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# Applied Accelerated Artificial Intelligence



## Introduction to Containers and IDE Dockers

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National  
Supercomputing  
Mission



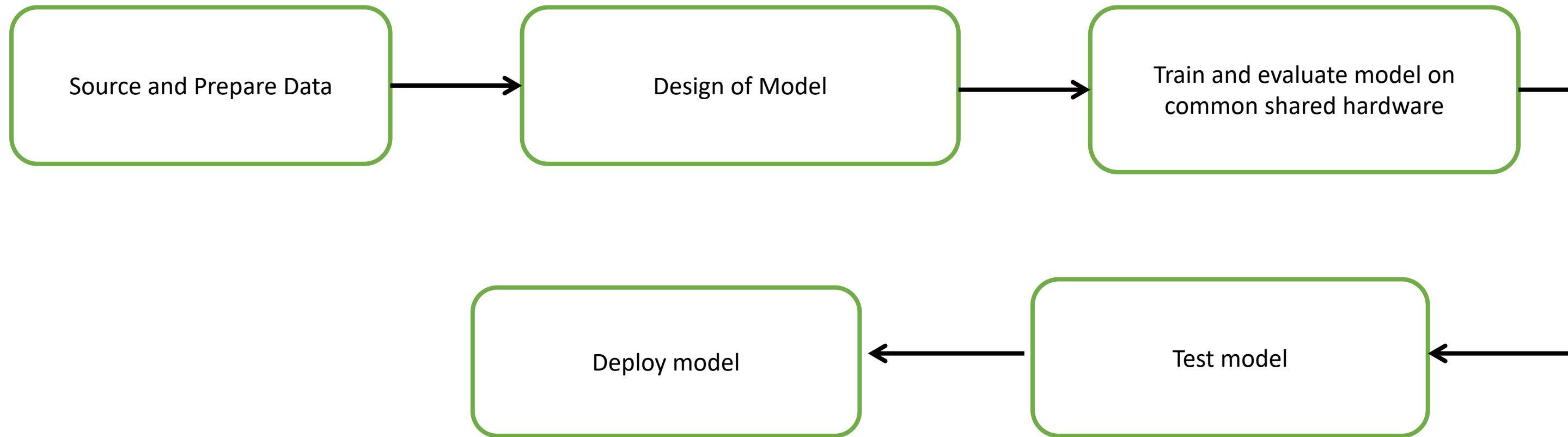
Centre for  
Development of  
Advanced Computing



# Agenda

- ML workflow and problems faced
- Demo – Dockers
- NGC
- Jupyter Notebook
- Demo – Jupyter Notebook

# Generic ML workflow ?

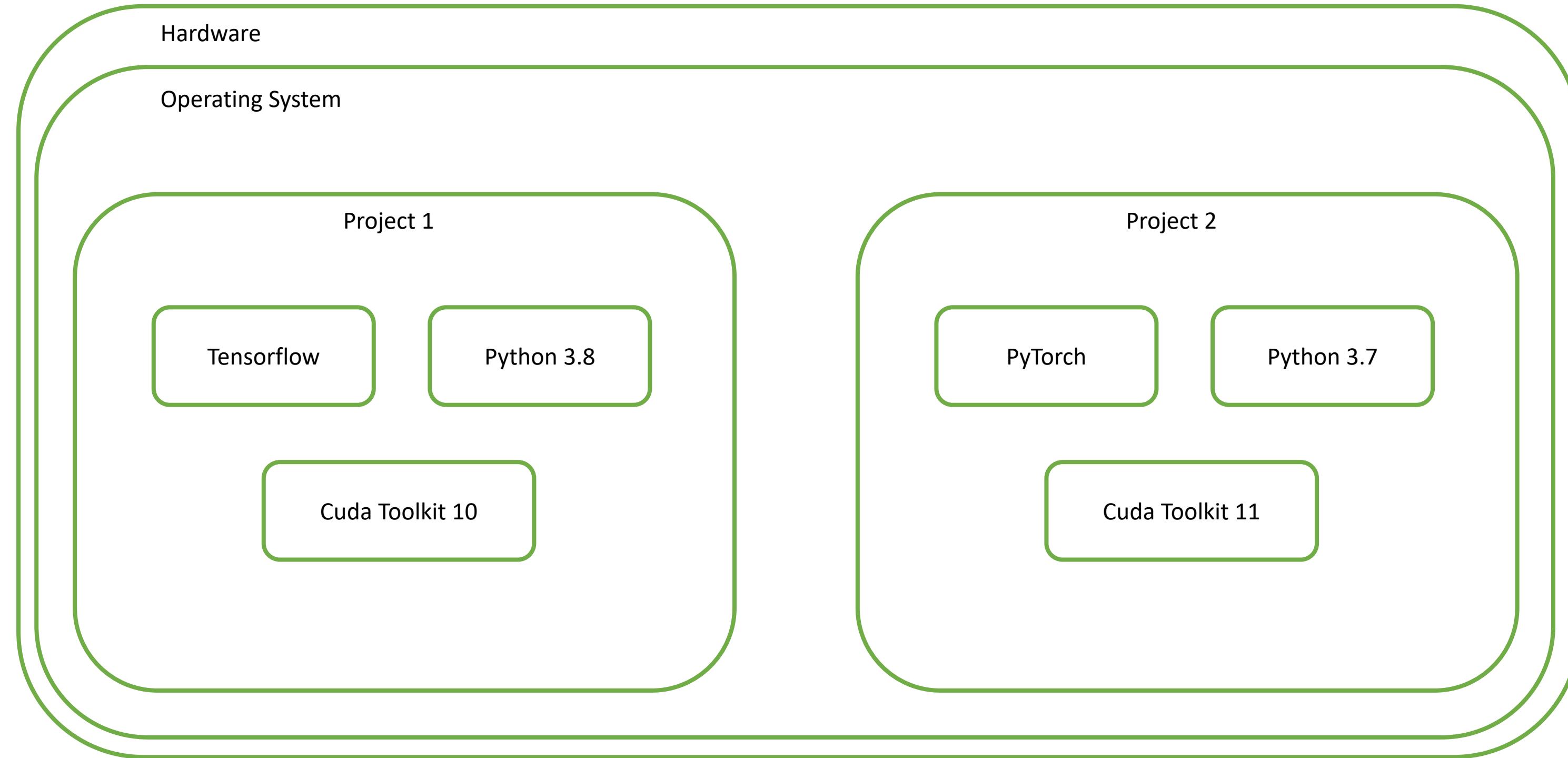


On average, 40% of businesses said it takes more than a month to put an ML model into production.

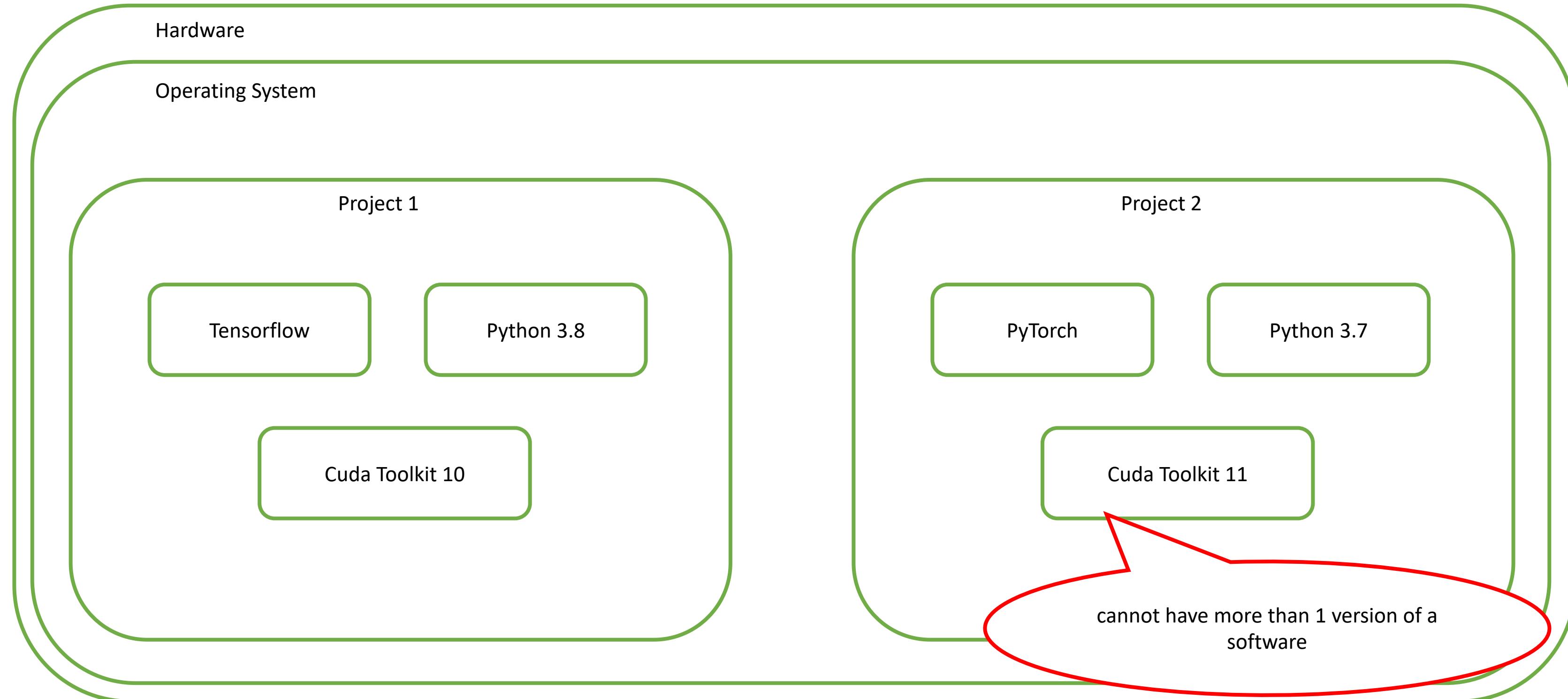
# Problems

- Lot of software dependencies to handle.
- Access the same hardware with different frameworks and environments.
- Deployment and version control problems

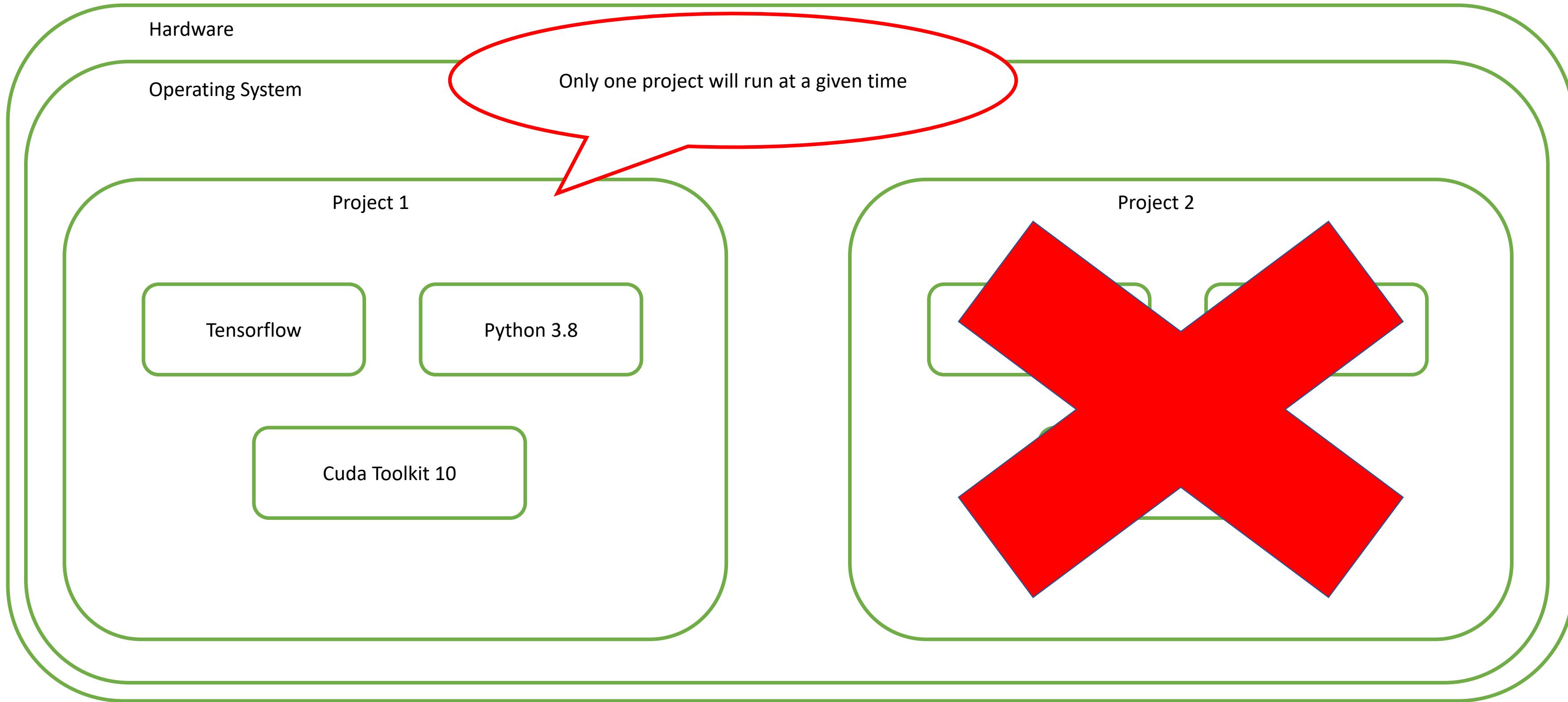
# Dependency problem



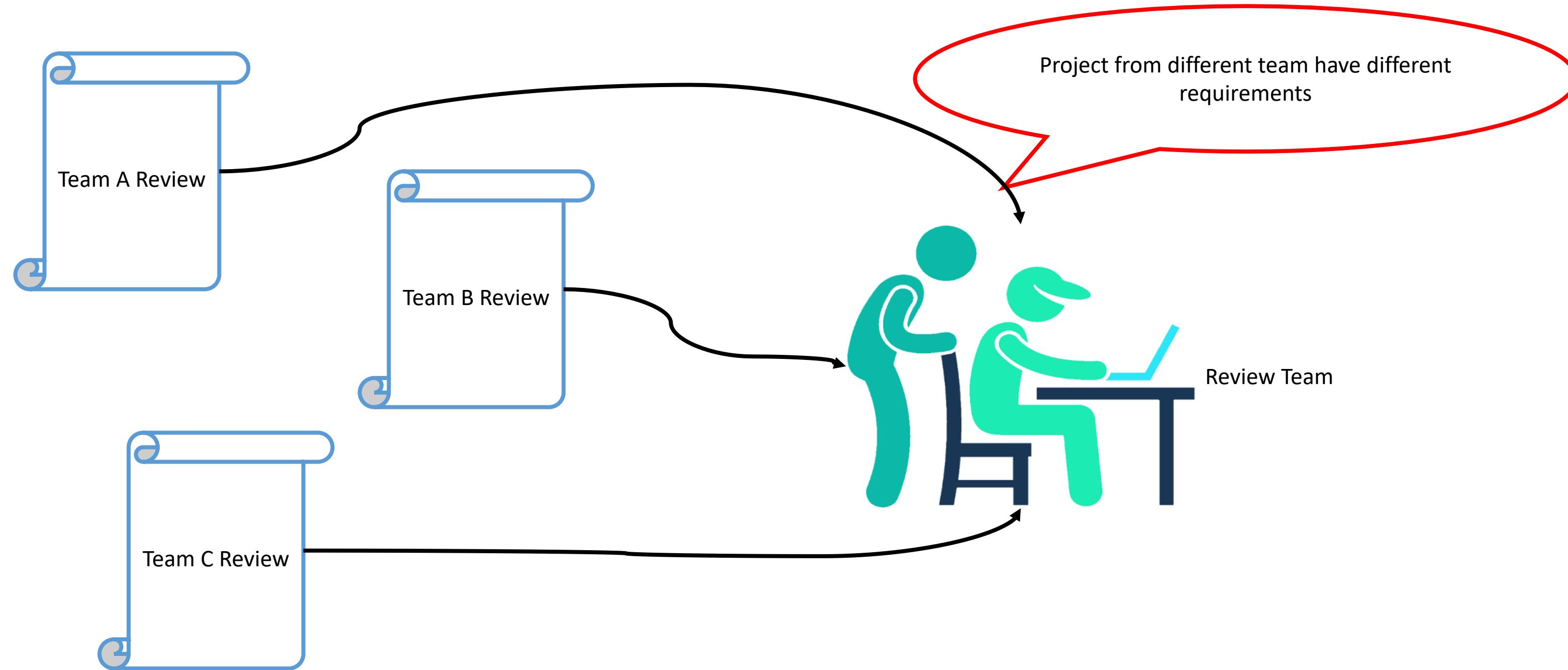
# Dependency problem



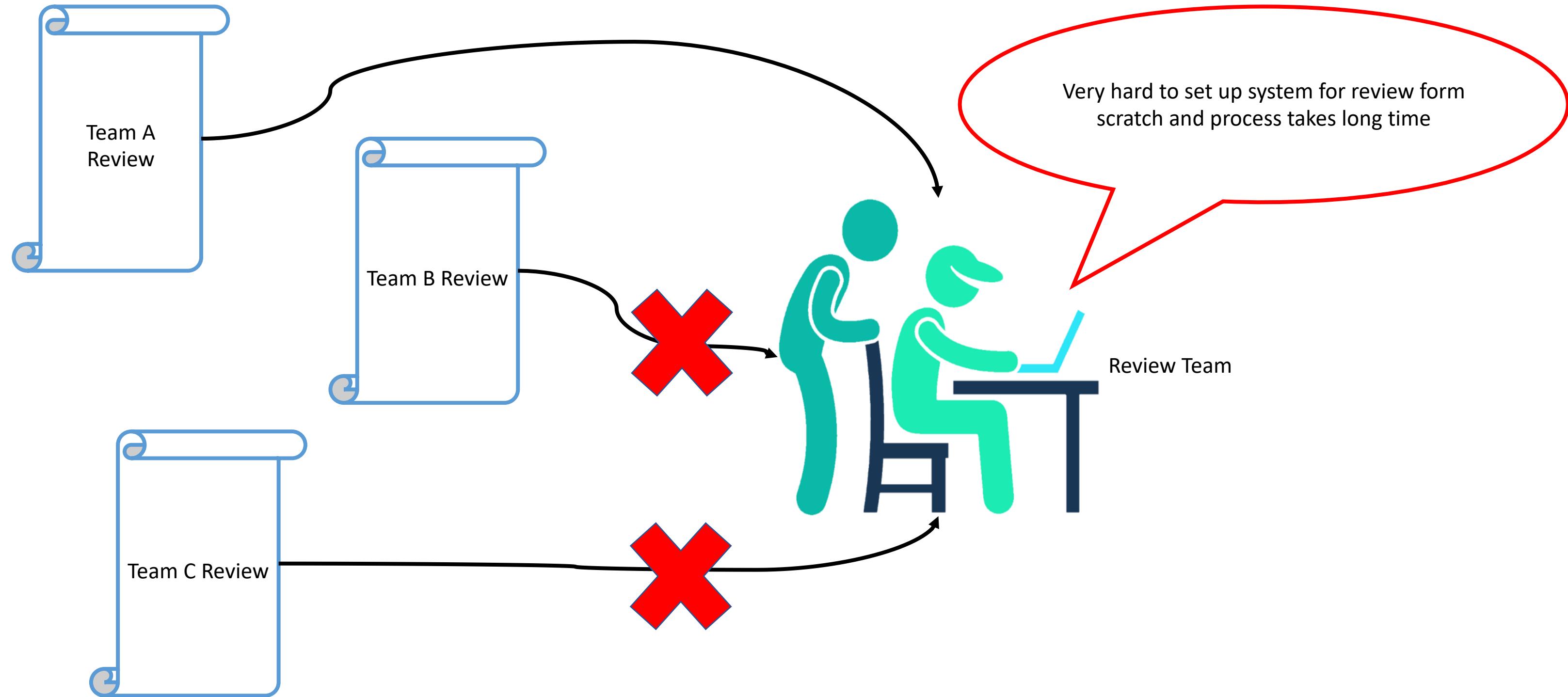
# Dependency problem



# Problems of Version control



# Problems of Version control

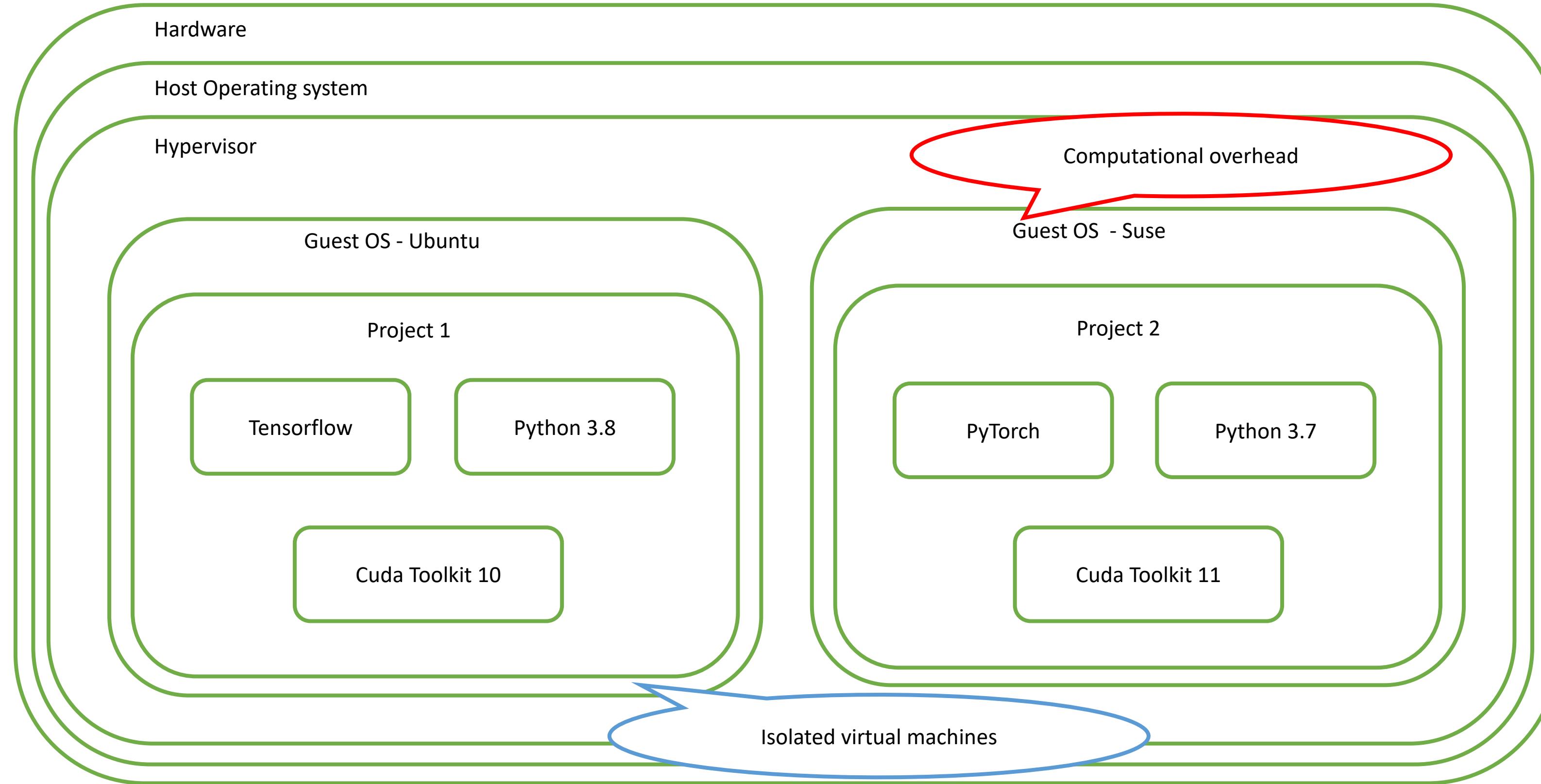




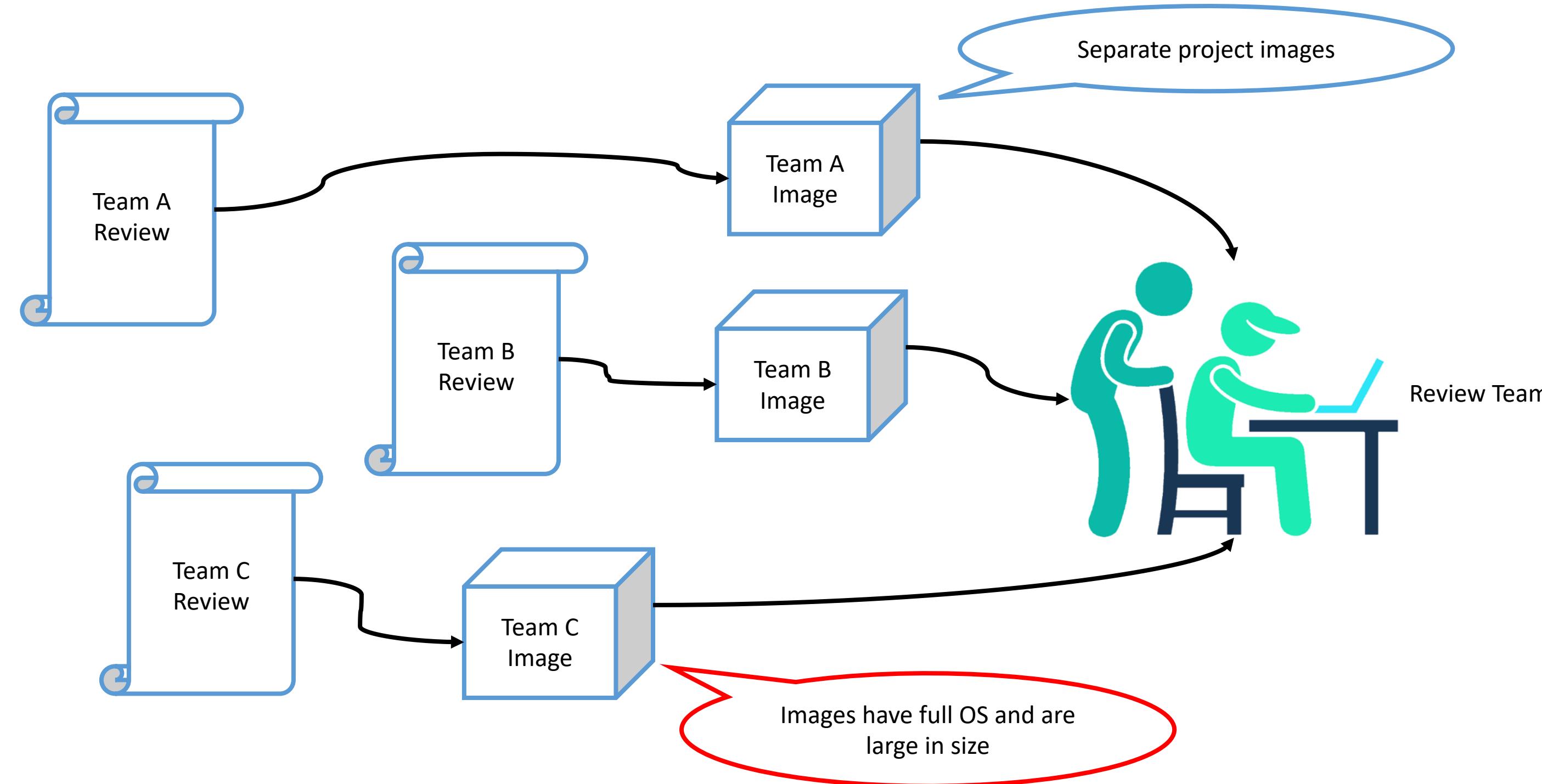
# Possible Solutions

1. Virtual machine
2. Docker and Containers

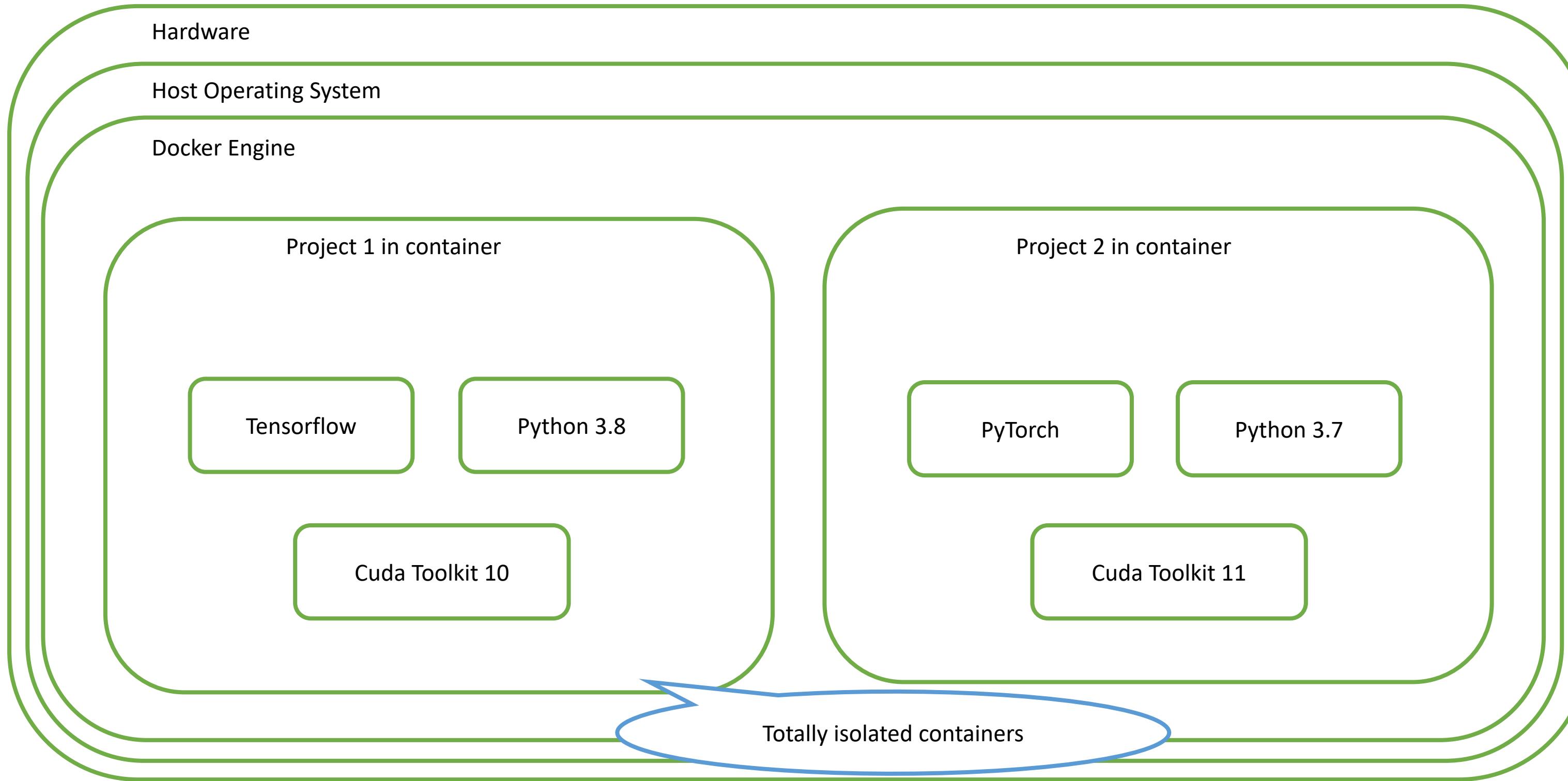
# Virtual Machine – Solution



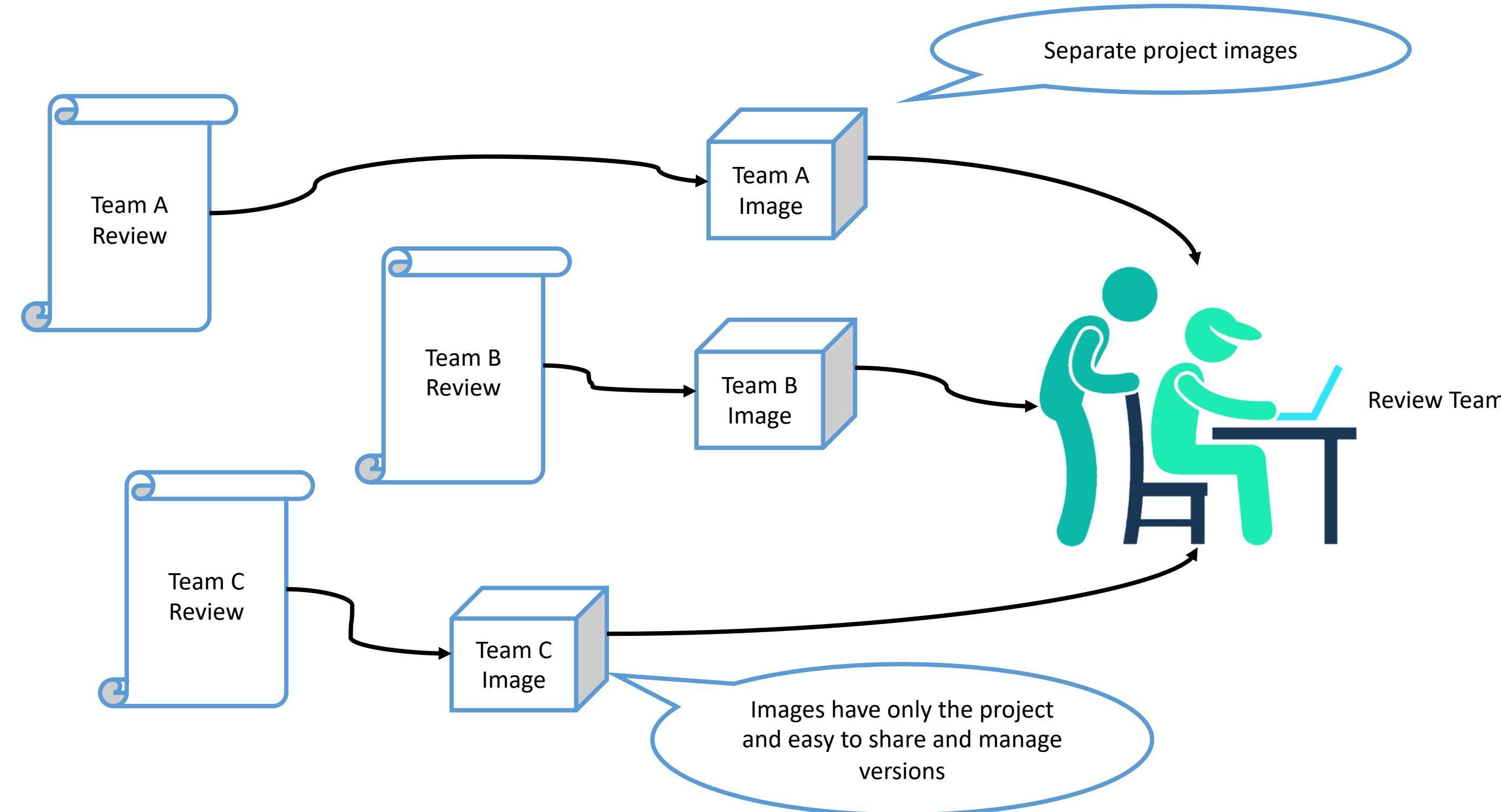
# Version control – Virtual Machine Solution



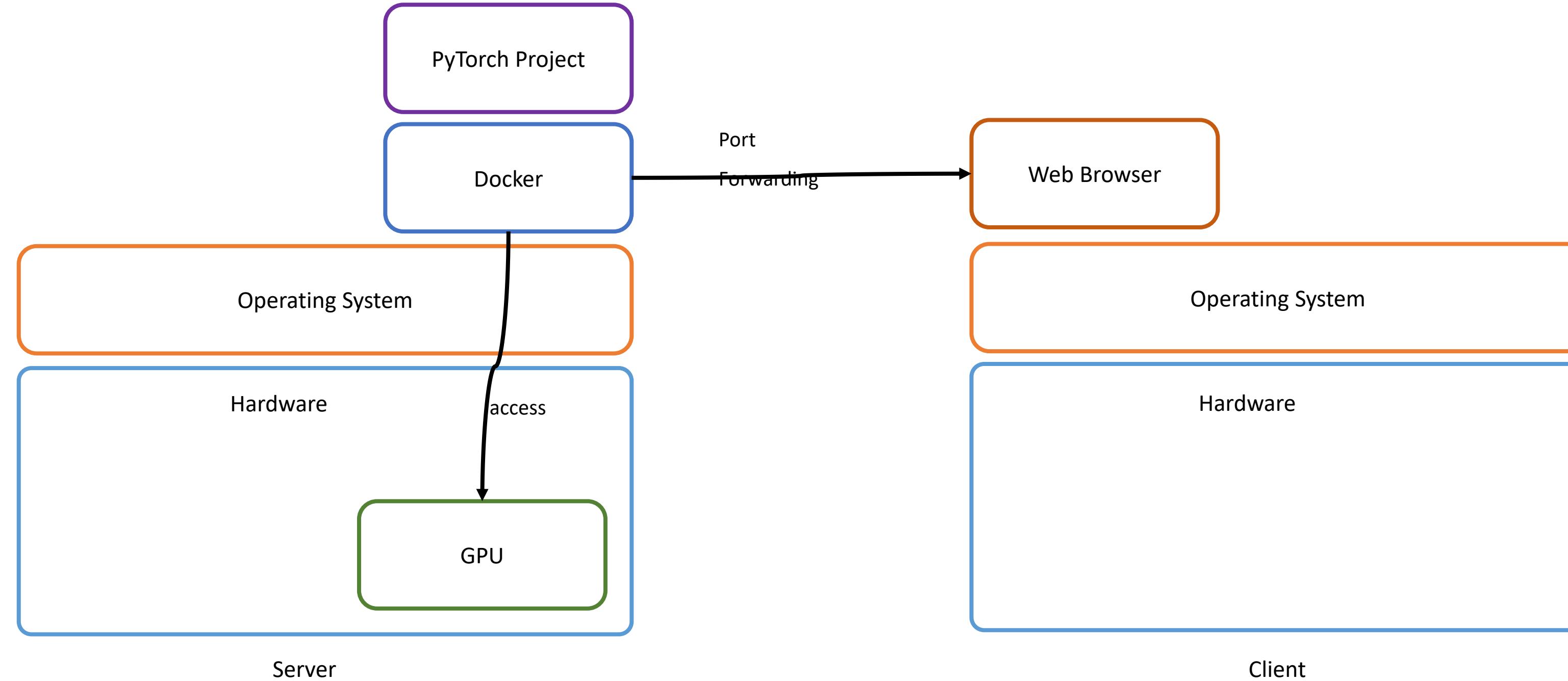
# Dockers – Solution



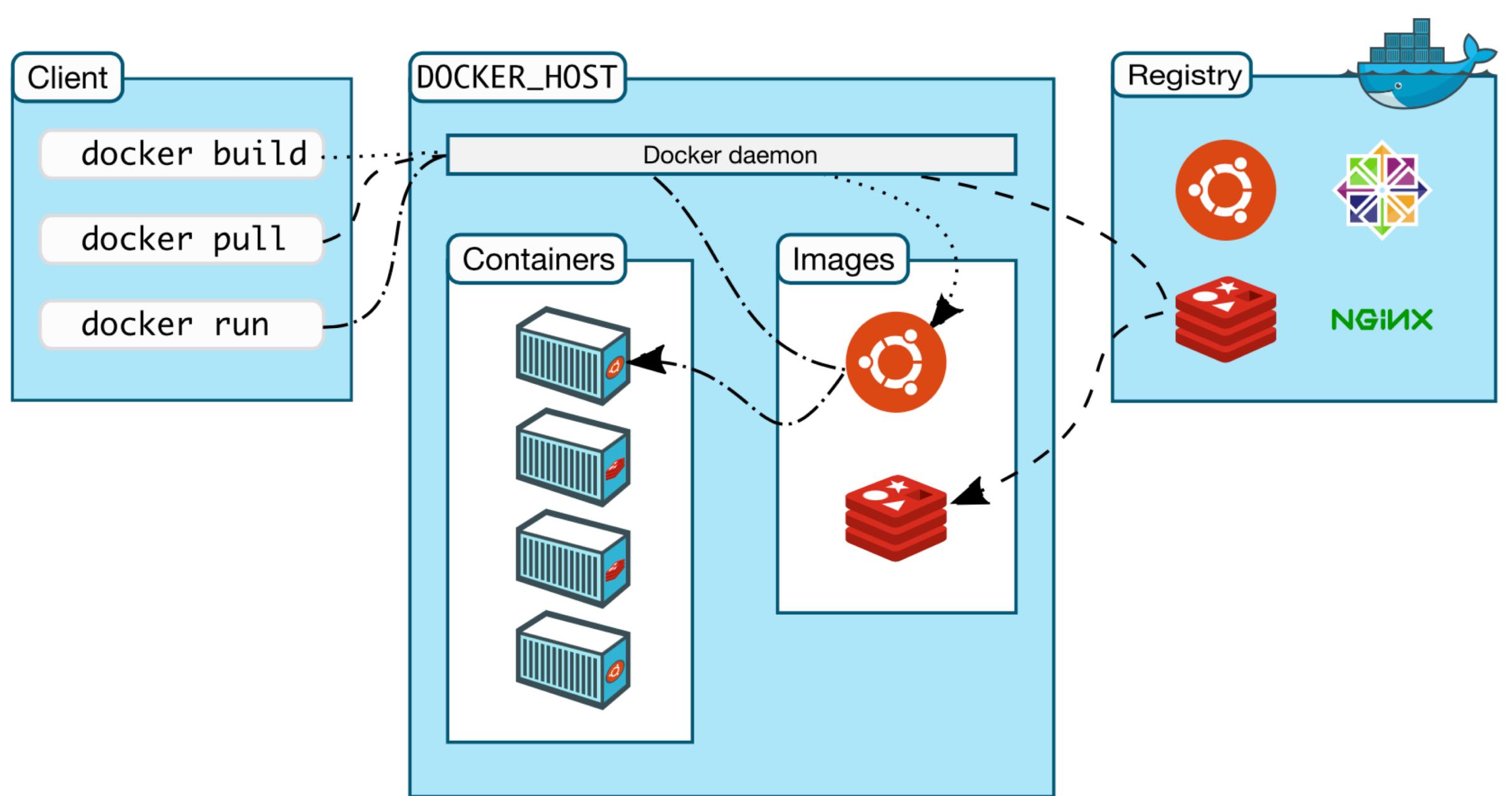
# Version control – Dockers Solution



# Dockers Access – GPU



# Dockers

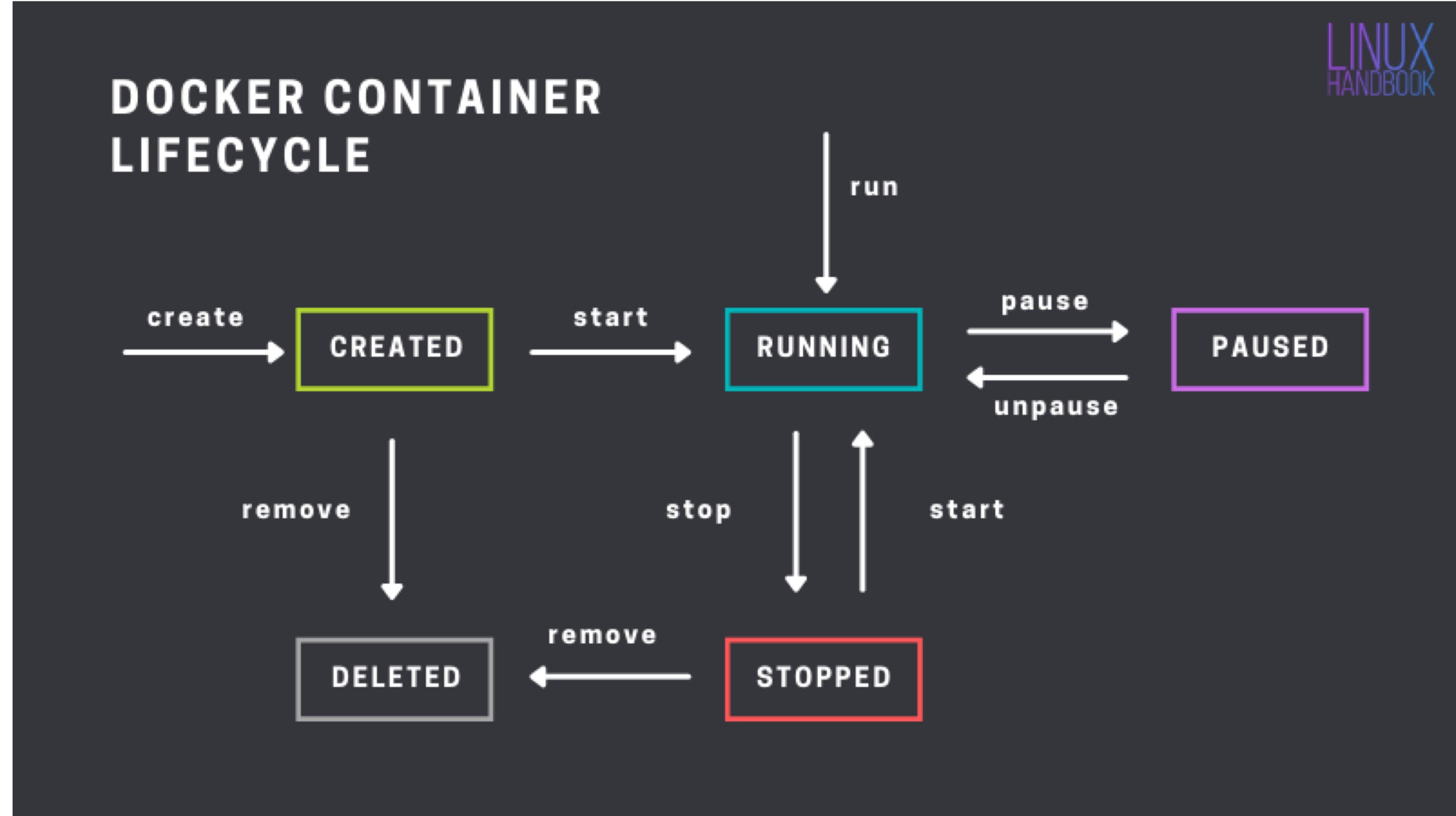


**The Docker daemon :**  
listens for Docker API requests  
and manages Docker objects

**The Docker client:**  
primary way that many Docker  
users interact with Docker

**The Docker registries:**  
Docker registry stores Docker images.

# Dockers





# Demo – Dockers



# Demo NVIDIA NGC – Nvidia Gpu Cloud)

The NGC Catalog is a **curated set of GPU-optimized software for AI, HPC and Visualization.**

The NGC Catalog consists of containers, pre-trained models, Helm charts for Kubernetes deployments and industry specific AI toolkits with software development kits (SDKs).

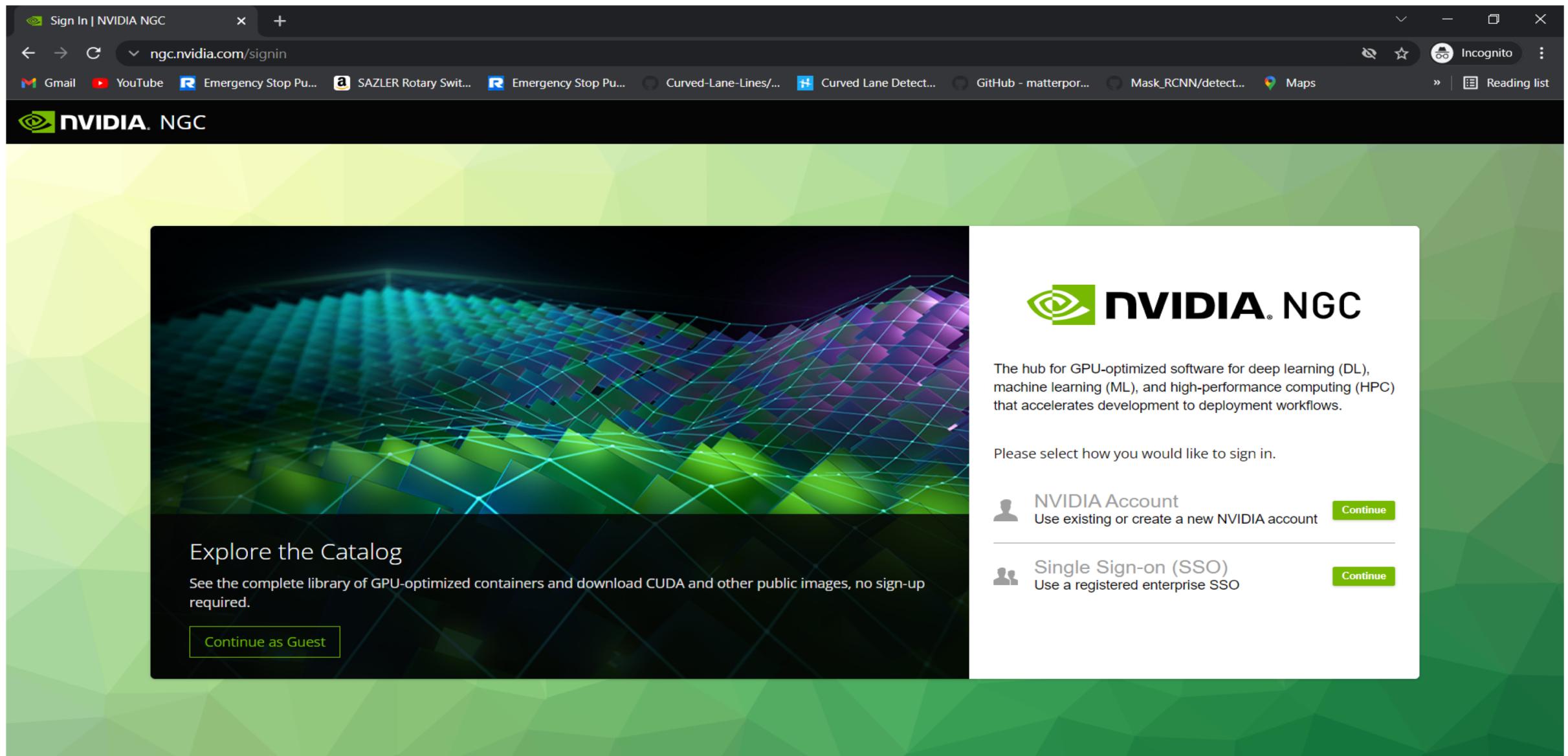
NGC provides software to meet the needs of data scientists, developers, and researchers with various levels of AI expertise.



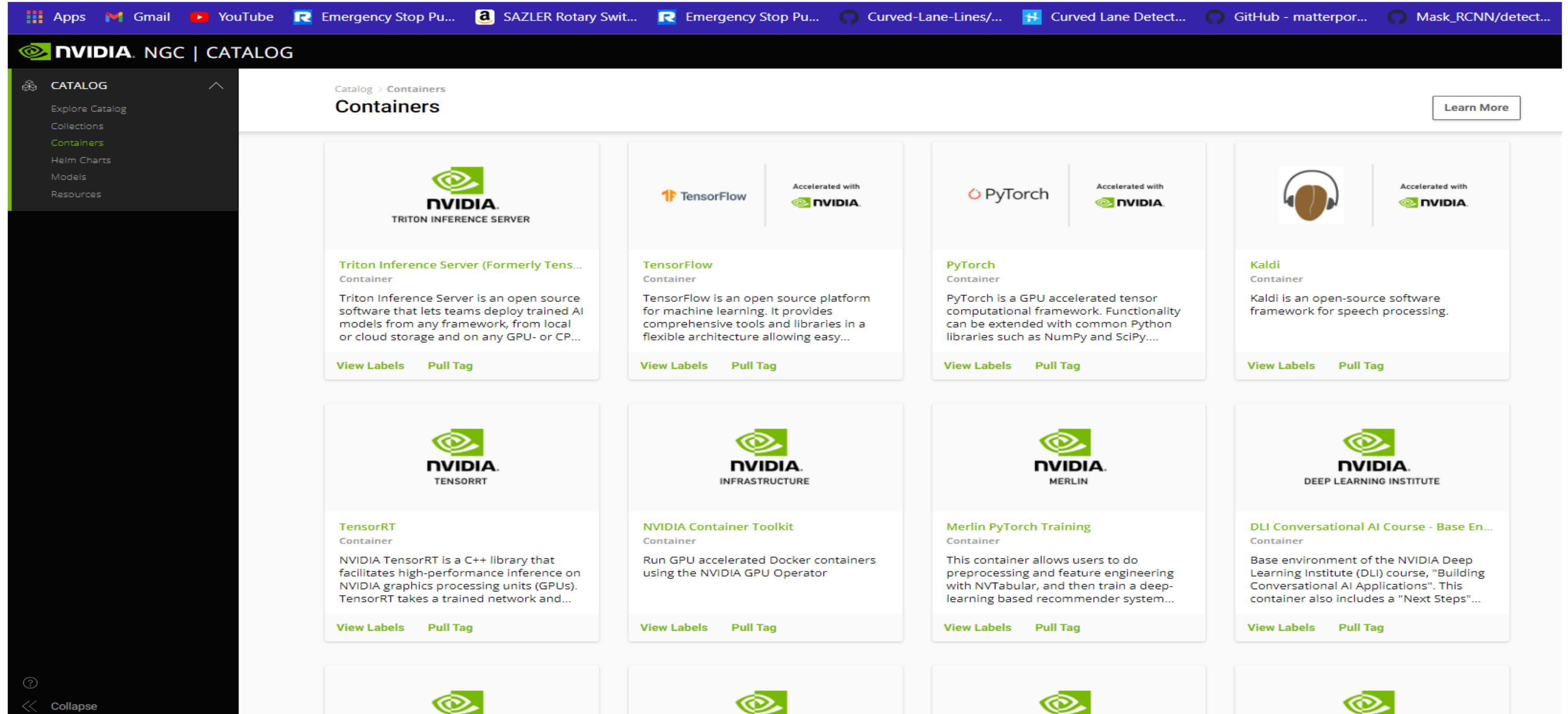
# Accessing NGC Software

## Step 1 : Signing Up for an NGC Registered Account

From your browser, go to the [NGC Sign In page](#) and then click **Continue** by the **NVIDIA Account** choice to create a new NVIDIA account



## Step 2 : Go to dashboard , select containers and search for TensorFlow container

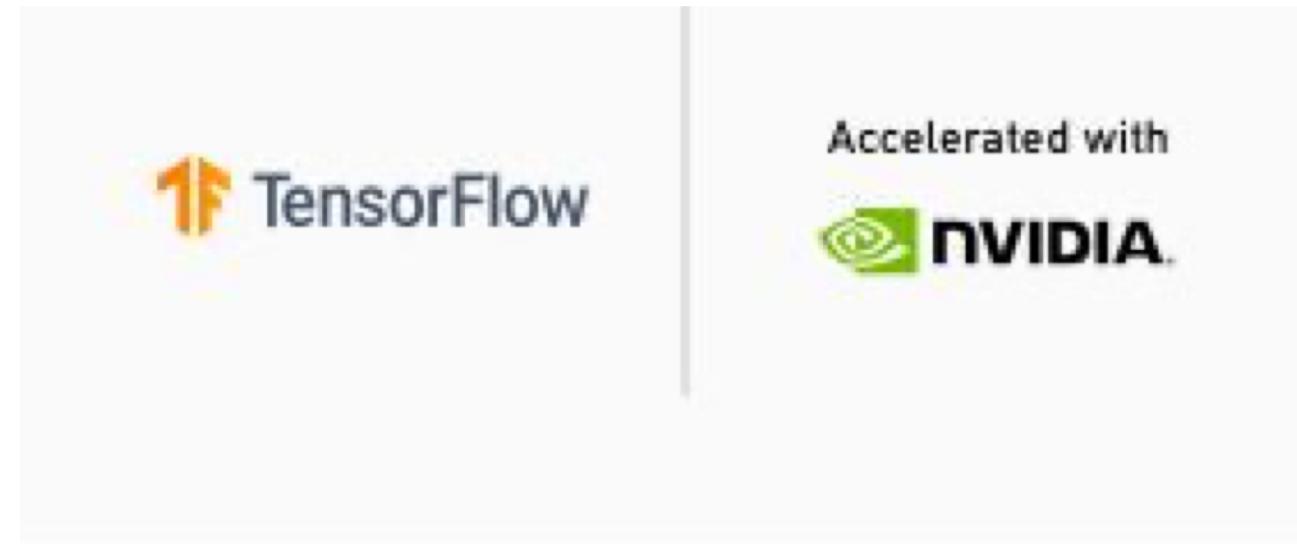


The screenshot shows the NVIDIA NGC Catalog interface. The top navigation bar includes links for Apps, Gmail, YouTube, Emergency Stop Pull Requests, SAZLER Rotary Switch, Emergency Stop Pull Requests, Curved-Lane-Lines/..., Curved Lane Detection, GitHub - matterport/Mask\_RCNN, and Mask\_RCNN/detect... . The main title is "NVIDIA NGC | CATALOG". On the left, a sidebar titled "CATALOG" lists options: Explore Catalog, Collections, **Containers**, Helm Charts, Models, and Resources. The main content area is titled "Containers" and displays eight container cards:

- TRITON INFERENCE SERVER**: Triton Inference Server (Formerly TensorFlow Container). It is an open source software for deploying trained AI models. It is accelerated with NVIDIA.
- TensorFlow**: TensorFlow Container. TensorFlow is an open source platform for machine learning. It provides comprehensive tools and libraries in a flexible architecture allowing easy...
- PyTorch**: PyTorch Container. PyTorch is a GPU accelerated tensor computational framework. Functionality can be extended with common Python libraries such as NumPy and SciPy....
- Kaldi**: Kaldi Container. Kaldi is an open-source software framework for speech processing.
- TENSORRT**: TensorRT Container. NVIDIA TensorRT is a C++ library that facilitates high-performance inference on NVIDIA graphics processing units (GPUs). TensorRT takes a trained network and...
- NVIDIA INFRASTRUCTURE**: NVIDIA Container Toolkit Container. Run GPU accelerated Docker containers using the NVIDIA GPU Operator.
- MERLIN**: Merlin PyTorch Training Container. This container allows users to do preprocessing and feature engineering with NVTabular, and then train a deep-learning based recommender system...
- DEEP LEARNING INSTITUTE**: DLI Conversational AI Course - Base Environment Container. Base environment of the NVIDIA Deep Learning Institute (DLI) course, "Building Conversational AI Applications". This container also includes a "Next Steps"...

Each card has "View Labels" and "Pull Tag" buttons at the bottom. A "Learn More" button is located in the top right corner of the main content area.

Step 3 : just copy the command by clicking on **pull tag**.



## TensorFlow

Container

TensorFlow is an open source platform for machine learning. It provides comprehensive tools and libraries in a flexible architecture allowing easy...

[View Labels](#)    [Pull Tag](#)



Step 4 : paste the command in command prompt and execute it to download the TensorFlow image.

```
chpc@LAPTOP-TDCS0MDA:~$ sudo docker run -it --gpus all -p 8888:8888 nvcr.io/nvidia/tensorflow:22.01-tf1-py3
[sudo] password for chpc:
Unable to find image 'nvcr.io/nvidia/tensorflow:22.01-tf1-py3' locally
22.01-tf1-py3: Pulling from nvidia/tensorflow
ea362f368469: Pulling fs layer
946996a35715: Pulling fs layer
b68628bdd658: Pulling fs layer
ea362f368469: Downloading [==>
788ed670ac9a: Waiting
5bce02e2160d: Waiting
dde9cc1db7fe: Waiting
db5cf65155a: Waiting
488189cee8db: Waiting
8b6a34345376: Waiting
f860e6a3e66f: Waiting
1f89580a8279: Waiting
9b4ca11389c4: Waiting
4c73fe39fac1: Waiting
e6b9cd52cedc: Waiting
e08a1f543f15: Pulling fs layer
b4a2f72692cc: Pulling fs layer
554f1fcfe15: Waiting
3984dc05bbfd: Pulling fs layer
395f16d8ba95: Waiting
d47692734fe3: Pulling fs layer
e76aaa82663b: Waiting
deae5dd9b967: Pulling fs layer
e7701e12f55d: Waiting
dc3e7ef29793: Waiting
3d6f3e52de2c: Waiting
9d572f4dfe30: Waiting
6ee9f3ed004a: Waiting
479d7266e7e2: Waiting
b904efdeda5c: Waiting
f4beac05a4d9: Waiting
0738dd5303f2: Waiting
67cb97dbc fca: Waiting
89c5d7b35812: Waiting
6dc697c3ec49: Waiting
76c872618db8: Waiting
31b56b672639: Waiting
24daaf68204d: Waiting
```

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# Jupyter notebook

- Developed by project jupyter.
- Ipython notebook(2011)
  - Interactive python shell at terminal.
  - Support for interactive data visualization and use of GUI toolkits.
  - Flexible, embeddable interpreters to load into one's own projects.
  - Tools for parallel computing.



## ● Jupyter notebook(2015)

- Jupyter Notebook (formerly IPython Notebooks) is a web-based interactive computational environment for creating notebook documents.
- Open source, interactive data science and scientific computing across over 40 programming languages (such as python, R, Julia, Scala).
- Jupyter Notebook can connect to many *kernels* to allow programming in different languages.
- This web application allows you to create and share documents that contain live code, equations, visualization and explanatory text.
- You can use Jupyter Notebooks for all sorts of data science tasks including data cleaning and transformation, numerical simulation, exploratory data analysis, data visualization, statistical modeling, machine learning, deep learning, and much more.



127.0.0.1



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Select items to perform actions on them.

Upload    New ▾

<input type="checkbox"/>	0	/	Name	Last Modified	File size
<input type="checkbox"/>	0	/		2 minutes ago	
<input type="checkbox"/>	0	<a href="#">_MACOSX</a>		2 minutes ago	
<input type="checkbox"/>	0	<a href="#">APTOS_Dataset</a>		2 minutes ago	
<input type="checkbox"/>	0	<a href="#">jup_dmo</a>		35 minutes ago	
<input type="checkbox"/>	0	<a href="#">Program to unzip the file.ipynb</a>	Running a minute ago	3.05 kB	
<input type="checkbox"/>	0	<a href="#">test_single_gpu-Copy1.ipynb</a>	Running 14 minutes ago	2.09 MB	
<input type="checkbox"/>	0	<a href="#">Untitled.ipynb</a>	an hour ago	72 B	
<input type="checkbox"/>	0	<a href="#">APTOS_Dataset.zip</a>	13 minutes ago	628 MB	



# Step 1 : view the images.

Command : \$docker images

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
aag_mtf_2022_jan	latest	2077f83c4cab	3 weeks ago	9.73GB
nvcr.io/nvidia/tensorflow	22.01-tf1-py3	4388f8085466	3 weeks ago	15.1GB
nvcr.io/nvidia/pytorch	21.12-py3	4c14b66a4c09	2 months ago	14.7GB
tensorflow/tensorflow	latest-gpu	0b7c1e7aa055	3 months ago	5.71GB
nvcr.io/nvidia/digits	21.09-tensorflow-py3	22d4b7c5ed49	5 months ago	14.6GB
nvidia/cuda	9.0-cudnn7-devel	5a02663c1015	7 months ago	2.52GB
tensorflow/tensorflow	latest-gpu-jupyter	346d69d2c7f8	8 months ago	5.91GB
tensorflow/tensorflow	latest	1d932048a281	8 months ago	1.3GB
tensorflow/tensorflow	2.2.2-gpu-py3-jupyter	3eecc2022a52	13 months ago	3.99GB
nvcr.io/nvidia/pytorch	20.12-py3	ad0f29ddeb63	14 months ago	14.2GB
nvcr.io/nvidia/tensorflow	20.03-tf2-py3	9af3e368023b	22 months ago	7.44GB
tensorflow/tensorflow	1.11.0-devel-gpu-py3	9be5b6a9d896	3 years ago	3.7GB



## Step 2 : creation of container with container name as jupyter\_demo

```
Command : $sudo NV_GPU=0,1,2,3 nvidia-docker  
run -it -p 3001:8801 --name="jupyter_demo" -  
v /home/uday/msp_containers/chpc_demo:/workspa  
ce/chpc_demo nvcr.io/nvidia/tensorflow:20.03-
```

```
[uday@dgx:~$ sudo NV_GPU=0,1,2,3 nvidia-docker run -it -p 3001:8801 --name="jupyter_demo" --shm-size="10G" -v /home/uday/msp_containers/chpc_demo:/workspace/chpc_demo nvcr.io/nvidi  
a/tensorflow:20.03-tf2-py3  
[[sudo] password for uday:  
  
=====  
== TensorFlow ==  
=====  
  
NVIDIA Release 20.03-tf2 (build 11026100)  
TensorFlow Version 2.1.0  
  
Container image Copyright (c) 2019, NVIDIA CORPORATION. All rights reserved.  
Copyright 2017-2019 The TensorFlow Authors. All rights reserved.  
  
Various files include modifications (c) NVIDIA CORPORATION. All rights reserved.  
NVIDIA modifications are covered by the license terms that apply to the underlying project or file.  
  
Detected MOFED 4.6-1.0.1.
```

# Thank You