



TensorFlow World

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TensorFlow

Hyperparameter tuning for TensorFlow using Katib and Kubeflow

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tensorflow.world

#TFWorld

High Level Goals

- Understand automated machine learning landscape
- Deep dive into hyperparameter optimization (HPO)
- Be able to install and use Katib for HPO
- Understand Kubeflow components



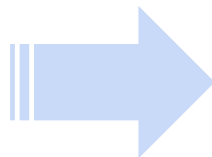
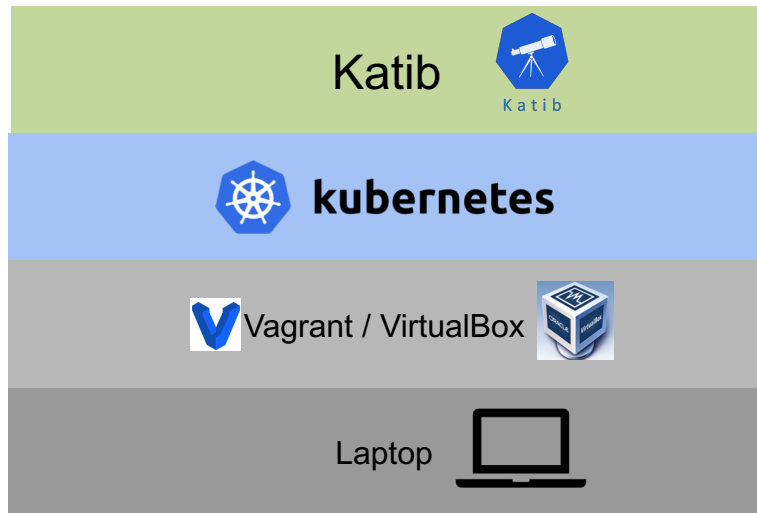
Agenda

- Tutorial – Setup prerequisites
- Automated machine learning landscape
- Hyperparameter, Katib and Kubeflow overview
- Tutorial – Setup Kubernetes
- HPO and Katib deep dive
- Tutorial – Katib
- Kubeflow overview and demo
- Summary

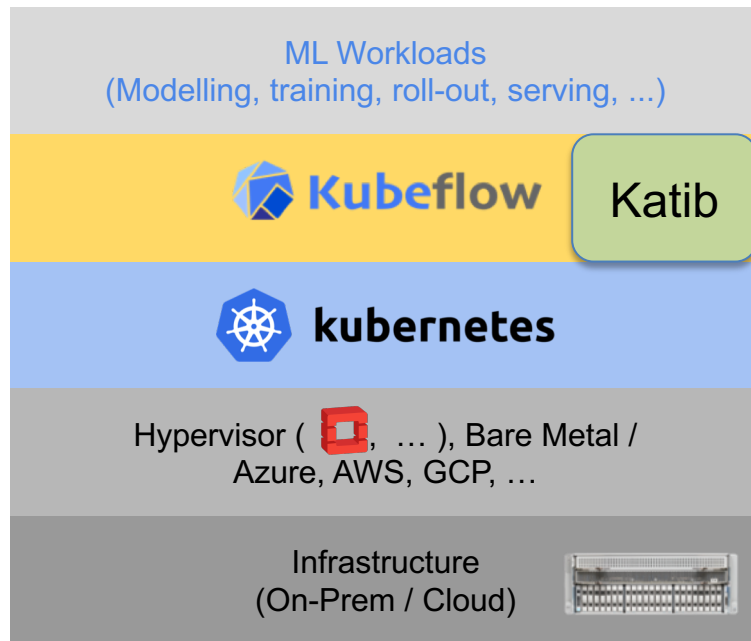


Tutorial Setup

Today's Tutorial



Production



VirtualBox and Vagrant



Vagrant

Box: minikatib/tfworld
Version: 0.2.0



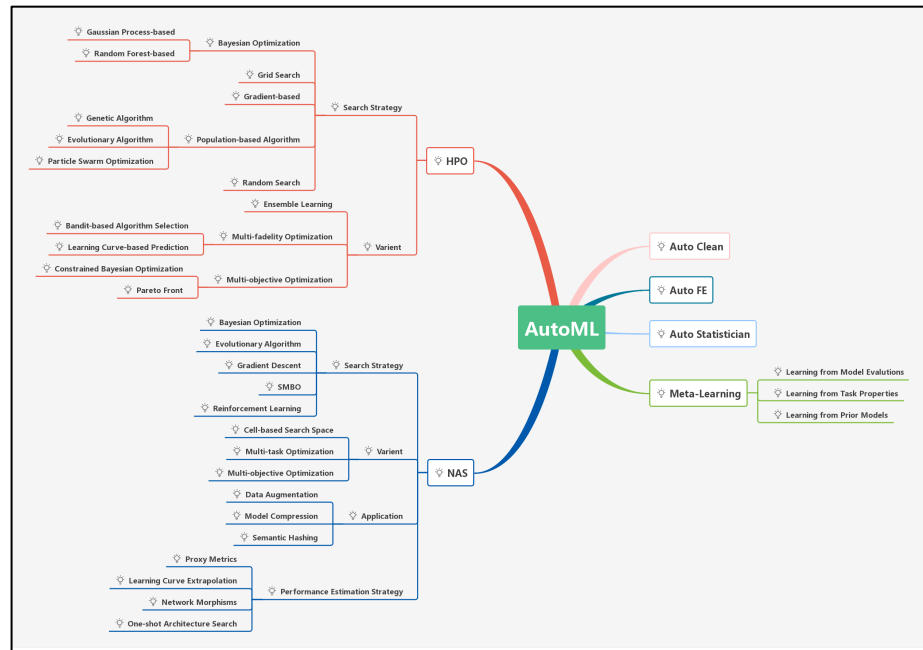

Tutorial: Setup Prerequisites

- Instructions - <https://tfworldkatib.github.io/tutorial/prereqs/prereqs.html>
- Questions



Automated Machine Learning

INPUT MNIST dataset



Output

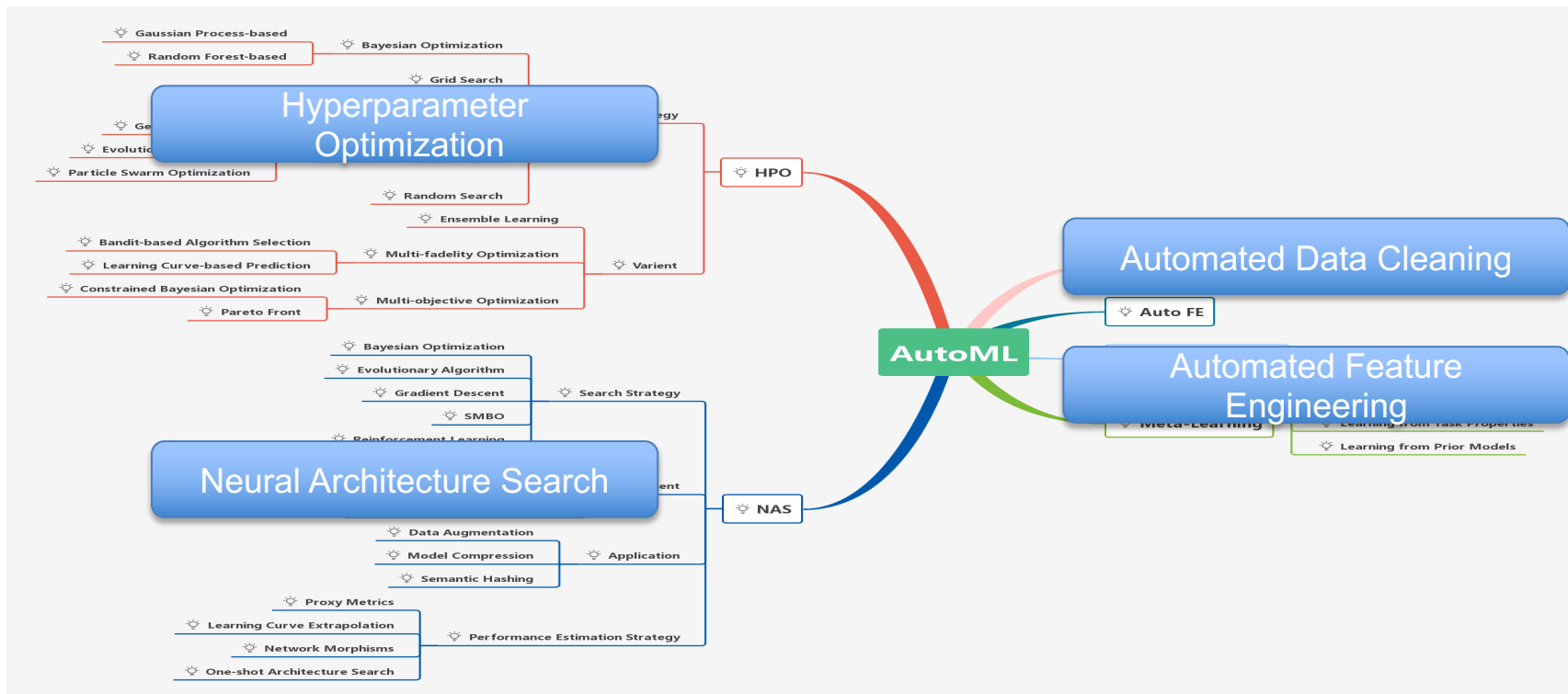
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4

8

Source - <https://github.com/hibayesian/awesome-automl-papers>

Automated Machine Learning



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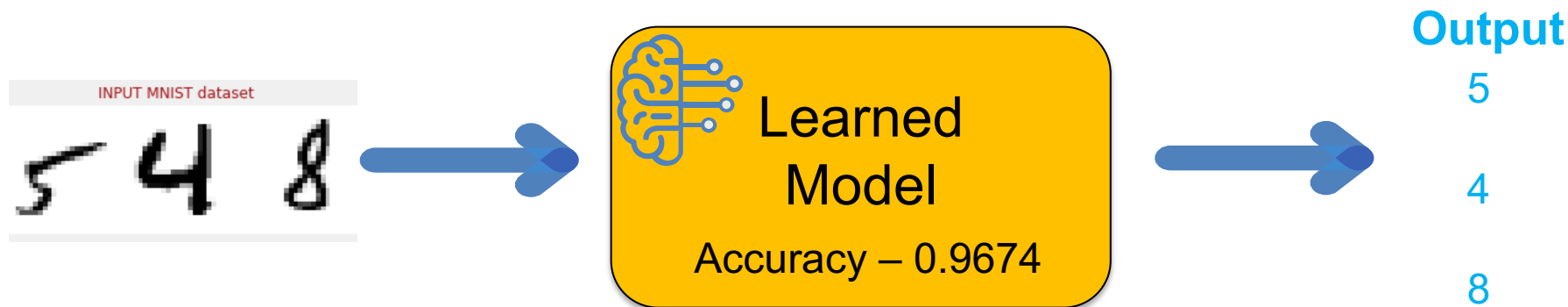
TensorFlow

<https://tfworldkatib.github.io/tutorial>

tensorflow.world
#TFWorld

Source - <https://github.com/hibayesian/awesome-automl-papers>

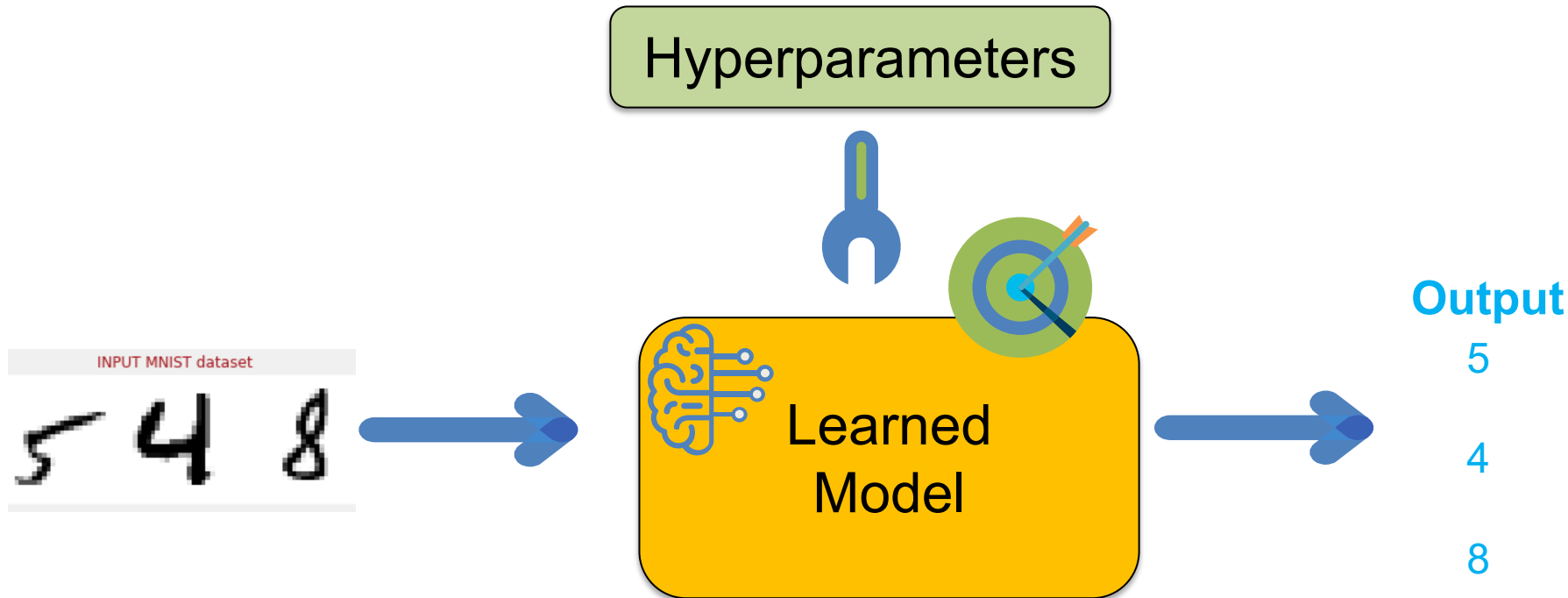
Use Case: Improve Model Performance



How to improve model prediction accuracy 0.9674 ?

https://github.com/kubeflow/tf-operator/blob/master/examples/v1/mnist_with_summaries/mnist_with_summaries.py

What is Hyperparameter



Hyperparameter: Examples

- Learning rate
- Batch size
- Optimizer
- Number of layers in the neural network

Hyperparameter are variables set by data scientist prior to the training process to improve model performance



Why Automate Hyperparameter Tuning?

- **Not transferable**

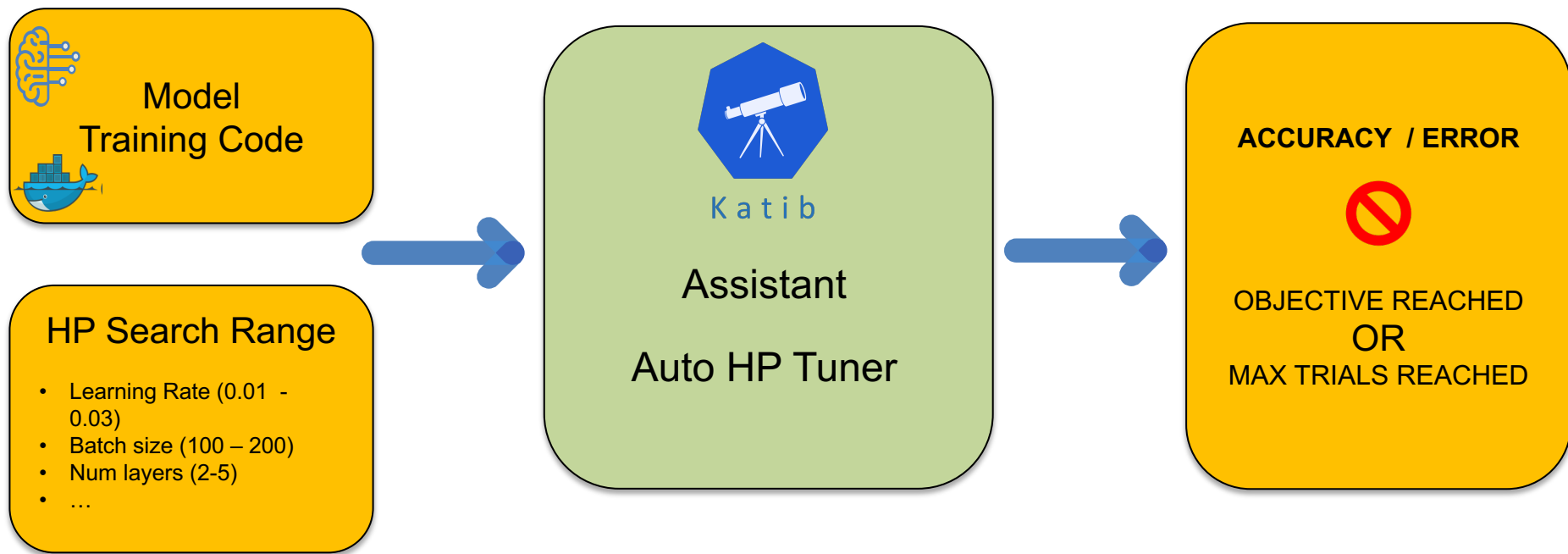
- No magic hyperparameter values that work across every dataset

- **Manual tuning inefficient and error prone**

- Exponential search space growth
- Tracking metrics manually is hard



Who is Katib?

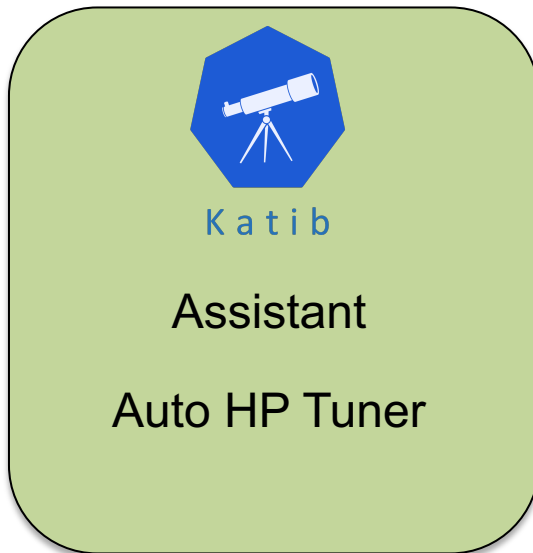


Katib Config

```
containers:  
- name: tensorflow  
  image: gcr.io/kubeflow-ci/tf-mnist-with-summaries:1.0
```

```
parameters:  
- name: --learning_rate  
  parameterType: double  
  feasibleSpace:  
    min: "0.01"  
    max: "0.05"  
- name: --batch_size  
  parameterType: int  
  feasibleSpace:  
    min: "100"  
    max: "200"
```

```
spec:  
  parallelTrialCount: 3  
  maxTrialCount: 12  
  maxFailedTrialCount: 3  
  objective:  
    type: maximize  
    goal: 0.99  
    objectiveMetricName: accuracy_1
```



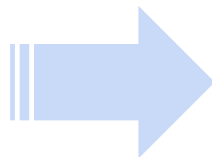
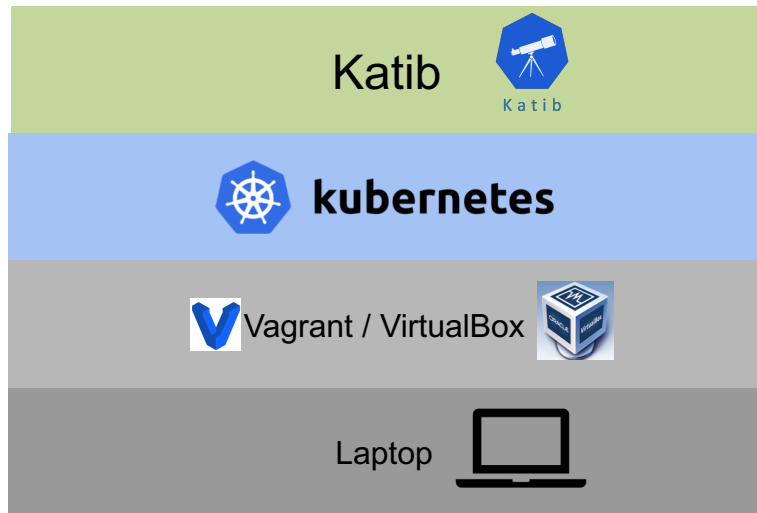
```
algorithm:  
  algorithmName: random
```

```
Message: Experiment has succeeded  
d because max trial count has reached  
Reason: ExperimentSucceeded  
Status: True  
Type: Succeeded  
Current Optimal Trial:  
Observation:  
  Metrics:  
    Name: accuracy_1  
    Value: 0.970499992371  
Parameter Assignments:  
  Name: --learning_rate  
  Value: 0.011776169865117337  
  Name: --batch_size  
  Value: 152
```

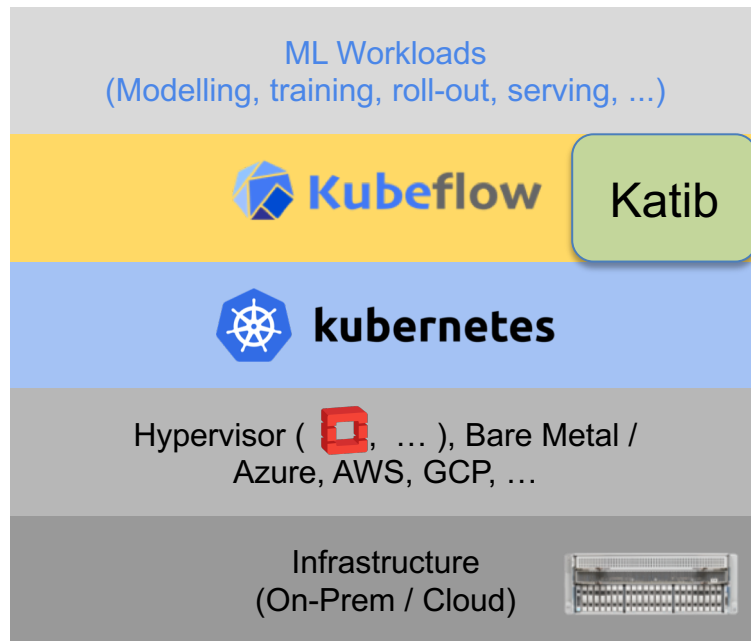


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Containers



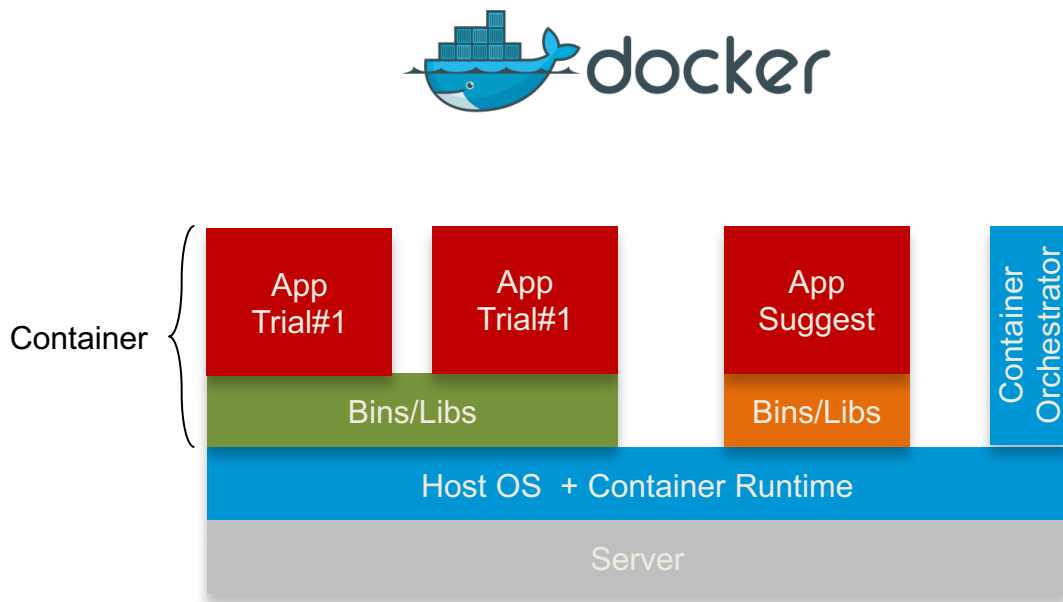
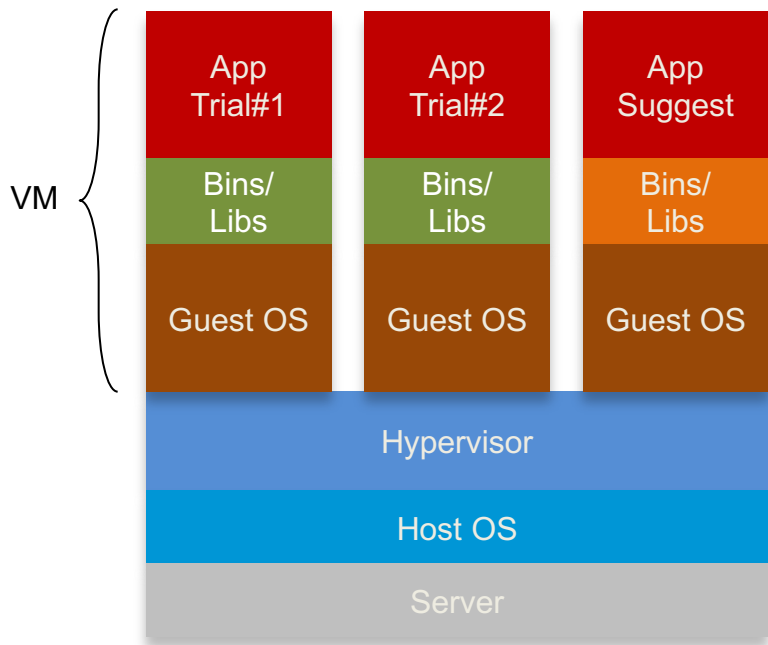
Containers changed Shipping Industry



- Today, 90+% of all cargo ships in a standard container
- Faster delivery, reduced (dis-)charging times, increased security (less loss/damage of goods)
- Average shipment cost reduced from >25% to <3%:
Key enabler to globalization and just-in-time production



Containers





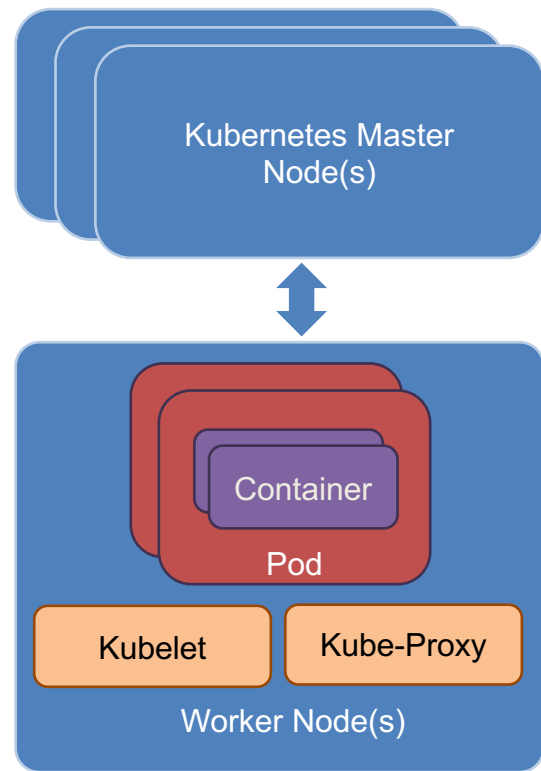
kubernetes

Greek for "Helmsman"

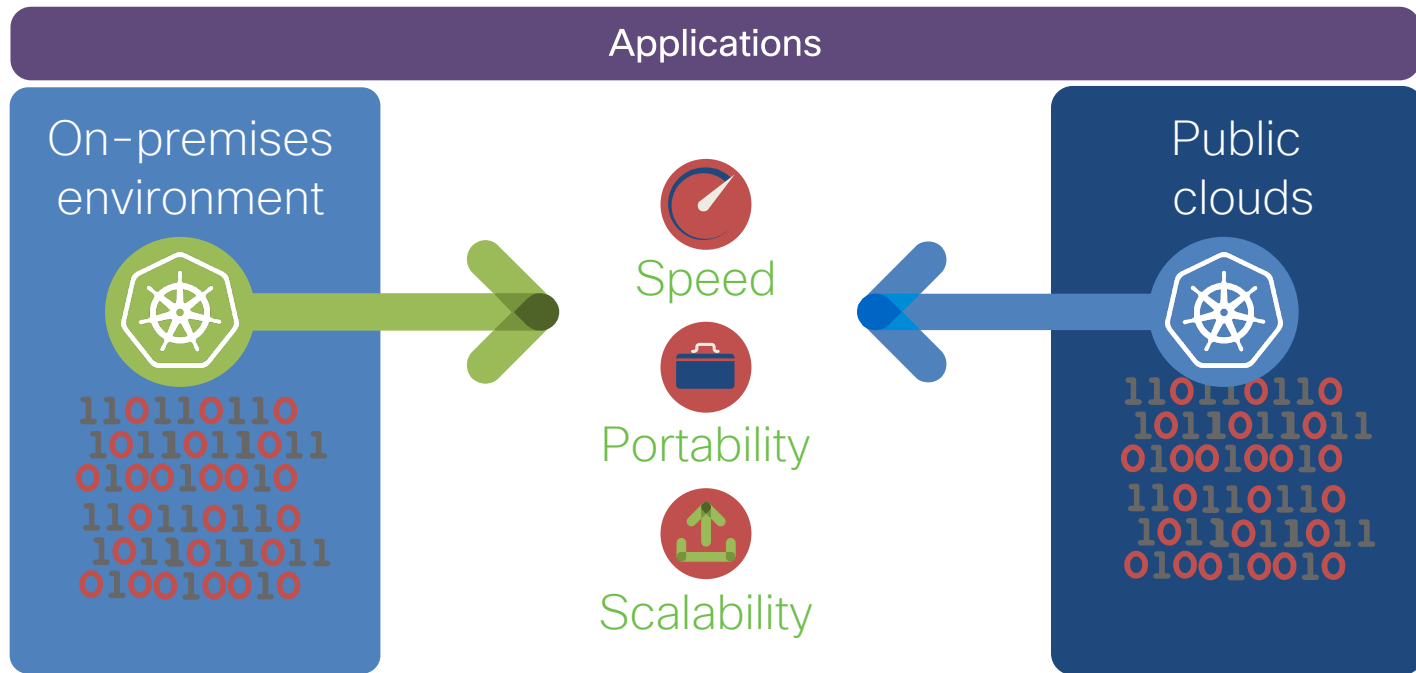


What is Kubernetes (K8s)

- Container orchestrator
- 100% Open source, written in Go
- Runs and manages pods
- Declarative APIs
- Rich ecosystem of plug-ins for scheduling, storage, networking

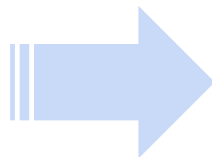
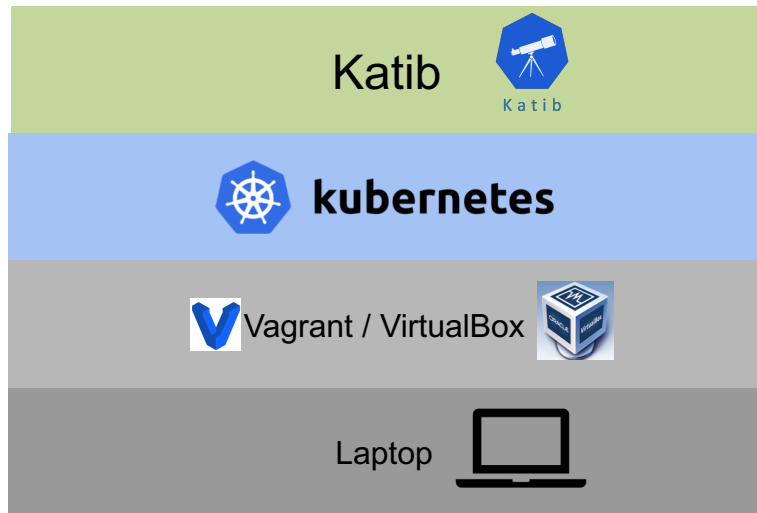


K8s as the new platform of choice

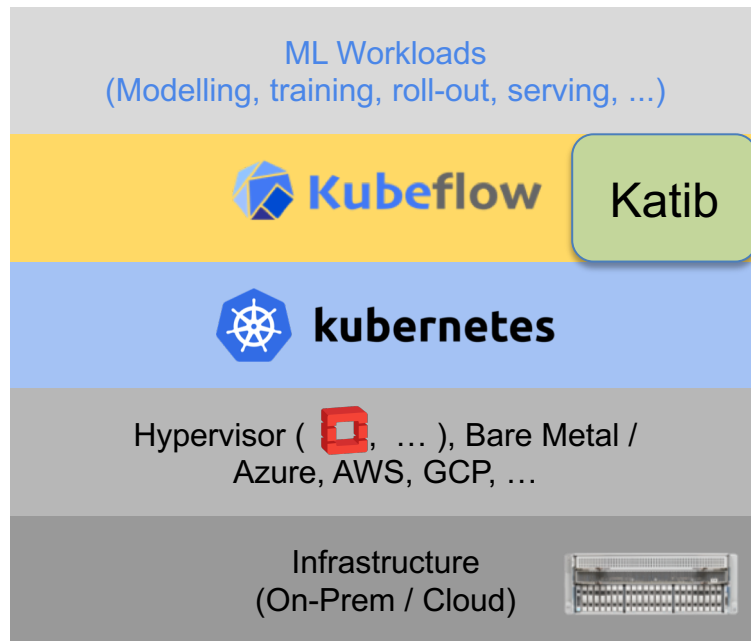


Tutorial Setup

Today's Tutorial



Production



Tutorial : Setup Kubernetes

- Instructions -
<https://tfworldkatib.github.io/tutorial/kubernetes/setup.html>
- Questions





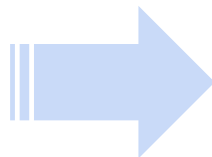
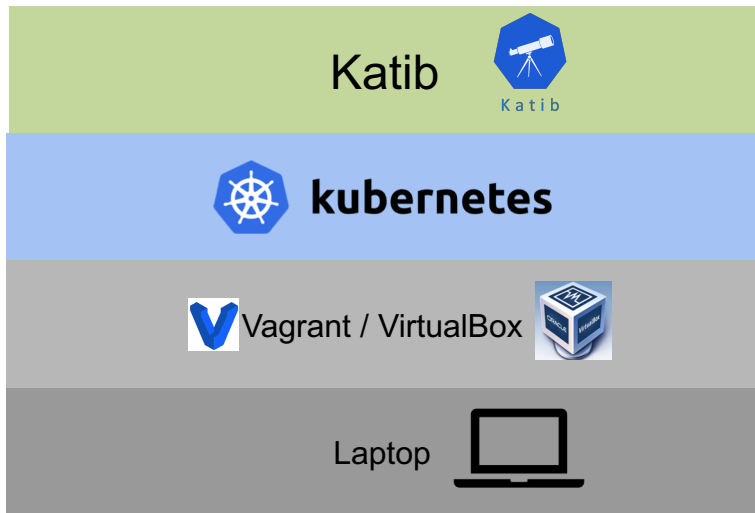
Katib

Katib

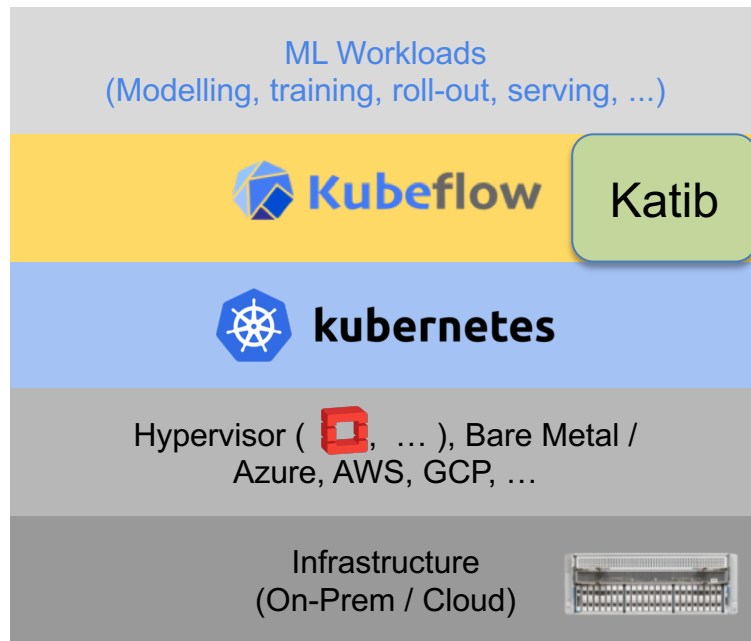


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Tutorial : Katib

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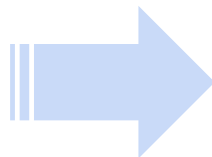
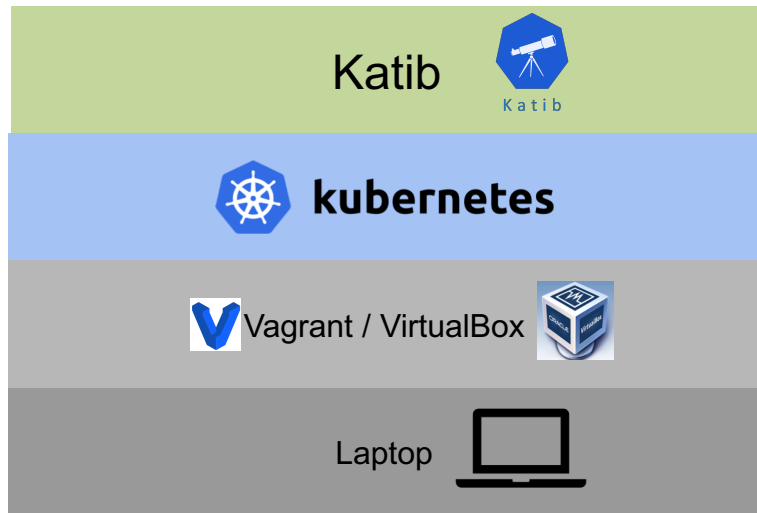


Kubeflow

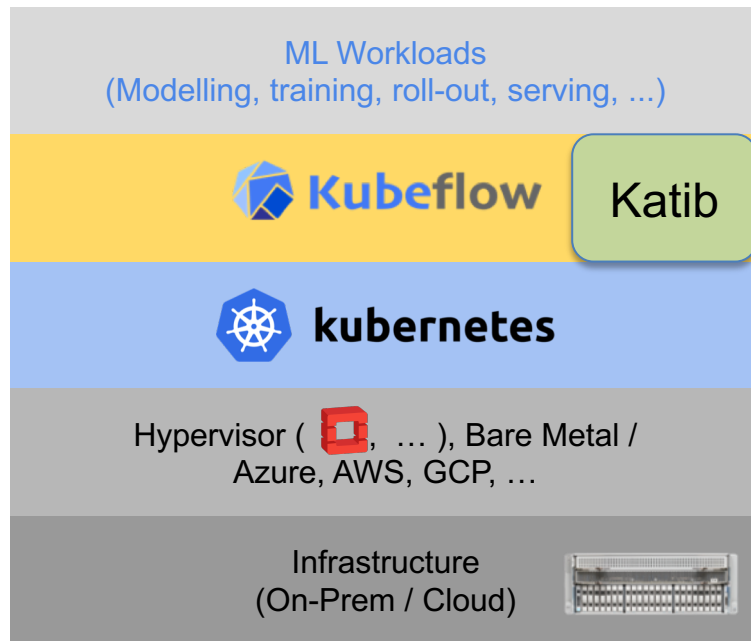


Tutorial Setup

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Production





Machine Learning Lifecycle Manager that
makes it easy to **develop**, **deploy** and
manage portable, scalable end-to-end ML
workflows everywhere



Kubeflow Demo

- Installation
- Data exploration using Jupyter notebooks
- Model training using different machine learning frameworks
- Model serving
- Pipelines
- Questions



Summary

- Tools are available to make automated machine learning accessible
- Manual tuning of hyperparameters is hard, use automation like Katib
- Katib still requires us to understand the problem space and how to manually fine tune suggestion algorithms
- Portability can be achieved either using Kubernetes applications or Kubeflow pipelines.
- Kubeflow and Katib are rapidly evolving, bringing the latest innovations in the ML landscape to you



How to contribute

- Both Kubeflow and Katib are extensible frameworks, if you find something missing please [look at how to contribute](#)
- Appreciate any contribution to the tutorial at <https://github.com/tfworldkatib/tutorial>



Contact Info

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