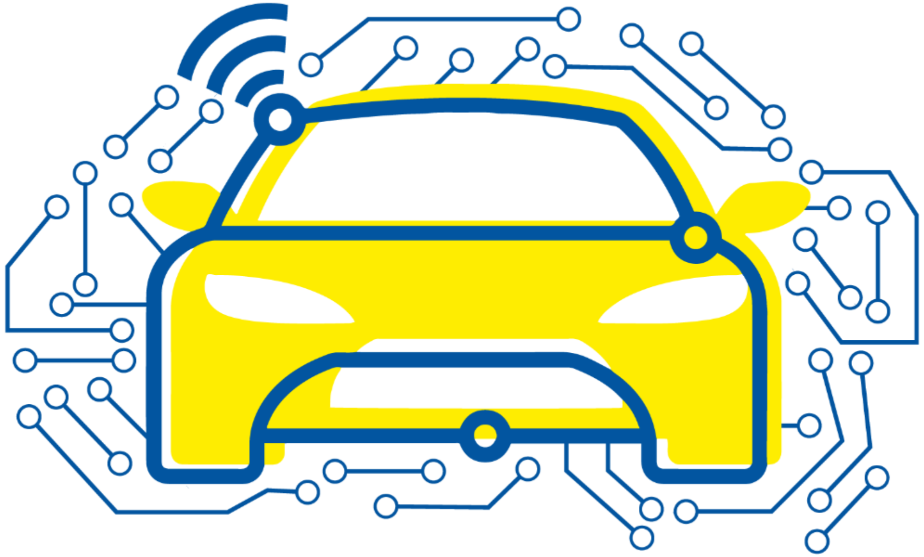
Automated and Connected Driving Challenges

Section 1 – Introduction & Tools

Tools

Overview

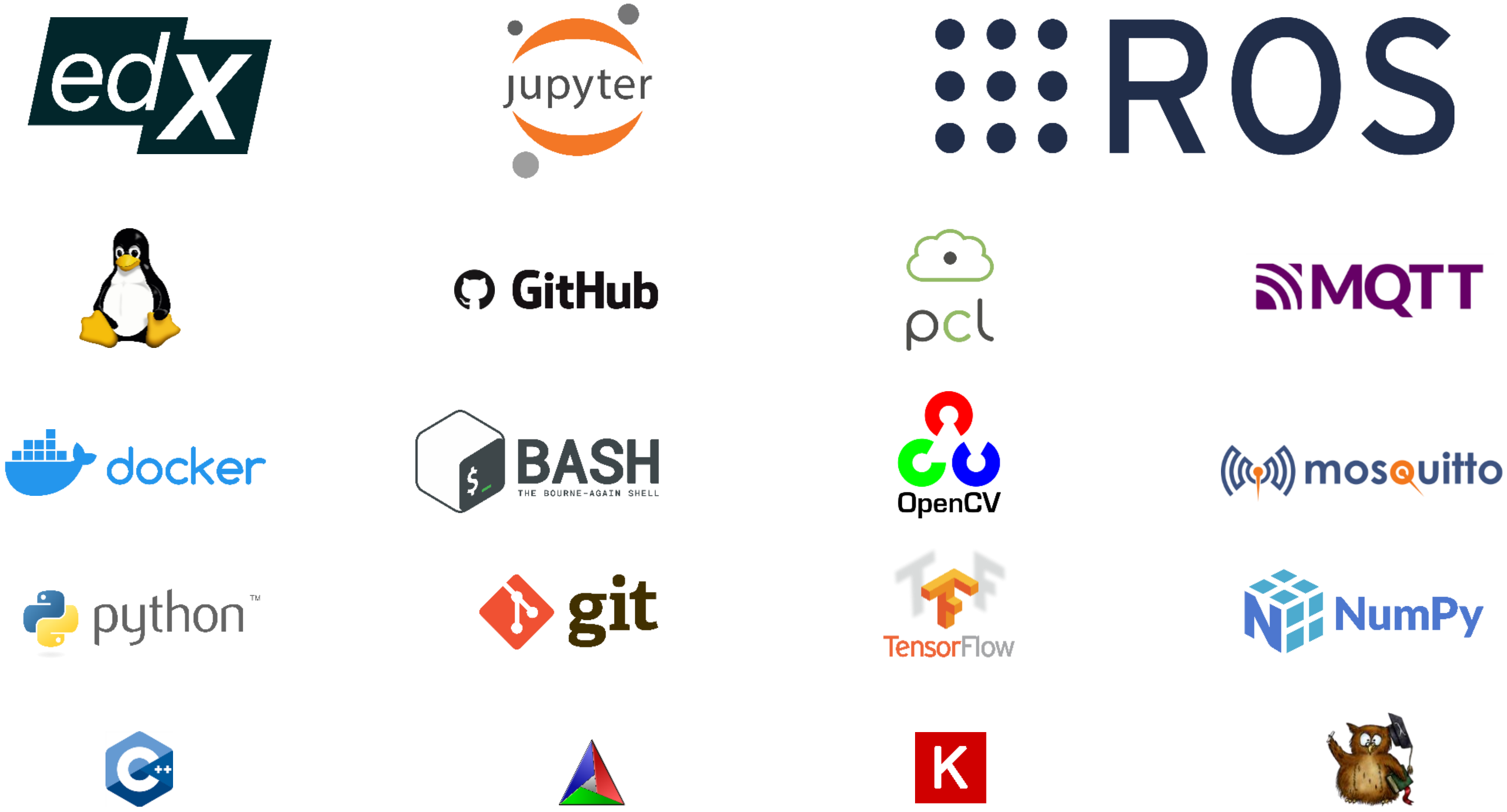


Bastian Lampe

Institute for Automotive Engineering

Tools – Overview

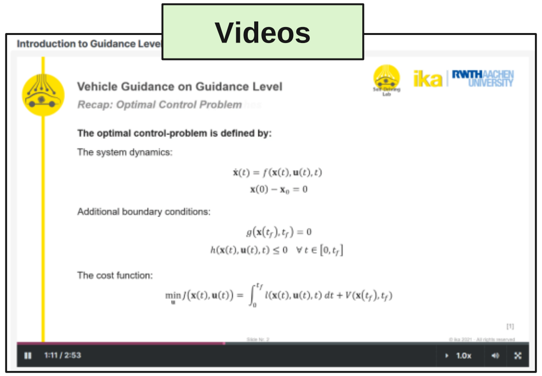
Tools in ACDC



Tools – Overview

edX Course Platform

Videos


Introduction to Guidance Level

Vehicle Guidance on Guidance Level

Recap: Optimal Control Problem

The optimal control-problem is defined by:

The system dynamics:

$$\dot{\mathbf{x}}(t) = f(\mathbf{x}(t), \mathbf{u}(t), t)$$
$$\mathbf{x}(0) - \mathbf{x}_0 = 0$$

Additional boundary conditions:

$$g(\mathbf{x}(t_f), t_f) = 0$$
$$h(\mathbf{x}(t), \mathbf{u}(t), t) \leq 0 \quad \forall\, t \in [0, t_f]$$

The cost function:

$$\min_{\mathbf{u}} J(\mathbf{x}(t), \mathbf{u}(t)) = \int_0^{t_f} l(\mathbf{x}(t), \mathbf{u}(t), t)\, dt + V(\mathbf{x}(t_f), t_f)$$

[1]

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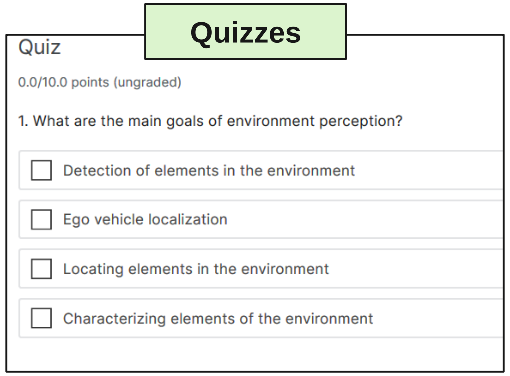
Quizzes


Quiz

0.0/10.0 points (ungraded)

1. What are the main goals of environment perception?

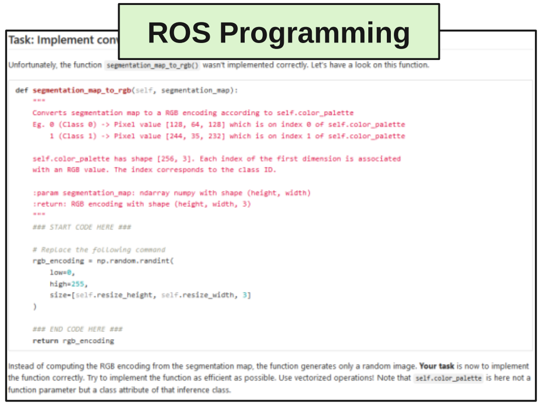
□ Detection of elements in the environment

□ Ego vehicle localization

□ Locating elements in the environment

□ Characterizing elements of the environment

ROS Programming

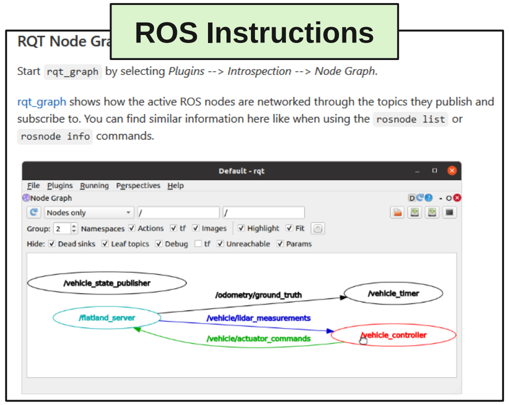

Task: Implement con

Unfortunately, the function `segmentation_map_to_rgb()` wasn't implemented correctly. Let's have a look on this function.

```
def segmentation_map_to_rgb(self, segmentation_map):
    """
    Converts segmentation map to a RGB encoding according to self.color_palette
    Eg. 0 (Class 0) -> Pixel value [128, 64, 128] which is on index 0 of self.color_palette
        1 (Class 1) -> Pixel value [244, 35, 232] which is on index 1 of self.color_palette

    self.color_palette has shape [256, 3]. Each index of the first dimension is associated
    with an RGB value. The index corresponds to the class ID.

    :param segmentation_map: ndarray numpy with shape (height, width)
    :return: RGB encoding with shape (height, width, 3)
    """
    ### START CODE HERE ###

    # Replace the following command
    rgb_encoding = np.random.randint(
        low=0,
        high=255,
        size=[self.resize_height, self.resize_width, 3]
    )

    ### END CODE HERE ###
    return rgb_encoding
```

Instead of computing the RGB encoding from the segmentation map, the function generates only a random image. **Your task** is now to implement the function correctly. Try to implement the function as efficient as possible. Use vectorized operations! Note that `self.color_palette` is here not a function parameter but a class attribute of that inference class.

ROS Instructions


RQT Node Gra

Start `rqt_graph` by selecting *Plugins --> Introspection --> Node Graph.*

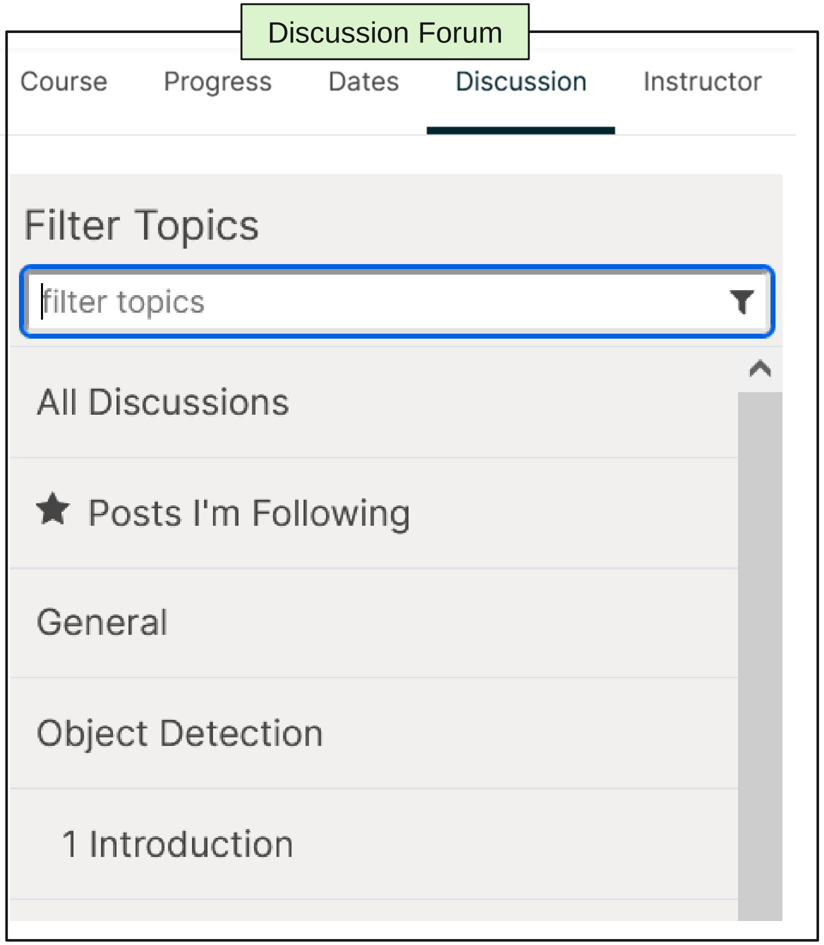
rqt_graph shows how the active ROS nodes are networked through the topics they publish and subscribe to. You can find similar information here like when using the `rosnode list` or `rosnode info` commands.

Nodes only

Group: 2 Namespaces ☑ Actions ☑ tf ☑ Images ☑ Highlight ☑ Fit

Hide: ☑ Dead sinks ☑ Leaf topics ☑ Debug □ tf ☑ Unreachable ☑ Params

Discussion Forum


Filter Topics

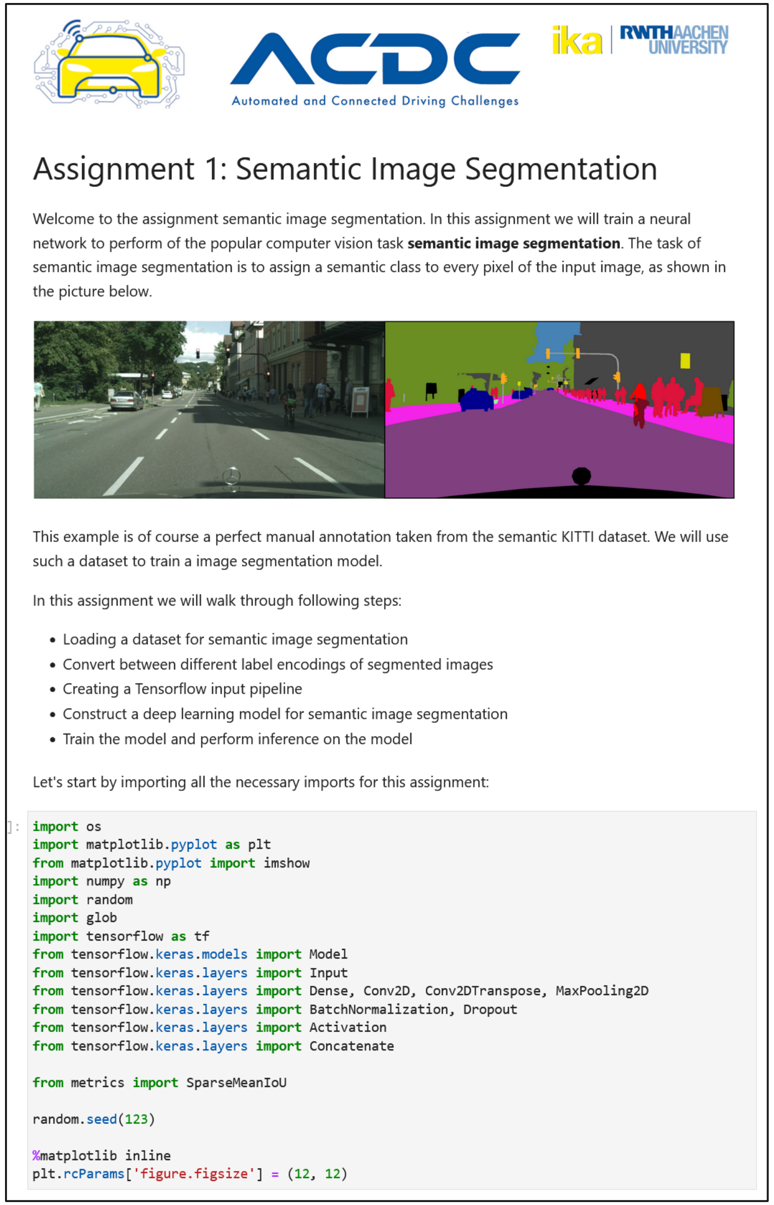
filter topics

Tools – Overview

Jupyter Notebooks

- Jupyter Notebooks allow to create and share documents that contain
  - live code,
  - equations,
  - visualizations and
  - narrative text

- You will find **prepared** notebooks that contain explanations and Python coding tasks



ACDC

Automated and Connected Driving Challenges

Assignment 1: Semantic Image Segmentation

Welcome to the assignment semantic image segmentation. In this assignment we will train a neural network to perform of the popular computer vision task **semantic image segmentation**. The task of semantic image segmentation is to assign a semantic class to every pixel of the input image, as shown in the picture below.

This example is of course a perfect manual annotation taken from the semantic KITTI dataset. We will use such a dataset to train a image segmentation model.

In this assignment we will walk through following steps:

- Loading a dataset for semantic image segmentation
- Convert between different label encodings of segmented images
- Creating a Tensorflow input pipeline
- Construct a deep learning model for semantic image segmentation
- Train the model and perform inference on the model

Let's start by importing all the necessary imports for this assignment:

```python
import os
import matplotlib.pyplot as plt
from matplotlib.pyplot import imshow
import numpy as np
import random
import glob
import tensorflow as tf
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Input
from tensorflow.keras.layers import Dense, Conv2D, Conv2DTranspose, MaxPooling2D
from tensorflow.keras.layers import BatchNormalization, Dropout
from tensorflow.keras.layers import Activation
from tensorflow.keras.layers import Concatenate

from metrics import SparseMeanIoU

random.seed(123)

%matplotlib inline
plt.rcParams['figure.figsize'] = (12, 12)
```

Tools – Overview

GitHub Issues

GitHub

- Issues are great for keeping track of
  - bugs and
  - general problems

  of a project‘s **Software / Code**.

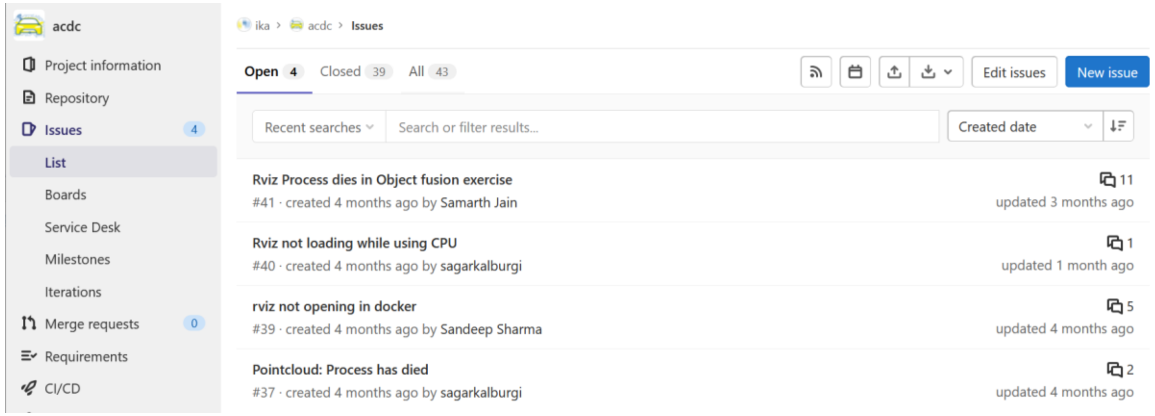
- Not for theory questions → edX forum

- **Search** for your problem in open and closed issues.

- Create a **new issue** if you have a **new problem**,
  e.g. when following the course’s tutorials.

- Fill in the issue **template** when submitting a new issue.

- Feel free to **contribute** to issues of other students!



acdc
Project information
Repository
Issues 4
List
Boards
Service Desk
Milestones
Iterations
Merge requests 0
Requirements
CI/CD

ika › acdc › Issues

Open 4 Closed 39 All 43 | Edit issues | New issue

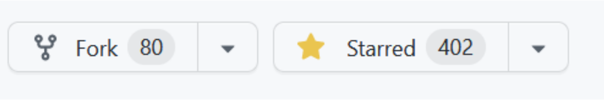
Recent searches | Search or filter results... | Created date

Rviz Process dies in Object fusion exercise — 11
#41 · created 4 months ago by Samarth Jain — updated 3 months ago

Rviz not loading while using CPU — 1
#40 · created 4 months ago by sagarkalburgi — updated 1 month ago

rviz not opening in docker — 5
#39 · created 4 months ago by Sandeep Sharma — updated 4 months ago

Pointcloud: Process has died — 2
#37 · created 4 months ago by sagarkalburgi — updated 4 months ago



Fork 80 | Starred 402

Klick **Star** if you like our work ☺

Tools – Overview

Software Tools

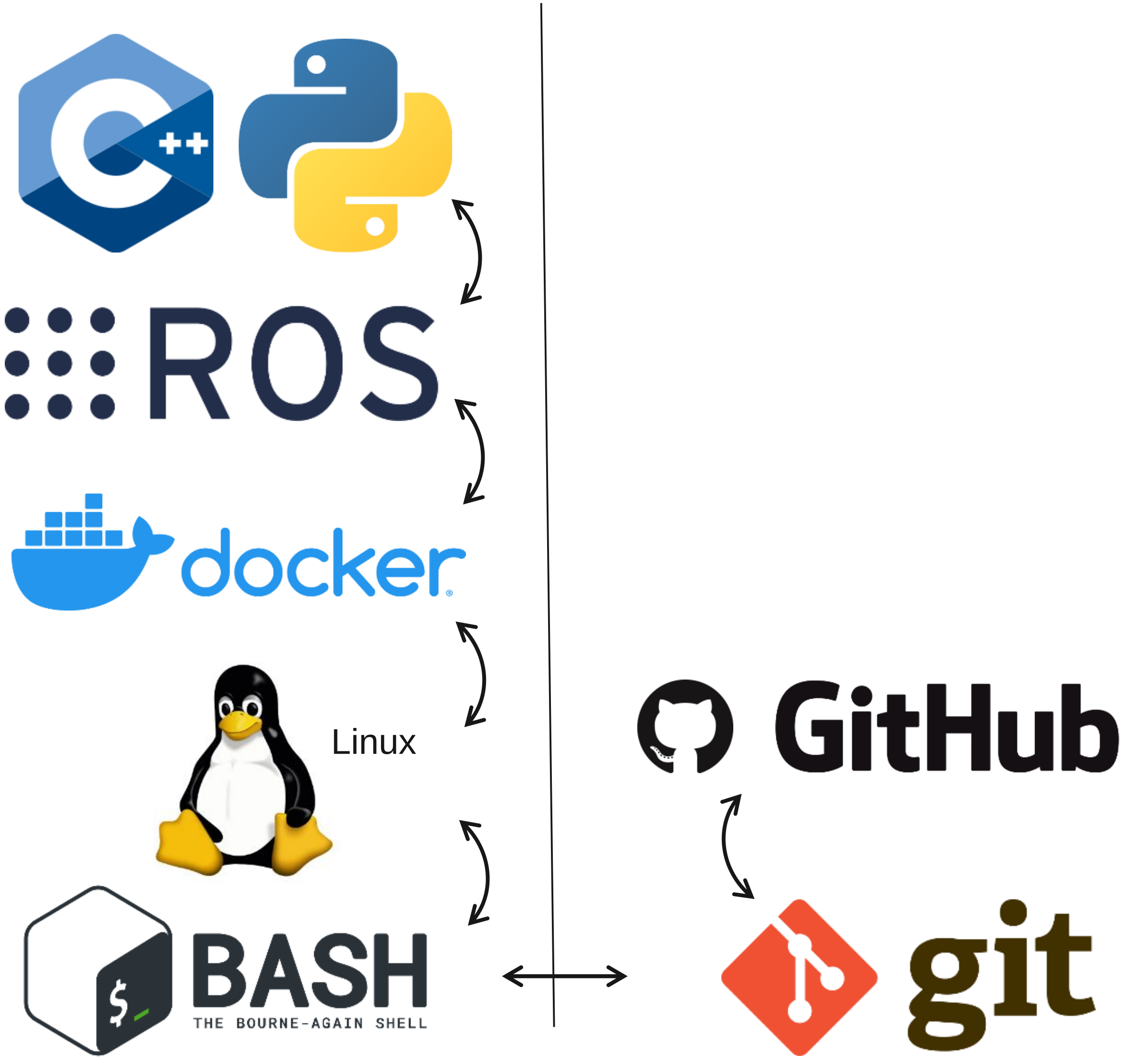
Language for user-written code

Middleware between user code and actual OS

Docker containers as platform as a service

Operating system (e.g. Ubuntu 20.04)

Unix shell & command language



web-service for managing git repositories

version control system for code organization

Tools – Overview

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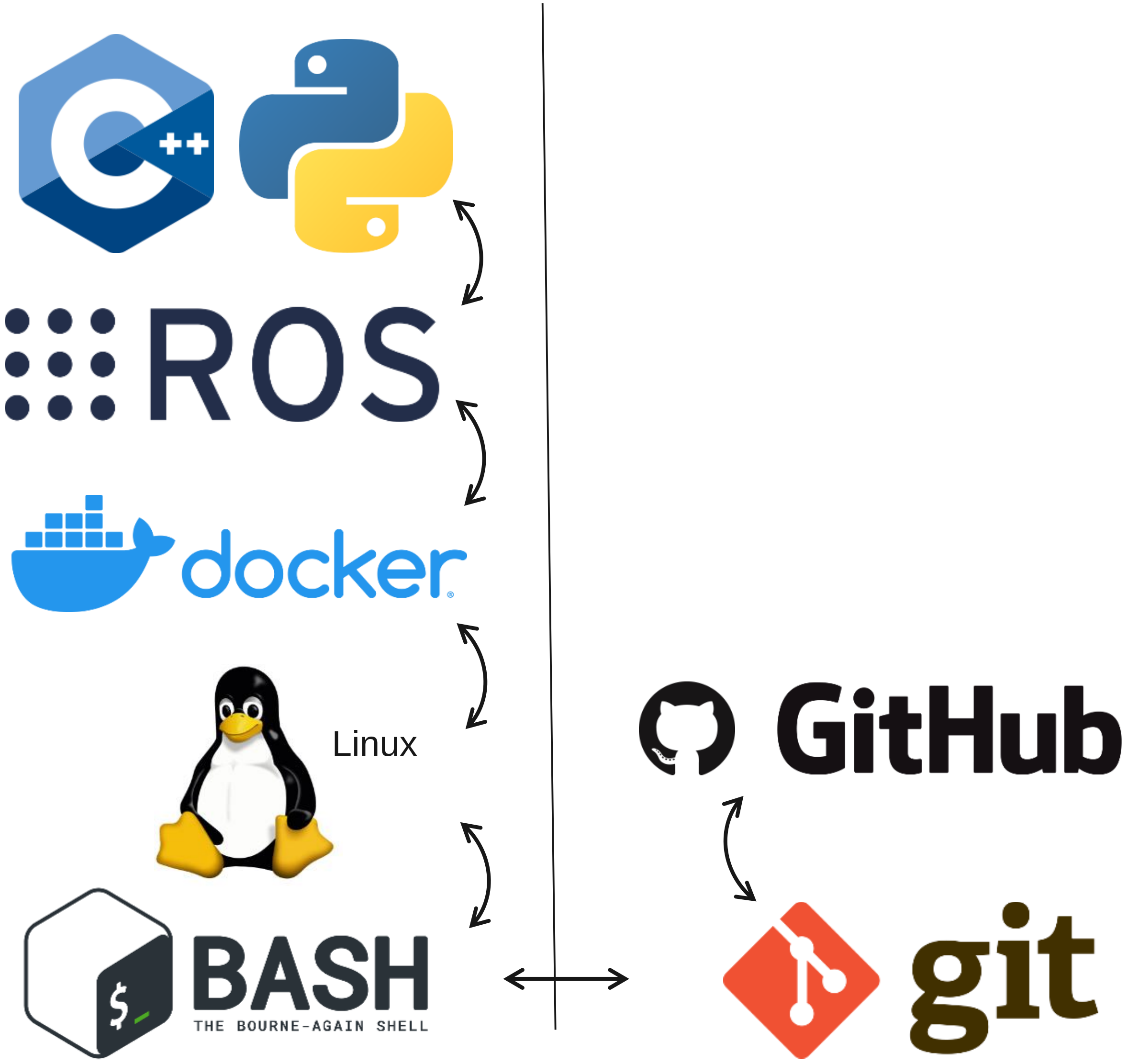

web-service for managing git repositories

version control system for code organization