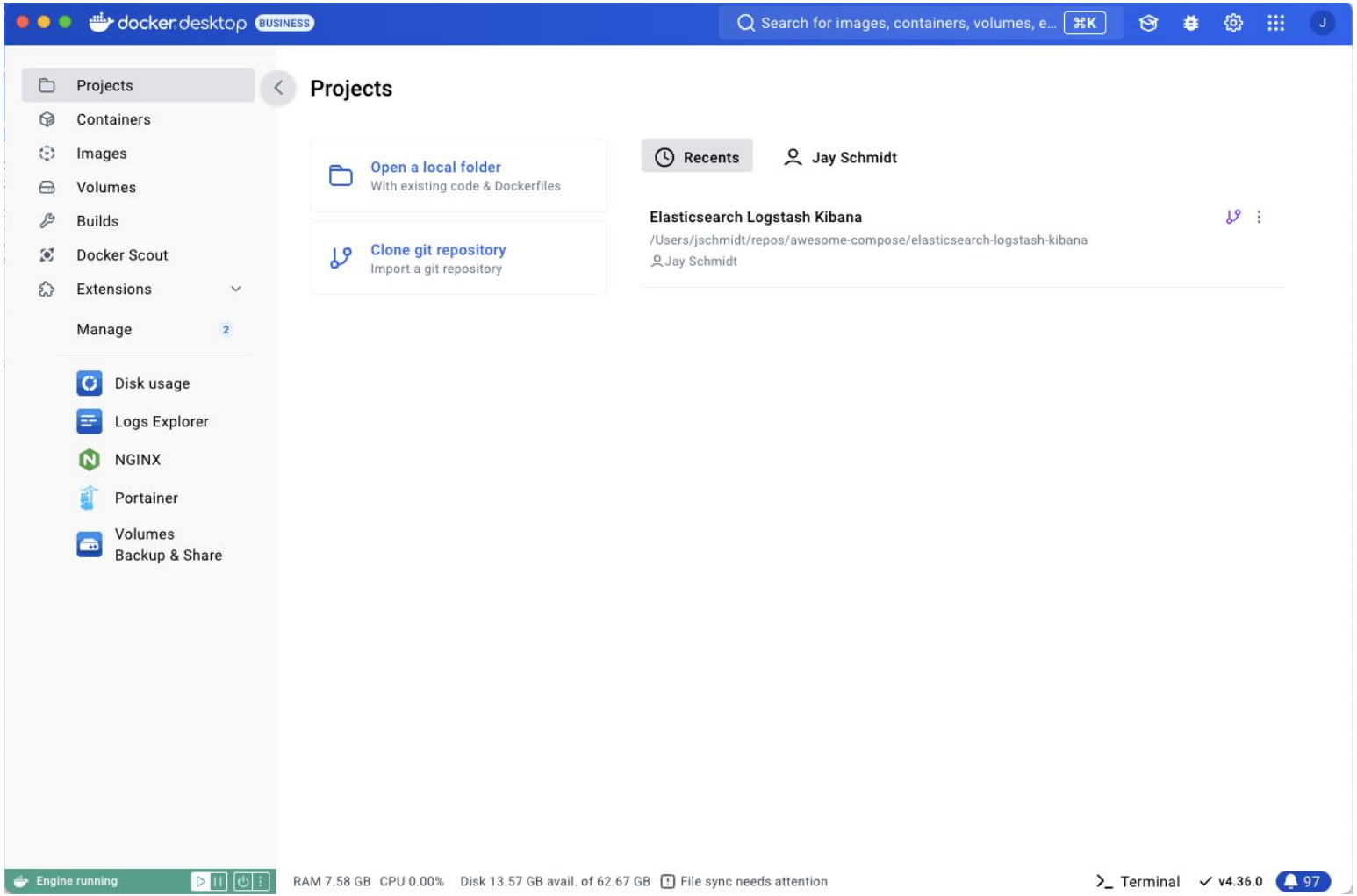
NORMAL DOCKER COMPOSE WORKFLOW

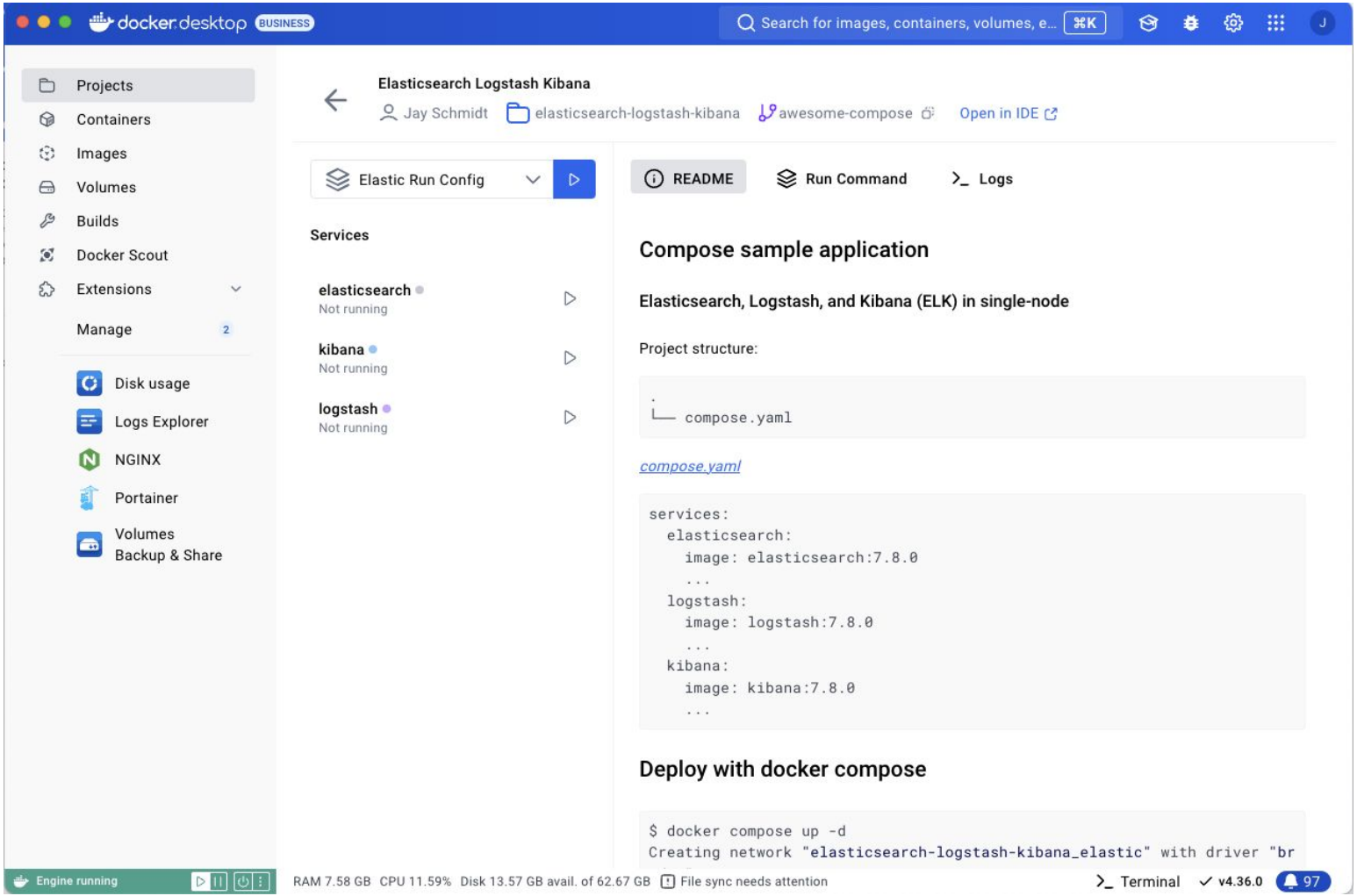


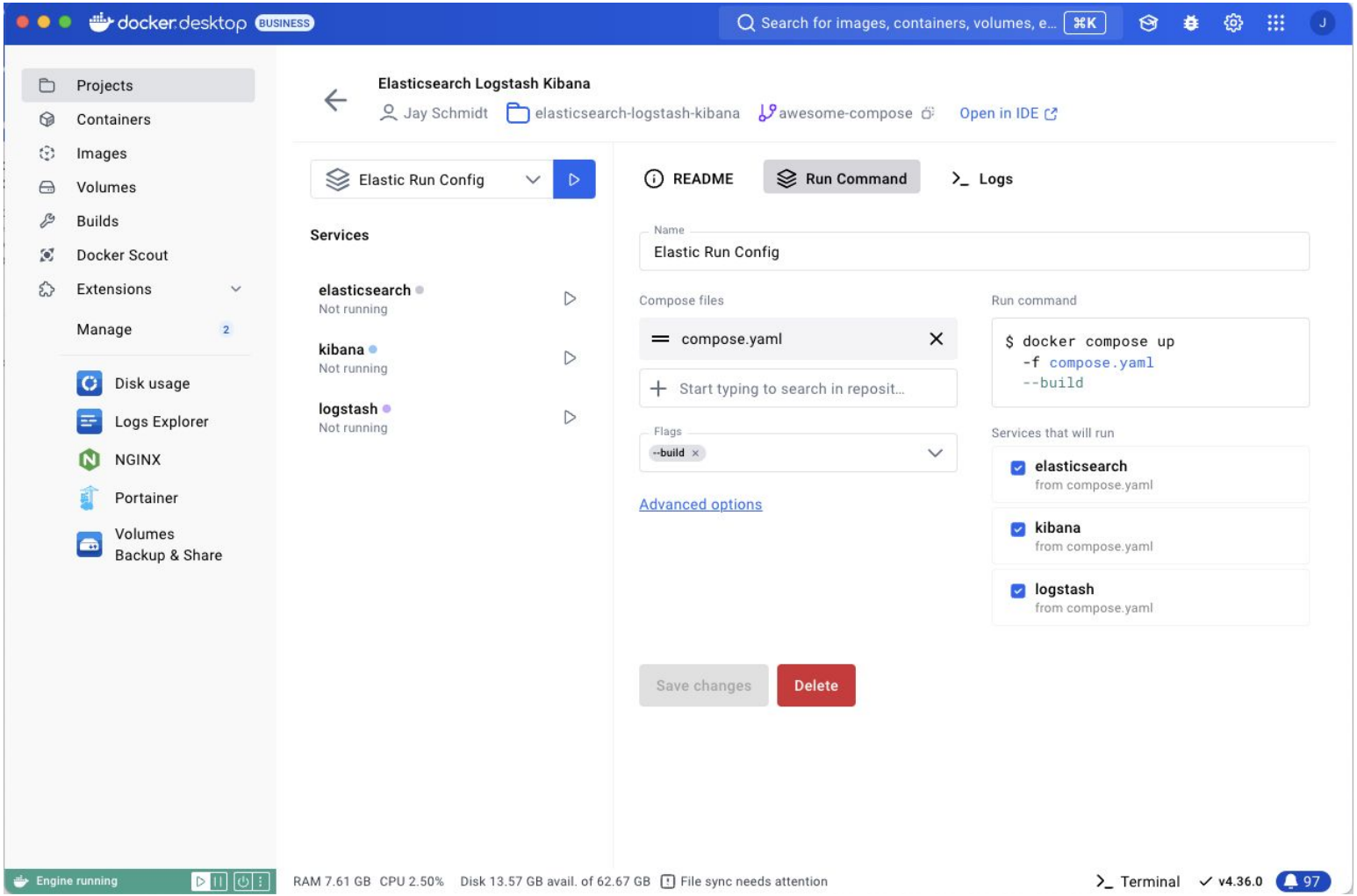
COMPOSE WATCH WORKFLOW

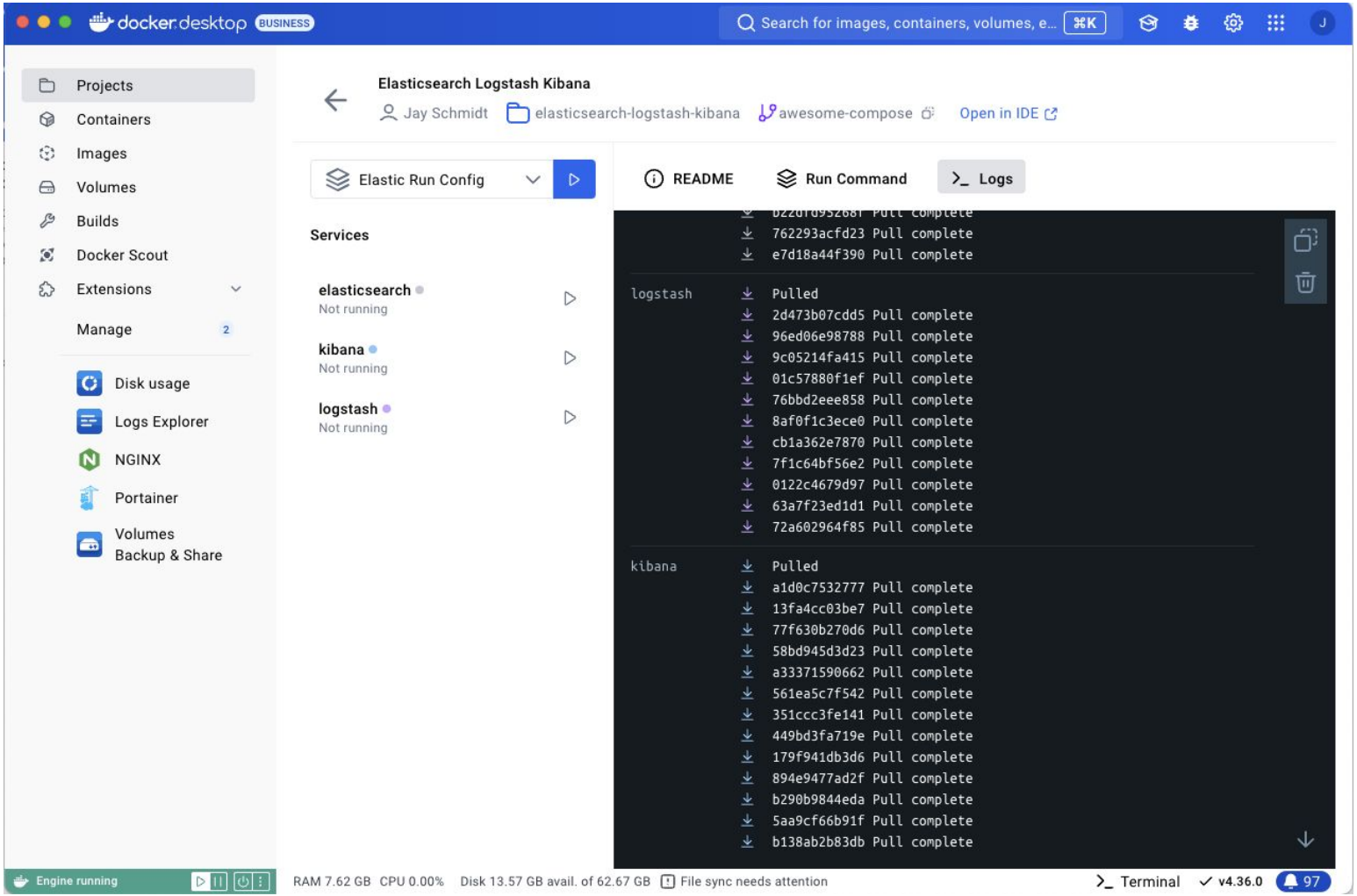


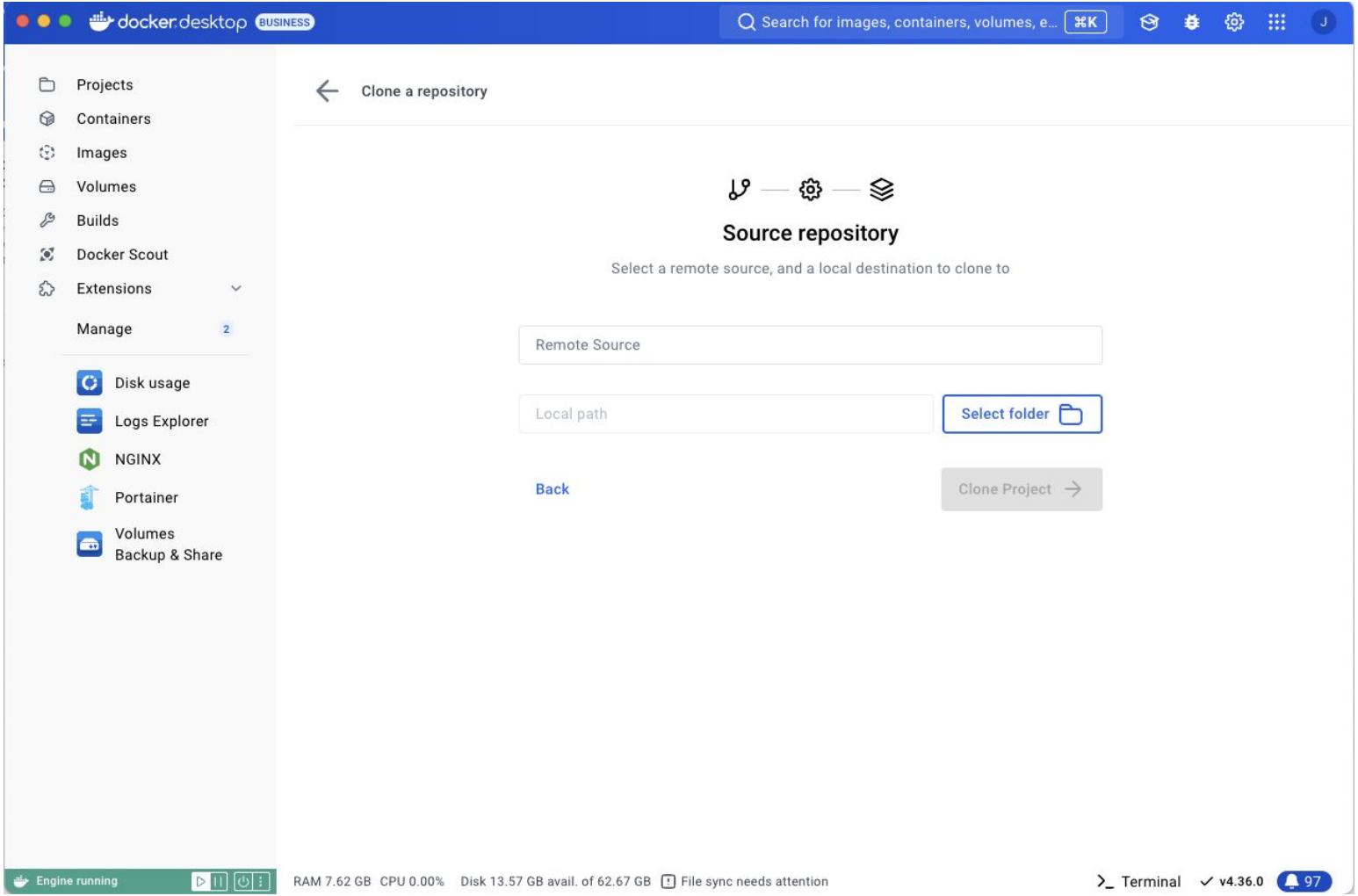
Docker Projects
“Compose in the GUI”


docker desktop
BUSINESS
Search for images, containers, volumes, e...
⌘K
Projects
Containers
Images
Volumes
Builds
Docker Scout
Extensions
Manage
2
Disk usage
Logs Explorer
NGINX
Portainer
Volumes Backup & Share
Projects
Open a local folder
With existing code & Dockerfiles
Clone git repository
Import a git repository
Recents
Jay Schmidt
Elasticsearch Logstash Kibana
/Users/jschmidt/repos/awesome-compose/elasticsearch-logstash-kibana
Jay Schmidt
Engine running
RAM 7.58 GB CPU 0.00%
Disk 13.57 GB avail. of 62.67 GB
File sync needs attention
Terminal
v4.36.0
97


docker desktop BUSINESS
Search for images, containers, volumes, e... ⌘K
Projects
Containers
Images
Volumes
Builds
Docker Scout
Extensions
Manage 2
Disk usage
Logs Explorer
NGINX
Portainer
Volumes Backup & Share
Elasticsearch Logstash Kibana
Jay Schmidt
elasticsearch-logstash-kibana
awesome-compose
Open in IDE
Elastic Run Config
README
Run Command
Logs
Services
elasticsearch
Not running
kibana
Not running
logstash
Not running
Compose sample application
Elasticsearch, Logstash, and Kibana (ELK) in single-node
Project structure:
└── compose.yaml
compose.yaml
services:
elasticsearch:
image: elasticsearch:7.8.0
...
logstash:
image: logstash:7.8.0
...
kibana:
image: kibana:7.8.0
...
Deploy with docker compose
$ docker compose up -d
Creating network "elasticsearch-logstash-kibana_elastic" with driver "br
Engine running
RAM 7.58 GB CPU 11.59% Disk 13.57 GB avail. of 62.67 GB
File sync needs attention
Terminal
v4.36.0
97


docker desktop BUSINESS
Search for images, containers, volumes, e... ⌘K
Projects
Containers
Images
Volumes
Builds
Docker Scout
Extensions
Manage 2
Disk usage
Logs Explorer
NGINX
Portainer
Volumes Backup & Share
Elasticsearch Logstash Kibana
Jay Schmidt
elasticsearch-logstash-kibana
awesome-compose
Open in IDE
Elastic Run Config
Services
elasticsearch
Not running
kibana
Not running
logstash
Not running
README
Run Command
Logs
Name
Elastic Run Config
Compose files
compose.yaml
Start typing to search in reposit...
Flags
--build
Advanced options
Run command
$ docker compose up
-f compose.yaml
--build
Services that will run
elasticsearch
from compose.yaml
kibana
from compose.yaml
logstash
from compose.yaml
Save changes
Delete
Engine running
RAM 7.61 GB CPU 2.50%
Disk 13.57 GB avail. of 62.67 GB
File sync needs attention
Terminal
v4.36.0
97


docker desktop BUSINESS
Search for images, containers, volumes, e... ⌘K
Projects
Containers
Images
Volumes
Builds
Docker Scout
Extensions
Manage 2
Disk usage
Logs Explorer
NGINX
Portainer
Volumes Backup & Share
Elasticsearch Logstash Kibana
Jay Schmidt
elasticsearch-logstash-kibana
awesome-compose
Open in IDE
Elastic Run Config
Services
elasticsearch
Not running
kibana
Not running
logstash
Not running
README
Run Command
Logs
762293acfd23 Pull complete
e7d18a44f390 Pull complete
logstash Pulled
2d473b07cdd5 Pull complete
96ed06e98788 Pull complete
9c05214fa415 Pull complete
01c57880f1ef Pull complete
76bbd2eee858 Pull complete
8af0f1c3ece0 Pull complete
cb1a362e7870 Pull complete
7f1c64bf56e2 Pull complete
0122c4679d97 Pull complete
63a7f23ed1d1 Pull complete
72a602964f85 Pull complete
kibana Pulled
a1d0c7532777 Pull complete
13fa4cc03be7 Pull complete
77f630b270d6 Pull complete
58bd945d3d23 Pull complete
a33371590662 Pull complete
561ea5c7f542 Pull complete
351ccc3fe141 Pull complete
449bd3fa719e Pull complete
179f941db3d6 Pull complete
894e9477ad2f Pull complete
b290b9844eda Pull complete
5aa9cf66b91f Pull complete
b138ab2b83db Pull complete
Engine running
RAM 7.62 GB CPU 0.00%
Disk 13.57 GB avail. of 62.67 GB
File sync needs attention
Terminal
v4.36.0
97

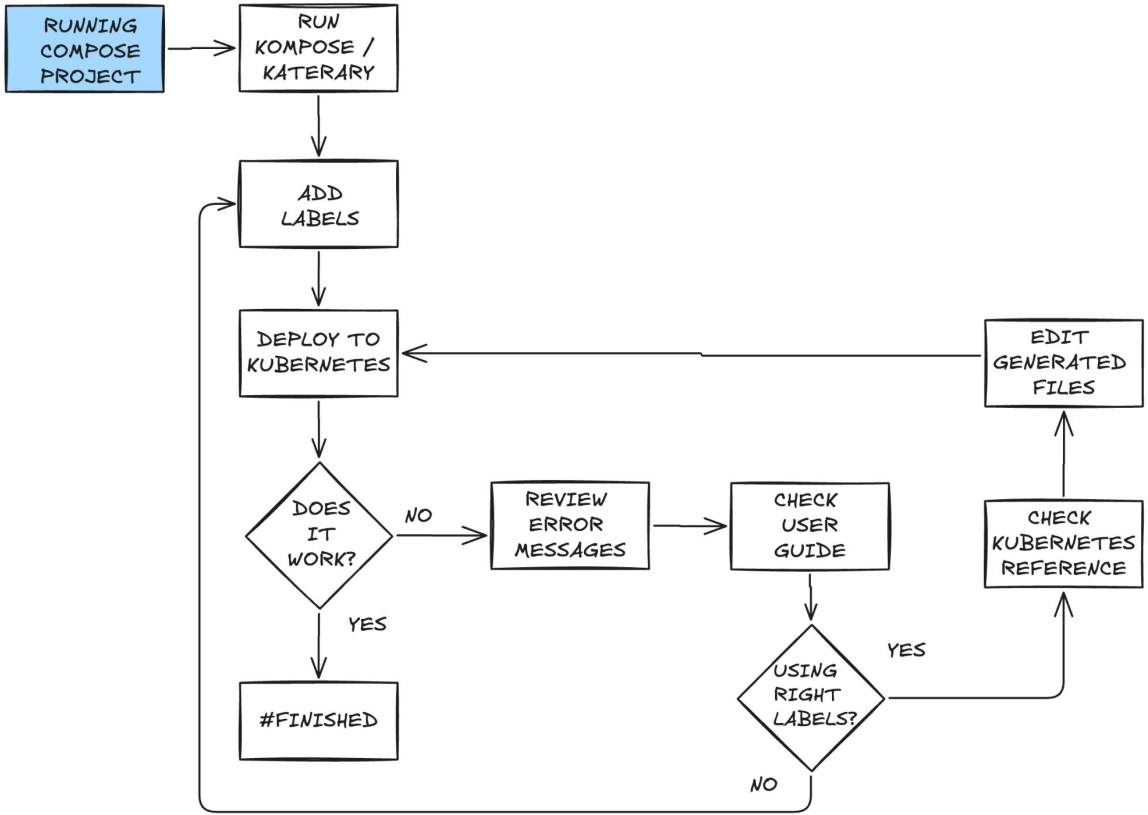

docker desktop
BUSINESS
Search for images, containers, volumes, e...
⌘K
J
Projects
Containers
Images
Volumes
Builds
Docker Scout
Extensions
Manage
2
Disk usage
Logs Explorer
NGINX
Portainer
Volumes Backup & Share
Clone a repository
Source repository
Select a remote source, and a local destination to clone to
Remote Source
Local path
Select folder
Back
Clone Project
Engine running
RAM 7.62 GB CPU 0.00%
Disk 13.57 GB avail. of 62.67 GB
File sync needs attention
Terminal
v4.36.0
97

Compose Bridge
“Get me to Kubernetes”

Compose Bridge

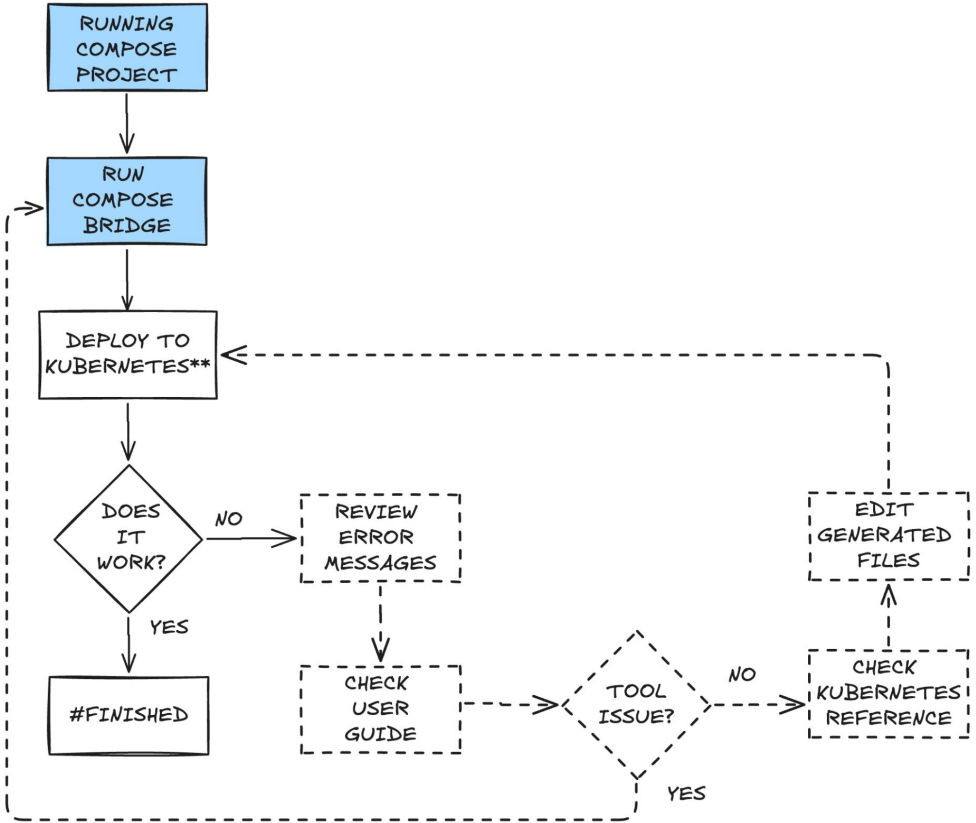
- Enables the use of compose.yaml files to create resource definitions for other platforms, primarily Kubernetes.
- Converts compose.yaml into Kubernetes manifests and Kustomize overlays.
    - compose-bridge -f compose.yaml convert.
- Modify default templates, add new templates, or build custom transformations to match infrastructure needs.
- Extract and customize transformation templates using compose-bridge transformations create my-template.
- kubectl Plugin is available

COMPOSE TO K8S VIA KOMPOSE* AND KATERNARY**



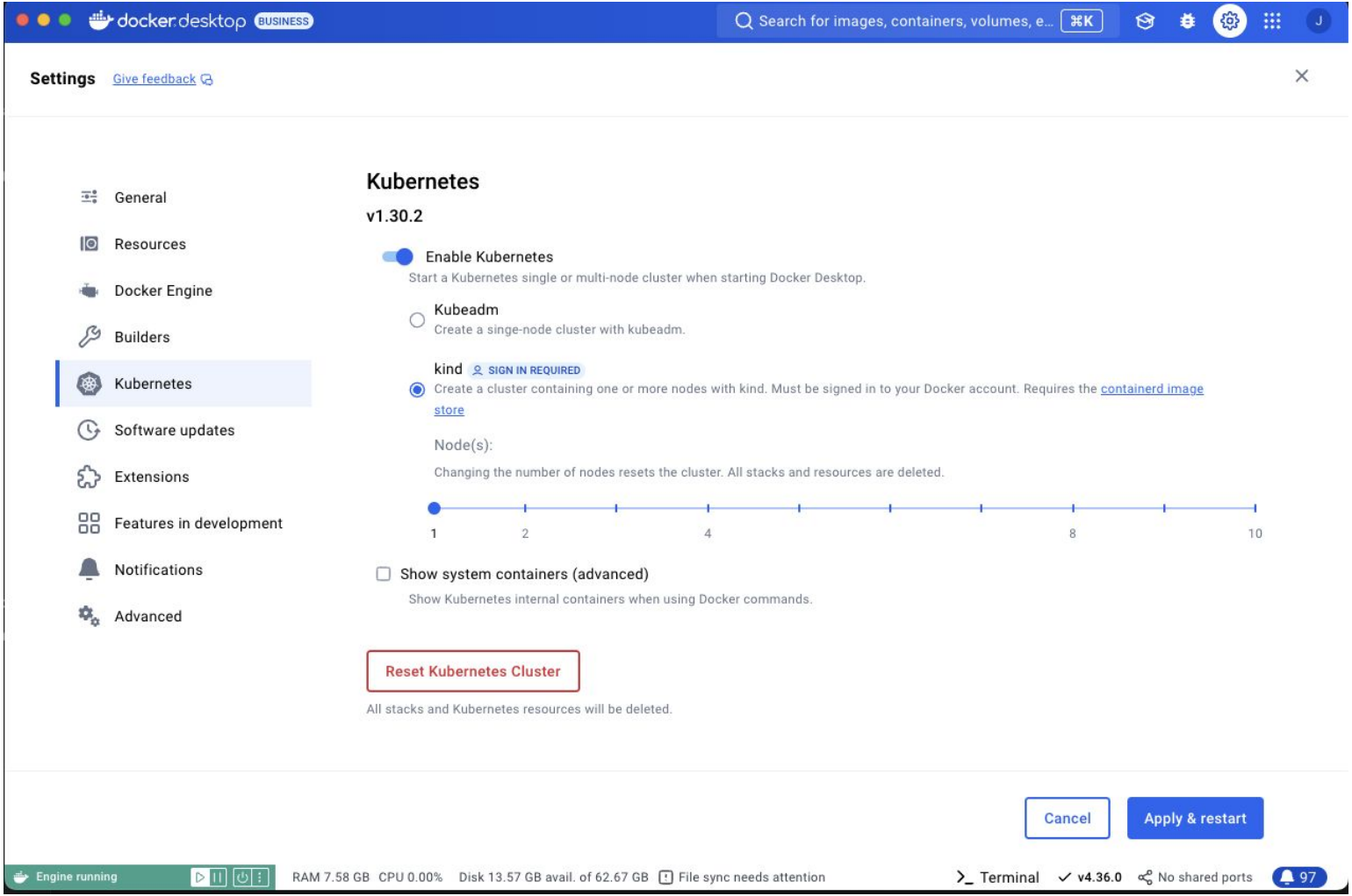
* OSS PROJECT KOMPOSE.IO
** OSS PROJECT GITHUB.COM/METAL3D/KATERNARY

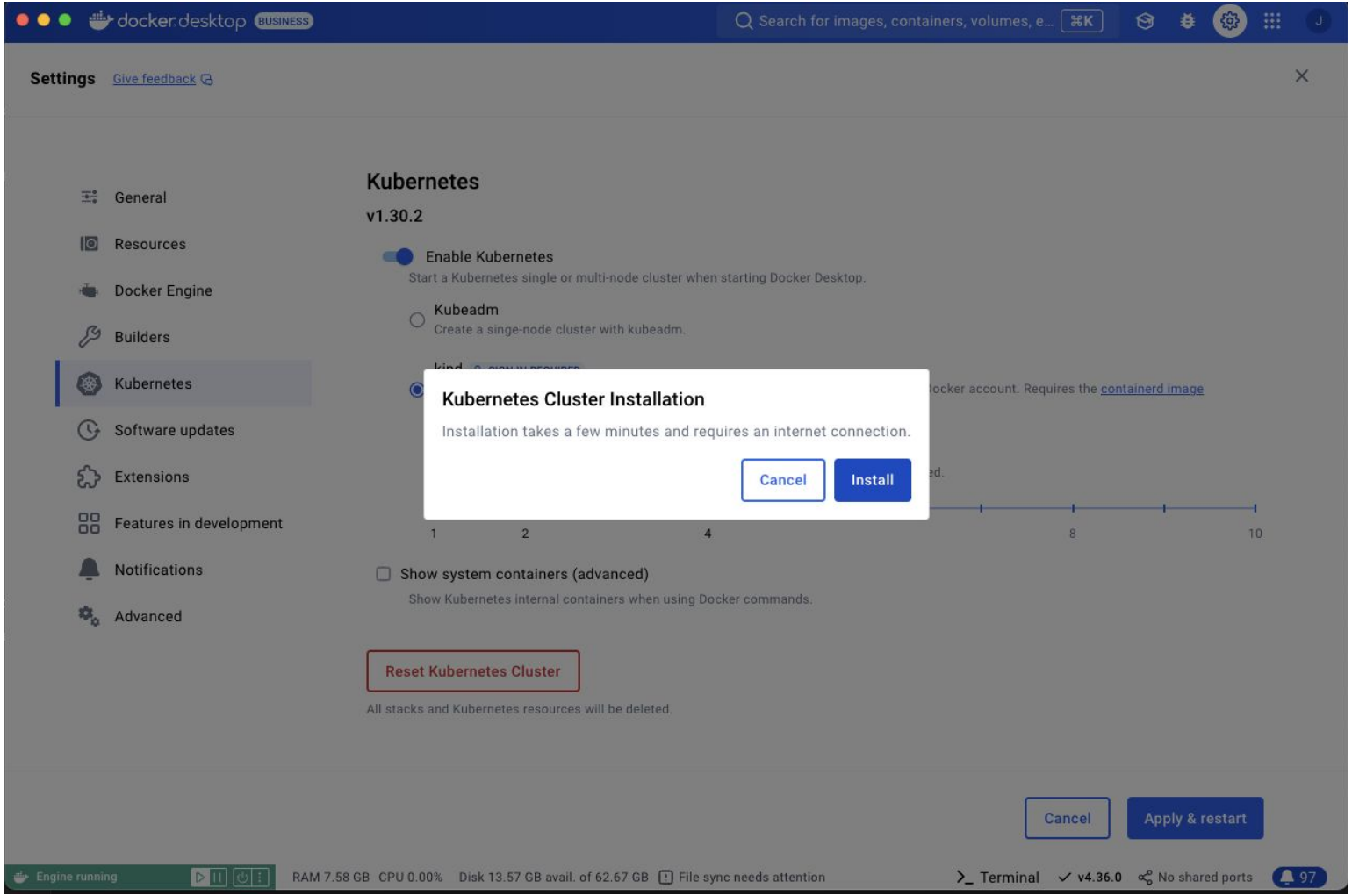
COMPOSE TO K8S VIA COMPOSE BRIDGE*

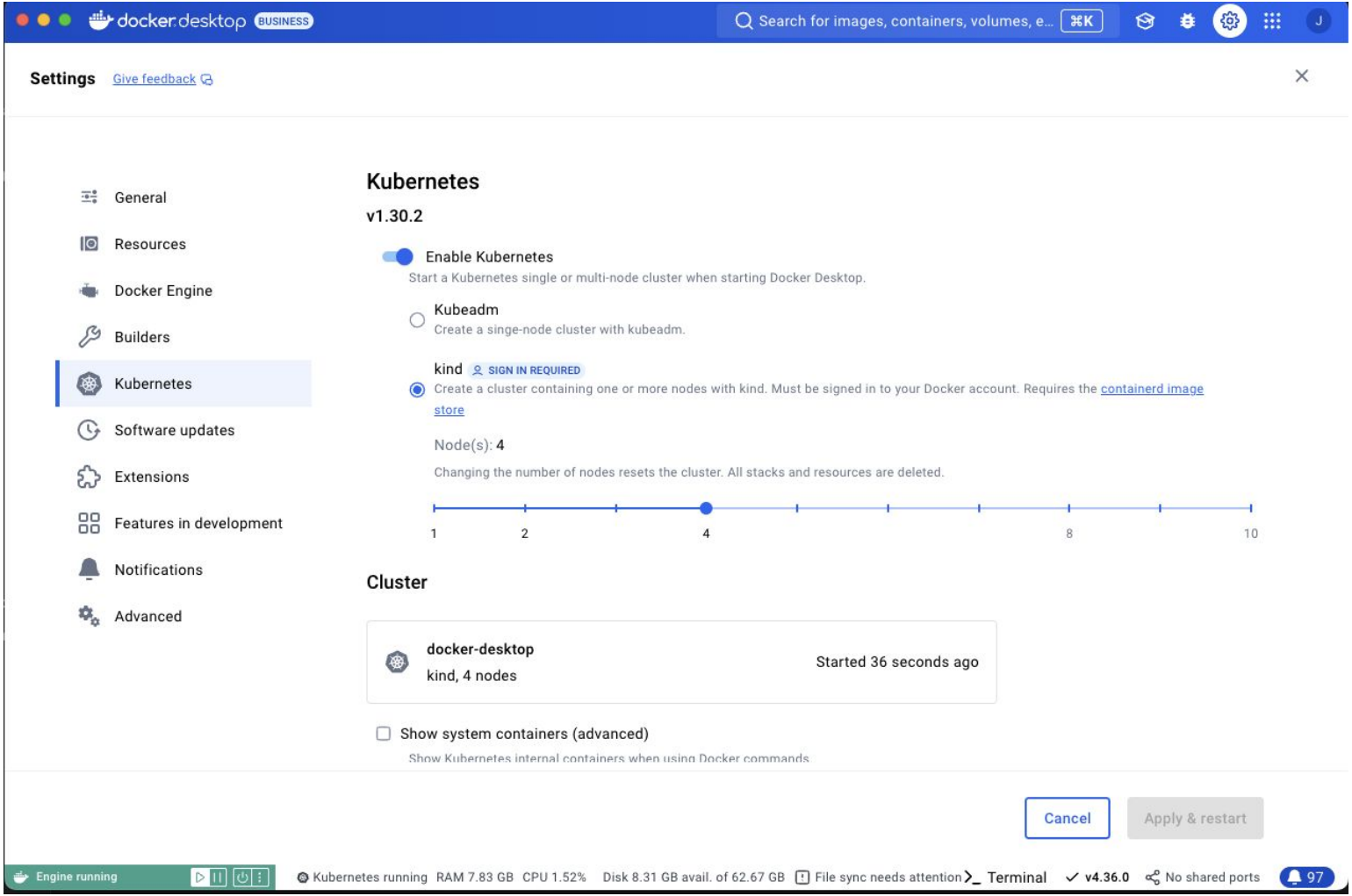


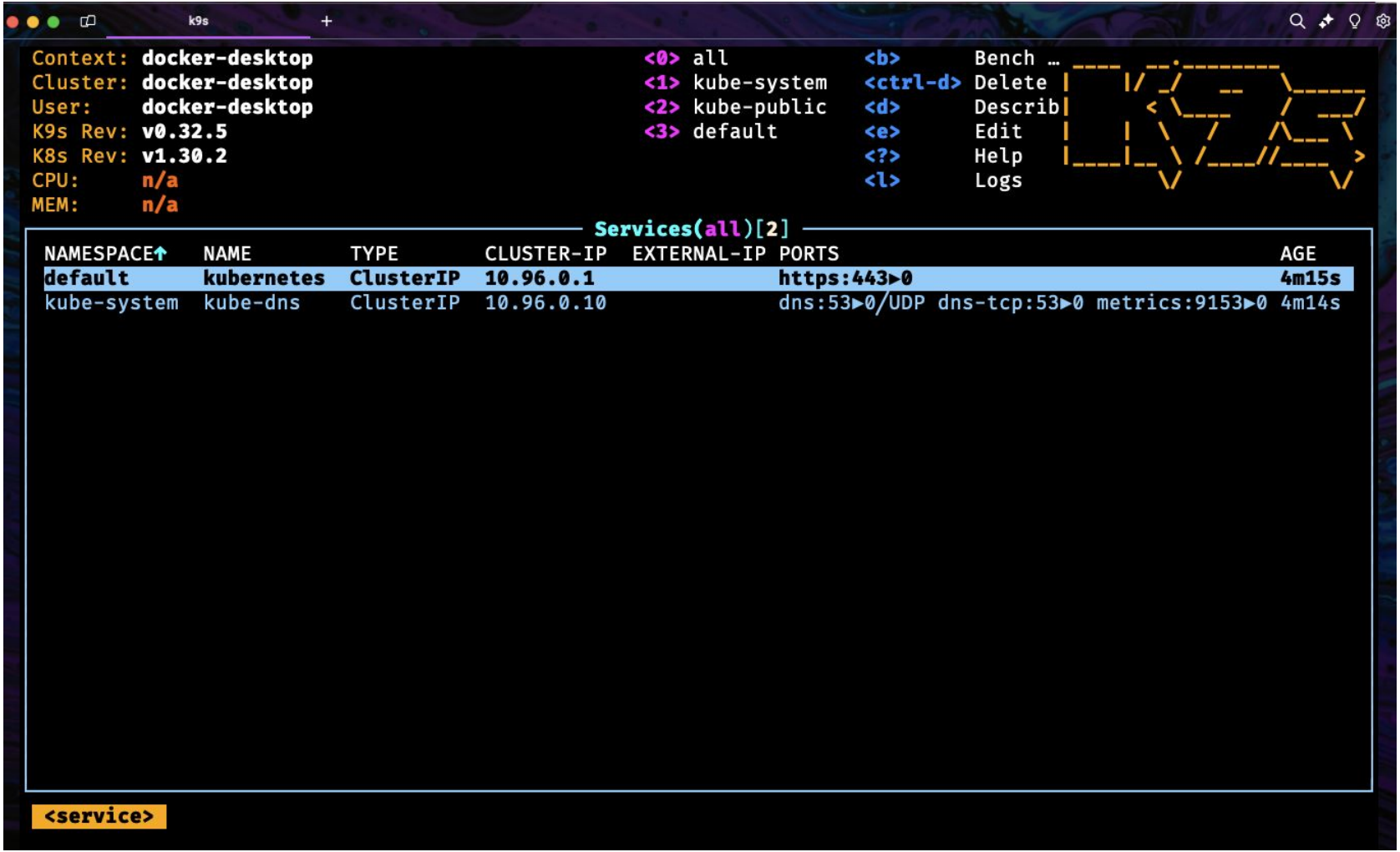
* AVAILABLE WITH DOCKER DESKTOP BUSINESS
** DOCKER DESKTOP HAS A BUILT IN K8S CLUSTER

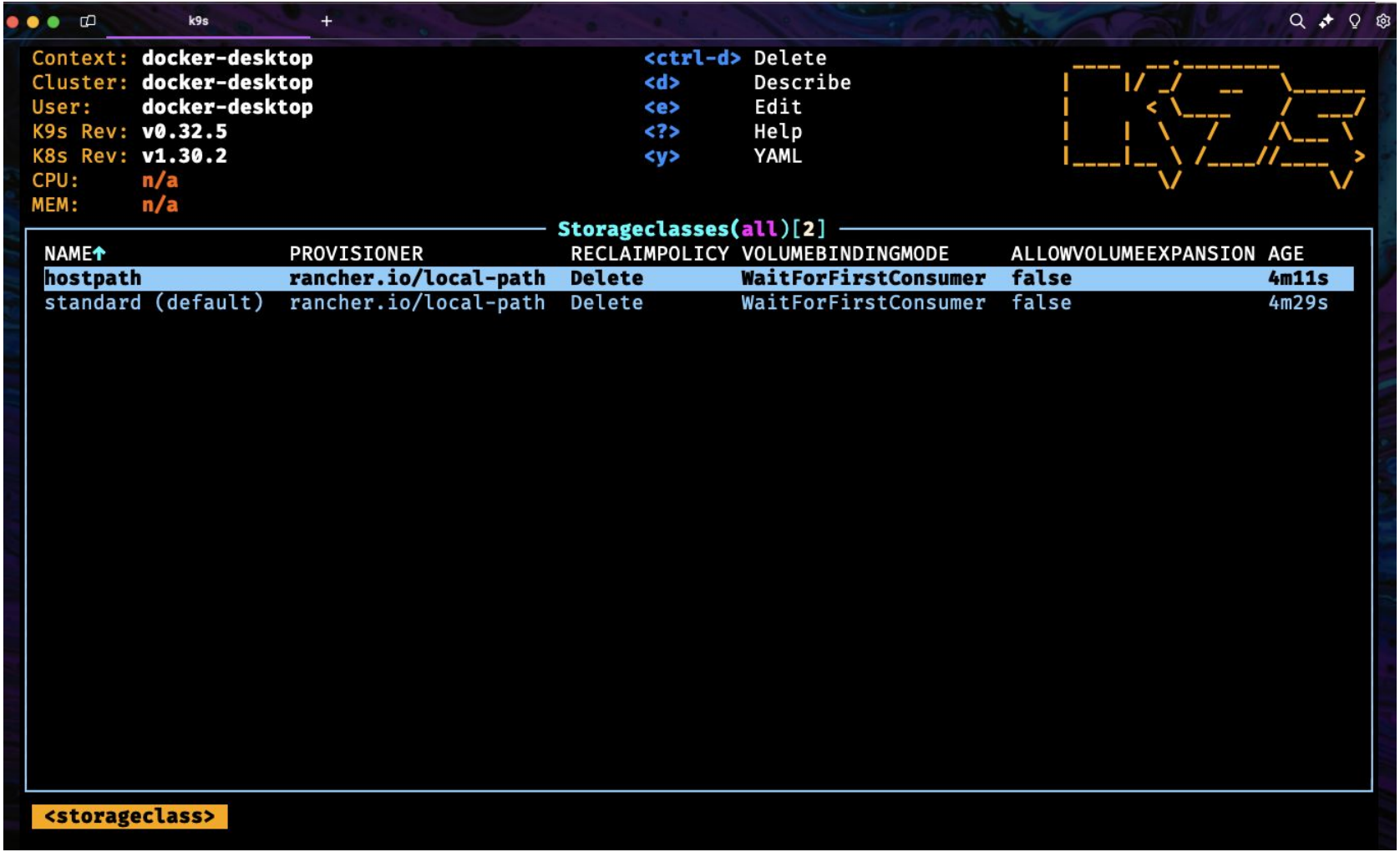
Docker Desktop and KinD “Easy and local K8s”


docker desktop
BUSINESS
Search for images, containers, volumes, e...
⌘K
J
Settings
Give feedback
General
Resources
Docker Engine
Builders
Kubernetes
Software updates
Extensions
Features in development
Notifications
Advanced
Kubernetes
v1.30.2
Enable Kubernetes
Start a Kubernetes single or multi-node cluster when starting Docker Desktop.
Kubeadm
Create a singe-node cluster with kubeadm.
kind
SIGN IN REQUIRED
Create a cluster containing one or more nodes with kind. Must be signed in to your Docker account. Requires the containerd image store
Node(s):
Changing the number of nodes resets the cluster. All stacks and resources are deleted.
1
2
4
8
10
Show system containers (advanced)
Show Kubernetes internal containers when using Docker commands.
Reset Kubernetes Cluster
All stacks and Kubernetes resources will be deleted.
Cancel
Apply & restart
Engine running
RAM 7.58 GB CPU 0.00%
Disk 13.57 GB avail. of 62.67 GB
File sync needs attention
Terminal
v4.36.0
No shared ports
97


docker desktop BUSINESS
Search for images, containers, volumes, e... ⌘K
Settings
Give feedback
General
Resources
Docker Engine
Builders
Kubernetes
Software updates
Extensions
Features in development
Notifications
Advanced
Kubernetes
v1.30.2
Enable Kubernetes
Start a Kubernetes single or multi-node cluster when starting Docker Desktop.
Kubeadm
Create a singe-node cluster with kubeadm.
containerd image
1
2
4
8
10
Show system containers (advanced)
Show Kubernetes internal containers when using Docker commands.
Reset Kubernetes Cluster
All stacks and Kubernetes resources will be deleted.
Kubernetes Cluster Installation
Installation takes a few minutes and requires an internet connection.
Cancel
Install
Cancel
Apply & restart
Engine running
RAM 7.58 GB CPU 0.00%
Disk 13.57 GB avail. of 62.67 GB
File sync needs attention
Terminal
v4.36.0
No shared ports
97


docker desktop BUSINESS
Search for images, containers, volumes, e... ⌘K
Settings
Give feedback
General
Resources
Docker Engine
Builders
Kubernetes
Software updates
Extensions
Features in development
Notifications
Advanced
Kubernetes
v1.30.2
Enable Kubernetes
Start a Kubernetes single or multi-node cluster when starting Docker Desktop.
Kubeadm
Create a singe-node cluster with kubeadm.
kind SIGN IN REQUIRED
Create a cluster containing one or more nodes with kind. Must be signed in to your Docker account. Requires the containerd image store
Node(s): 4
Changing the number of nodes resets the cluster. All stacks and resources are deleted.
1
2
4
8
10
Cluster
docker-desktop
kind, 4 nodes
Started 36 seconds ago
Show system containers (advanced)
Show Kubernetes internal containers when using Docker commands
Cancel
Apply & restart
Engine running
Kubernetes running
RAM 7.83 GB
CPU 1.52%
Disk 8.31 GB avail. of 62.67 GB
File sync needs attention
Terminal
v4.36.0
No shared ports
97


k9s
Context: docker-desktop
Cluster: docker-desktop
User: docker-desktop
K9s Rev: v0.32.5
K8s Rev: v1.30.2
CPU: n/a
MEM: n/a
<0> all
<1> kube-system
<2> kube-public
<3> default
<b> Bench …
<ctrl-d> Delete
<d> Describ
<e> Edit
<?> Help
<l> Logs
Services(all)[2]
NAMESPACE↑ NAME TYPE CLUSTER-IP EXTERNAL-IP PORTS AGE
default kubernetes ClusterIP 10.96.0.1 https:443▸0 4m15s
kube-system kube-dns ClusterIP 10.96.0.10 dns:53▸0/UDP dns-tcp:53▸0 metrics:9153▸0 4m14s
<service>


k9s
Context: docker-desktop
Cluster: docker-desktop
User: docker-desktop
K9s Rev: v0.32.5
K8s Rev: v1.30.2
CPU: n/a
MEM: n/a
<ctrl-d> Delete
<d> Describe
<e> Edit
<?> Help
<y> YAML
Storageclasses(all)[2]
NAME↑ PROVISIONER RECLAIMPOLICY VOLUMEBINDINGMODE ALLOWVOLUMEEXPANSION AGE
hostpath rancher.io/local-path Delete WaitForFirstConsumer false 4m11s
standard (default) rancher.io/local-path Delete WaitForFirstConsumer false 4m29s
<storageclass>

Docker Volumes
“Bind mounts and volume drivers”

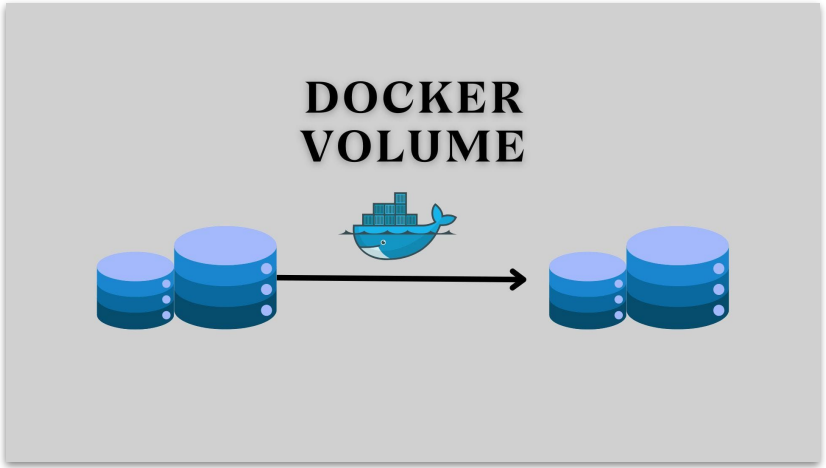
Bind Mounts and Synchronized Shares

- Bind Mounts
  - Direct File System Access
  - No data persistence in the container; all data resides on the host
  - Requires an absolute path on the host
  - Performance can vary based on the host system

- Synchronized File Shares
  - Improvement over standard Bind mounts
  - Improves host/container file synchronization performance
  - Uses a two-way file synchronization approach
  - Supports bi-directional synchronization
  - Resolves File I/O Performance Issues
  - Seamlessly integrated into Docker Desktop

Docker Managed Volumes

- Simplified data management - docker handles all aspects of lifecycle
- Volumes can easily be moved between environments and hosts.
- Potentially faster I/O versus bind mounts on non-linux systems
- Provide isolation and reduced complexity



Docker Volume Drivers

- Local Driver (default):
  - Stores data on the local host filesystem
  - Most common driver
  - Docker controls volumes
- NFS (Network File System):
  - Can share between docker hosts
  - Performance may vary wildly
- Azure File Storage:
  - Integrates with Azure's services
  - Scalable, managed storage
  - Can share between docker hosts
- Amazon EFS (Elastic File System):
  - Integrates with AWS' services
  - Scalable, managed storage
  - Can share between docker hosts
- GCP Persistent Disk:
  - Integrates with Google Cloud services
  - Scalable, managed storage
  - Can share between docker hosts
- Flocker:
  - Manages persistent storage for containers across multiple Docker hosts.
  - Designed for stateful services and high availability in multi-host environments.
- Rex-Ray:
  - Works with multiple storage backends
  - Provides storage orchestration across a mix of environments

Questions and Answers