Quick start guide to Kubeflow

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# **1. Install MicroK8s**

**traindb@traindb-VirtualBox:~/Desktop$ sudo snap install microk8s --classic --channel=1.21/stable**

|  |
| --- |
| [sudo] password for traindb:  microk8s (1.21/stable) v1.21.12 from Canonical✓ installed |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo usermod -a -G microk8s $USER**

**traindb@traindb-VirtualBox:~/Desktop$** **newgrp microk8s**

**traindb@traindb-VirtualBox:~/Desktop$ mkdir ~/.kube**

**traindb@traindb-VirtualBox:~/Desktop$ sudo chown -f -R $USER ~/.kube**

**traindb@traindb-VirtualBox:~/Desktop$ microk8s enable dns storage ingress metallb:10.64.140.43-10.64.140.49 istio dashboard registry knative // gpu kubeflow**

|  |
| --- |
| Enabling DNS  Applying manifest  serviceaccount/coredns created  configmap/coredns created  deployment.apps/coredns created  service/kube-dns created  clusterrole.rbac.authorization.k8s.io/coredns created  clusterrolebinding.rbac.authorization.k8s.io/coredns created  Restarting kubelet  DNS is enabled  Enabling default storage class  deployment.apps/hostpath-provisioner created  storageclass.storage.k8s.io/microk8s-hostpath created  serviceaccount/microk8s-hostpath created  clusterrole.rbac.authorization.k8s.io/microk8s-hostpath created  clusterrolebinding.rbac.authorization.k8s.io/microk8s-hostpath created  Storage will be available soon  Enabling Ingress  ingressclass.networking.k8s.io/public created  namespace/ingress created  serviceaccount/nginx-ingress-microk8s-serviceaccount created  clusterrole.rbac.authorization.k8s.io/nginx-ingress-microk8s-clusterrole created  role.rbac.authorization.k8s.io/nginx-ingress-microk8s-role created  clusterrolebinding.rbac.authorization.k8s.io/nginx-ingress-microk8s created  rolebinding.rbac.authorization.k8s.io/nginx-ingress-microk8s created  configmap/nginx-load-balancer-microk8s-conf created  configmap/nginx-ingress-tcp-microk8s-conf created  configmap/nginx-ingress-udp-microk8s-conf created  daemonset.apps/nginx-ingress-microk8s-controller created  Ingress is enabled  Enabling MetalLB  Applying Metallb manifest  namespace/metallb-system created  secret/memberlist created  Warning: policy/v1beta1 PodSecurityPolicy is deprecated in v1.21+, unavailable in v1.25+  podsecuritypolicy.policy/controller created  podsecuritypolicy.policy/speaker created  serviceaccount/controller created  serviceaccount/speaker created  clusterrole.rbac.authorization.k8s.io/metallb-system:controller created  clusterrole.rbac.authorization.k8s.io/metallb-system:speaker created  role.rbac.authorization.k8s.io/config-watcher created  role.rbac.authorization.k8s.io/pod-lister created  clusterrolebinding.rbac.authorization.k8s.io/metallb-system:controller created  clusterrolebinding.rbac.authorization.k8s.io/metallb-system:speaker created  rolebinding.rbac.authorization.k8s.io/config-watcher created  rolebinding.rbac.authorization.k8s.io/pod-lister created  daemonset.apps/speaker created  deployment.apps/controller created  configmap/config created  MetalLB is enabled |

**traindb@traindb-VirtualBox:~/Desktop$ microk8s status --wait-ready**

|  |
| --- |
| microk8s is running  high-availability: no  datastore master nodes: 127.0.0.1:19001  datastore standby nodes: none  addons:  enabled:  dns # CoreDNS  ha-cluster # Configure high availability on the current node  disabled:  ambassador # Ambassador API Gateway and Ingress  cilium # SDN, fast with full network policy  dashboard # The Kubernetes dashboard  fluentd # Elasticsearch-Fluentd-Kibana logging and monitoring  gpu # Automatic enablement of Nvidia CUDA  helm # Helm 2 - the package manager for Kubernetes  helm3 # Helm 3 - Kubernetes package manager  host-access # Allow Pods connecting to Host services smoothly  ingress # Ingress controller for external access  istio # Core Istio service mesh services  jaeger # Kubernetes Jaeger operator with its simple config  keda # Kubernetes-based Event Driven Autoscaling  knative # The Knative framework on Kubernetes.  kubeflow # Kubeflow for easy ML deployments  linkerd # Linkerd is a service mesh for Kubernetes and other frameworks  metallb # Loadbalancer for your Kubernetes cluster  metrics-server # K8s Metrics Server for API access to service metrics  multus # Multus CNI enables attaching multiple network interfaces to pods  openebs # OpenEBS is the open-source storage solution for Kubernetes  openfaas # openfaas serverless framework  portainer # Portainer UI for your Kubernetes cluster  prometheus # Prometheus operator for monitoring and logging  rbac # Role-Based Access Control for authorisation  registry # Private image registry exposed on localhost:32000  storage # Storage class; allocates storage from host directory  traefik # traefik Ingress controller for external access |

# **2. Install Juju**

**traindb@traindb-VirtualBox:~/Desktop$** **sudo snap install juju --classic**

|  |
| --- |
| juju 2.9.29 from Canonical✓ installed |

**traindb@traindb-VirtualBox:~/Desktop$** **juju bootstrap microk8s**

|  |
| --- |
| Since Juju 2 is being run for the first time, it has downloaded the latest public cloud information.  Creating Juju controller "microk8s-localhost" on microk8s/localhost  Bootstrap to Kubernetes cluster identified as microk8s/localhost  Fetching Juju Dashboard 0.8.1  Creating k8s resources for controller "controller-microk8s-localhost"  Starting controller pod  Bootstrap agent now started  Contacting Juju controller at 10.152.183.121 to verify accessibility...  Bootstrap complete, controller "microk8s-localhost" is now available in namespace "controller-microk8s-localhost"  Now you can run  juju add-model <model-name>  to create a new model to deploy k8s workloads. |

# **3. Deploying Kubeflow**

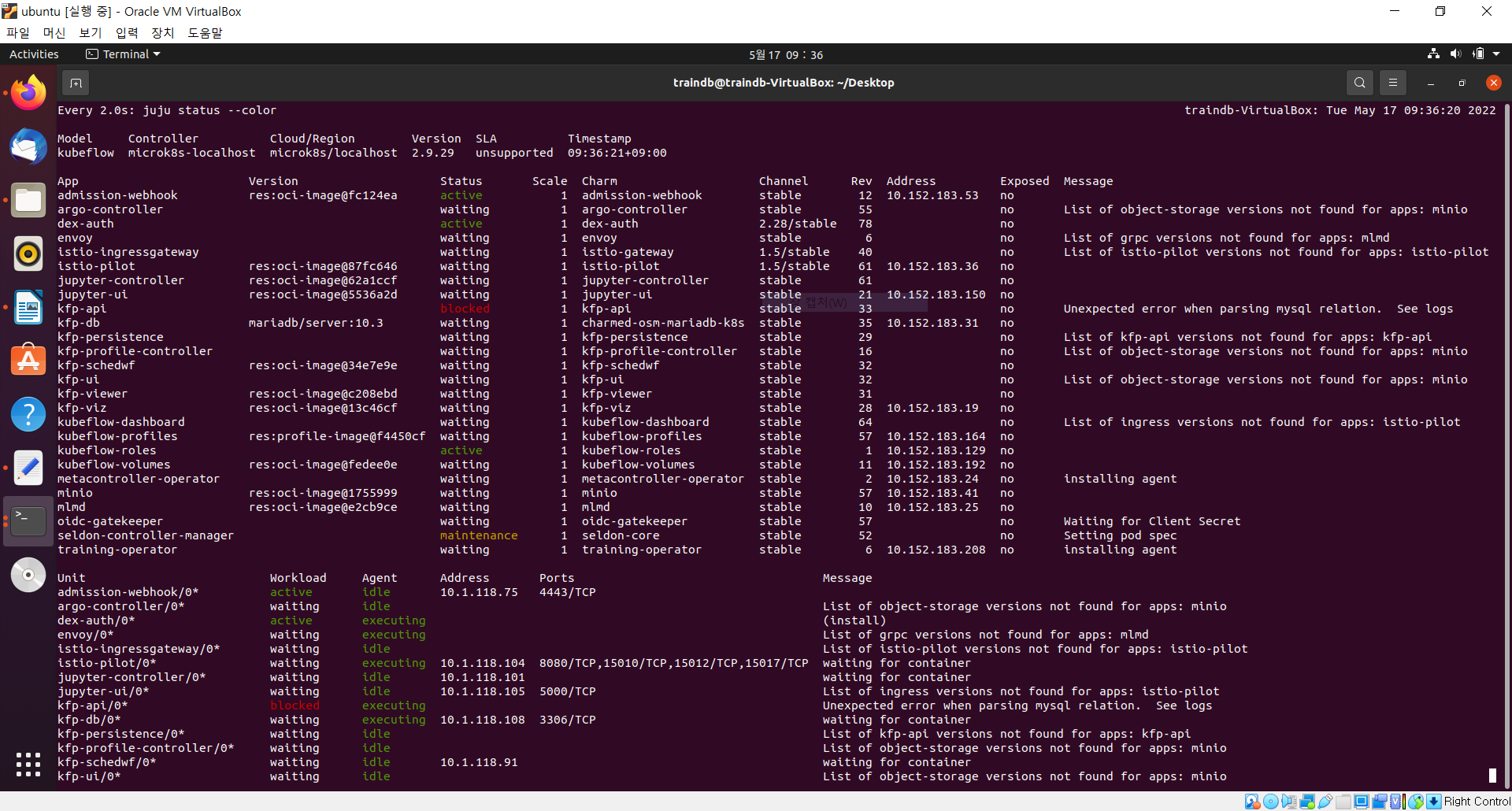
**traindb@traindb-VirtualBox:~/Desktop$** **juju add-model kubeflow**

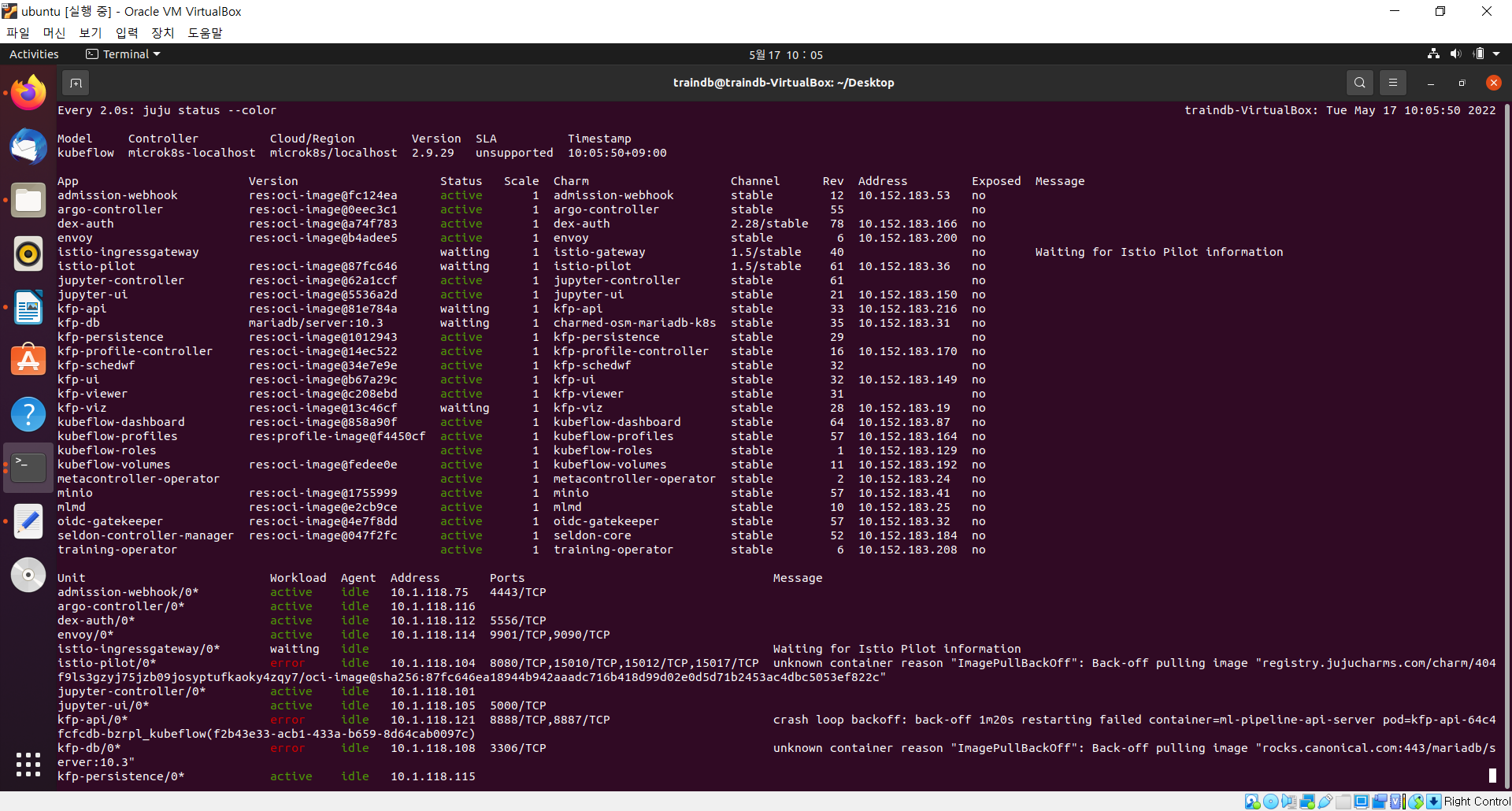
|  |
| --- |
| Added 'kubeflow' model on microk8s/localhost with credential 'microk8s' for user 'admin' |

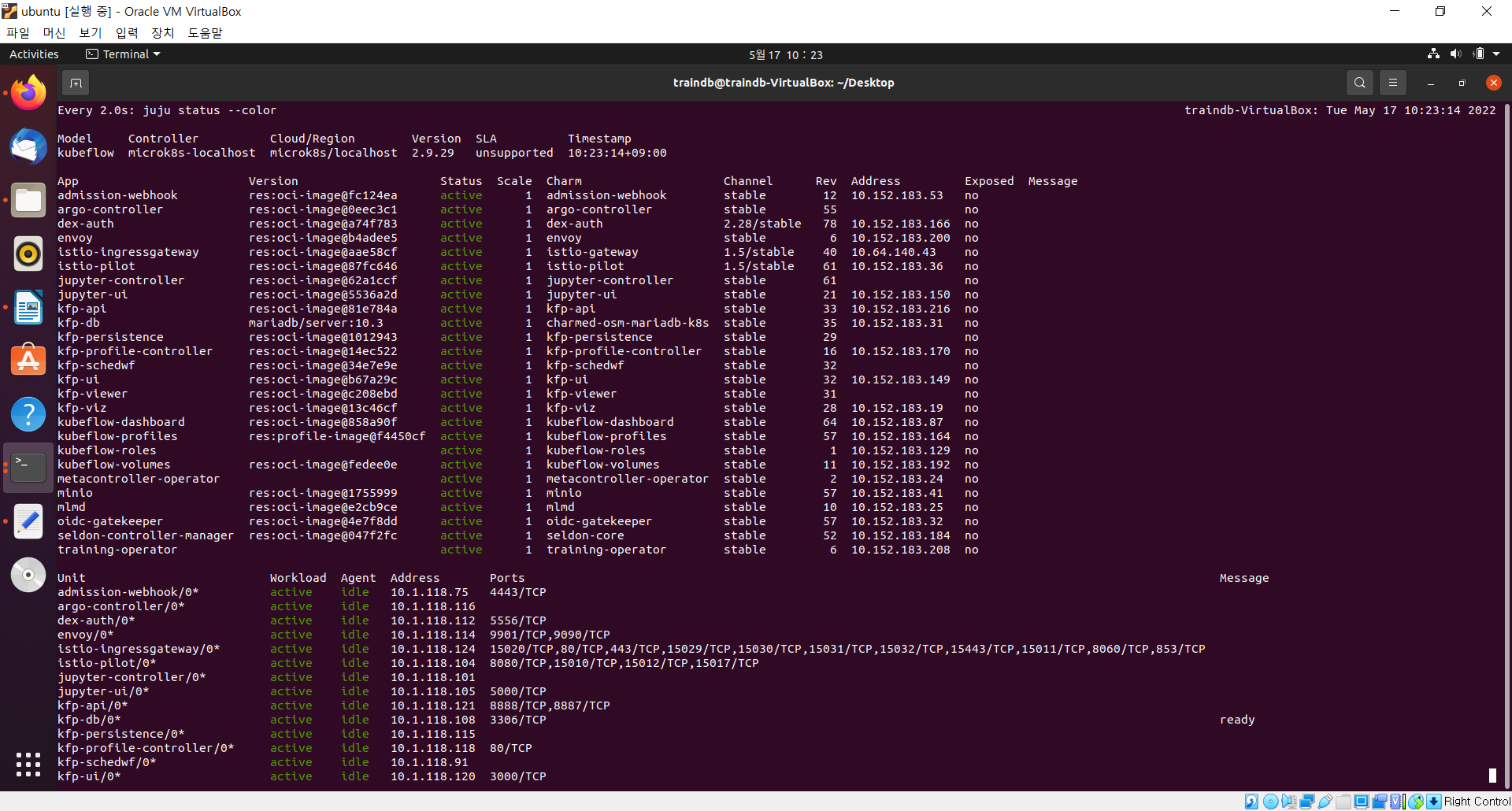
**traindb@traindb-VirtualBox:~/Desktop$** **juju deploy kubeflow-lite --trust**

|  |
| --- |
| Located bundle "kubeflow-lite" in charm-hub, revision 60  Located charm "admission-webhook" in charm-hub, channel stable  Located charm "argo-controller" in charm-hub, channel stable  Located charm "dex-auth" in charm-hub, channel 2.28/stable  Located charm "envoy" in charm-hub, channel stable  Located charm "istio-gateway" in charm-hub, channel 1.5/stable  Located charm "istio-pilot" in charm-hub, channel 1.5/stable  Located charm "jupyter-controller" in charm-hub, channel stable  Located charm "jupyter-ui" in charm-hub, channel stable  Located charm "kfp-api" in charm-hub, channel stable  Located charm "charmed-osm-mariadb-k8s" in charm-hub, channel stable  Located charm "kfp-persistence" in charm-hub, channel stable  Located charm "kfp-profile-controller" in charm-hub, channel stable  Located charm "kfp-schedwf" in charm-hub, channel stable  Located charm "kfp-ui" in charm-hub, channel stable  Located charm "kfp-viewer" in charm-hub, channel stable  Located charm "kfp-viz" in charm-hub, channel stable  Located charm "kubeflow-dashboard" in charm-hub, channel stable  Located charm "kubeflow-profiles" in charm-hub, channel stable  Located charm "kubeflow-roles" in charm-hub, channel stable  Located charm "kubeflow-volumes" in charm-hub, channel stable  Located charm "metacontroller-operator" in charm-hub, channel stable  Located charm "minio" in charm-hub, channel stable  Located charm "mlmd" in charm-hub, channel stable  Located charm "oidc-gatekeeper" in charm-hub, channel stable  Located charm "seldon-core" in charm-hub, channel stable  Located charm "training-operator" in charm-hub, channel stable  Executing changes:  - upload charm admission-webhook from charm-hub from channel latest/stable with architecture=amd64  - deploy application admission-webhook from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for admission-webhook  - upload charm argo-controller from charm-hub from channel latest/stable with architecture=amd64  - deploy application argo-controller from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for argo-controller  - upload charm dex-auth from charm-hub from channel 2.28/stable with architecture=amd64  - deploy application dex-auth from charm-hub with 1 unit with 2.28/stable  added resource oci-image  - set annotations for dex-auth  - upload charm envoy from charm-hub from channel latest/stable with architecture=amd64  - deploy application envoy from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for envoy  - upload charm istio-gateway from charm-hub from channel 1.5/stable with architecture=amd64  - deploy application istio-ingressgateway from charm-hub with 1 unit with 1.5/stable using istio-gateway  added resource oci-image  - set annotations for istio-ingressgateway  - upload charm istio-pilot from charm-hub from channel 1.5/stable with architecture=amd64  - deploy application istio-pilot from charm-hub with 1 unit with 1.5/stable  added resource oci-image  - set annotations for istio-pilot  - upload charm jupyter-controller from charm-hub from channel latest/stable with architecture=amd64  - deploy application jupyter-controller from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for jupyter-controller  - upload charm jupyter-ui from charm-hub from channel latest/stable with architecture=amd64  - deploy application jupyter-ui from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for jupyter-ui  - upload charm kfp-api from charm-hub from channel latest/stable with architecture=amd64  - deploy application kfp-api from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for kfp-api  - upload charm charmed-osm-mariadb-k8s from charm-hub from channel latest/stable with architecture=amd64  - deploy application kfp-db from charm-hub with 1 unit with latest/stable using charmed-osm-mariadb-k8s  - set annotations for kfp-db  - upload charm kfp-persistence from charm-hub from channel latest/stable with architecture=amd64  - deploy application kfp-persistence from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for kfp-persistence  - upload charm kfp-profile-controller from charm-hub from channel latest/stable with architecture=amd64  - deploy application kfp-profile-controller from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for kfp-profile-controller  - upload charm kfp-schedwf from charm-hub from channel latest/stable with architecture=amd64  - deploy application kfp-schedwf from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for kfp-schedwf  - upload charm kfp-ui from charm-hub from channel latest/stable with architecture=amd64  - deploy application kfp-ui from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for kfp-ui  - upload charm kfp-viewer from charm-hub from channel latest/stable with architecture=amd64  - deploy application kfp-viewer from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for kfp-viewer  - upload charm kfp-viz from charm-hub from channel latest/stable with architecture=amd64  - deploy application kfp-viz from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for kfp-viz  - upload charm kubeflow-dashboard from charm-hub from channel latest/stable with architecture=amd64  - deploy application kubeflow-dashboard from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for kubeflow-dashboard  - upload charm kubeflow-profiles from charm-hub from channel latest/stable with architecture=amd64  - deploy application kubeflow-profiles from charm-hub with 1 unit with latest/stable  added resource kfam-image  added resource profile-image  - set annotations for kubeflow-profiles  - upload charm kubeflow-roles from charm-hub from channel latest/stable with architecture=amd64  - deploy application kubeflow-roles from charm-hub with 1 unit with latest/stable  - set annotations for kubeflow-roles  - upload charm kubeflow-volumes from charm-hub from channel latest/stable with architecture=amd64  - deploy application kubeflow-volumes from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for kubeflow-volumes  - upload charm metacontroller-operator from charm-hub from channel latest/stable with architecture=amd64  - deploy application metacontroller-operator from charm-hub with 1 unit with latest/stable  - set annotations for metacontroller-operator  - upload charm minio from charm-hub from channel latest/stable with architecture=amd64  - deploy application minio from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for minio  - upload charm mlmd from charm-hub from channel latest/stable with architecture=amd64  - deploy application mlmd from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for mlmd  - upload charm oidc-gatekeeper from charm-hub from channel latest/stable with architecture=amd64  - deploy application oidc-gatekeeper from charm-hub with 1 unit with latest/stable  added resource oci-image  - set annotations for oidc-gatekeeper  - upload charm seldon-core from charm-hub from channel latest/stable with architecture=amd64  - deploy application seldon-controller-manager from charm-hub with 1 unit with latest/stable using seldon-core  added resource oci-image  - set annotations for seldon-controller-manager  - upload charm training-operator from charm-hub from channel latest/stable with architecture=amd64  - deploy application training-operator from charm-hub with 1 unit with latest/stable  added resource training-operator-image  - set annotations for training-operator  - add relation argo-controller - minio  - add relation dex-auth:oidc-client - oidc-gatekeeper:oidc-client  - add relation istio-pilot:ingress - dex-auth:ingress  - add relation istio-pilot:ingress - jupyter-ui:ingress  - add relation istio-pilot:ingress - kfp-ui:ingress  - add relation istio-pilot:ingress - kubeflow-dashboard:ingress  - add relation istio-pilot:ingress - kubeflow-volumes:ingress  - add relation istio-pilot:ingress - oidc-gatekeeper:ingress  - add relation istio-pilot:ingress-auth - oidc-gatekeeper:ingress-auth  - add relation istio-pilot:istio-pilot - istio-ingressgateway:istio-pilot  - add relation kfp-api - kfp-db  - add relation kfp-api:kfp-api - kfp-persistence:kfp-api  - add relation kfp-api:kfp-api - kfp-ui:kfp-api  - add relation kfp-api:kfp-viz - kfp-viz:kfp-viz  - add relation kfp-api:object-storage - minio:object-storage  - add relation kfp-profile-controller:object-storage - minio:object-storage  - add relation kfp-ui:object-storage - minio:object-storage  - add relation kubeflow-profiles - kubeflow-dashboard  - add relation mlmd:grpc - envoy:grpc  Deploy of bundle completed. |

**traindb@traindb-VirtualBox:~/Desktop$** **watch -c juju status --color**







# **4. Configuration**

**traindb@traindb-VirtualBox:~/Desktop$** **juju config dex-auth public-url=http://10.64.140.43.nip.io**

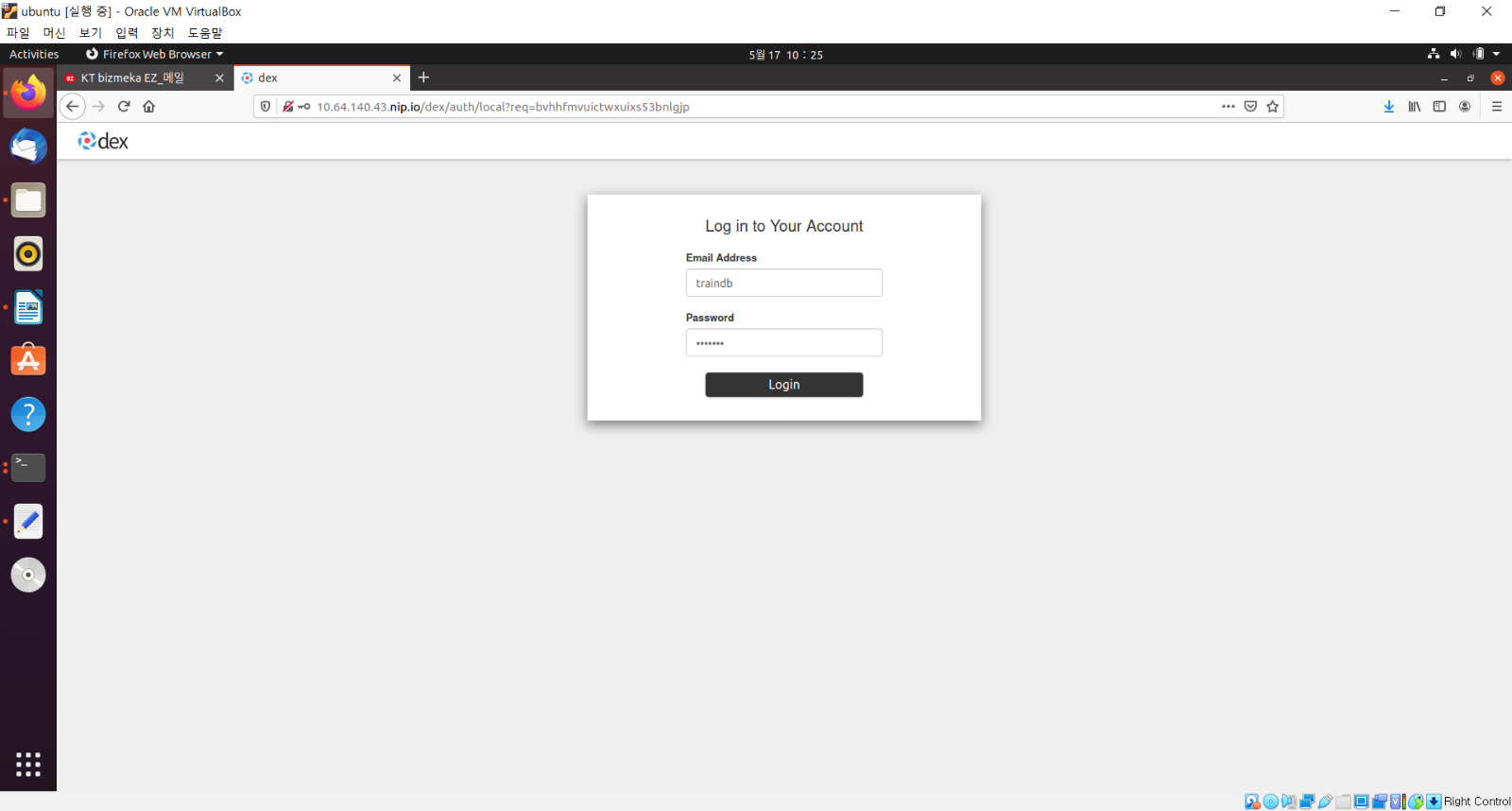
**traindb@traindb-VirtualBox:~/Desktop$** **juju config oidc-gatekeeper public-url=http://10.64.140.43.nip.io**

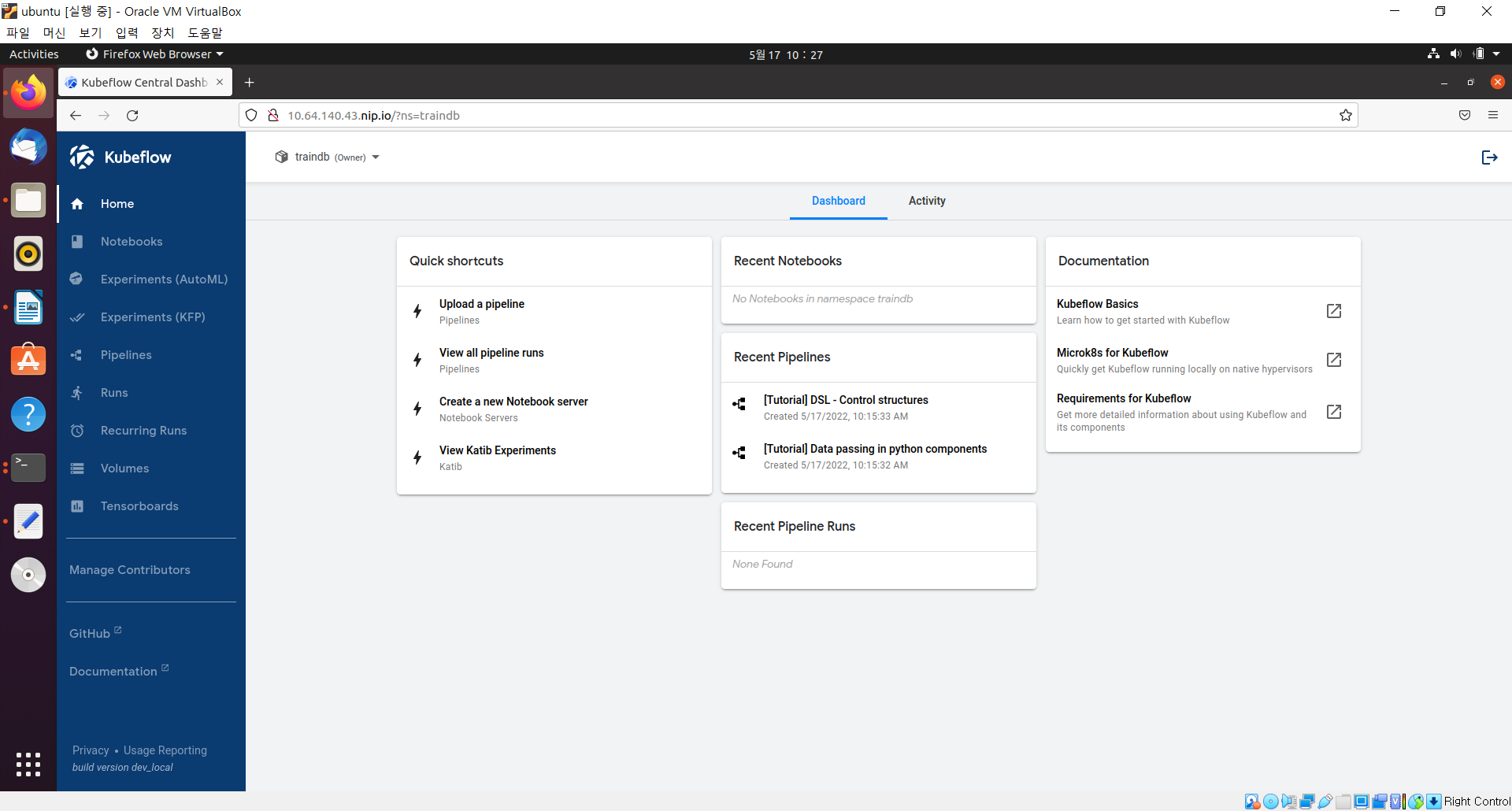
**traindb@traindb-VirtualBox:~/Desktop$** **juju config dex-auth static-username=traindb**

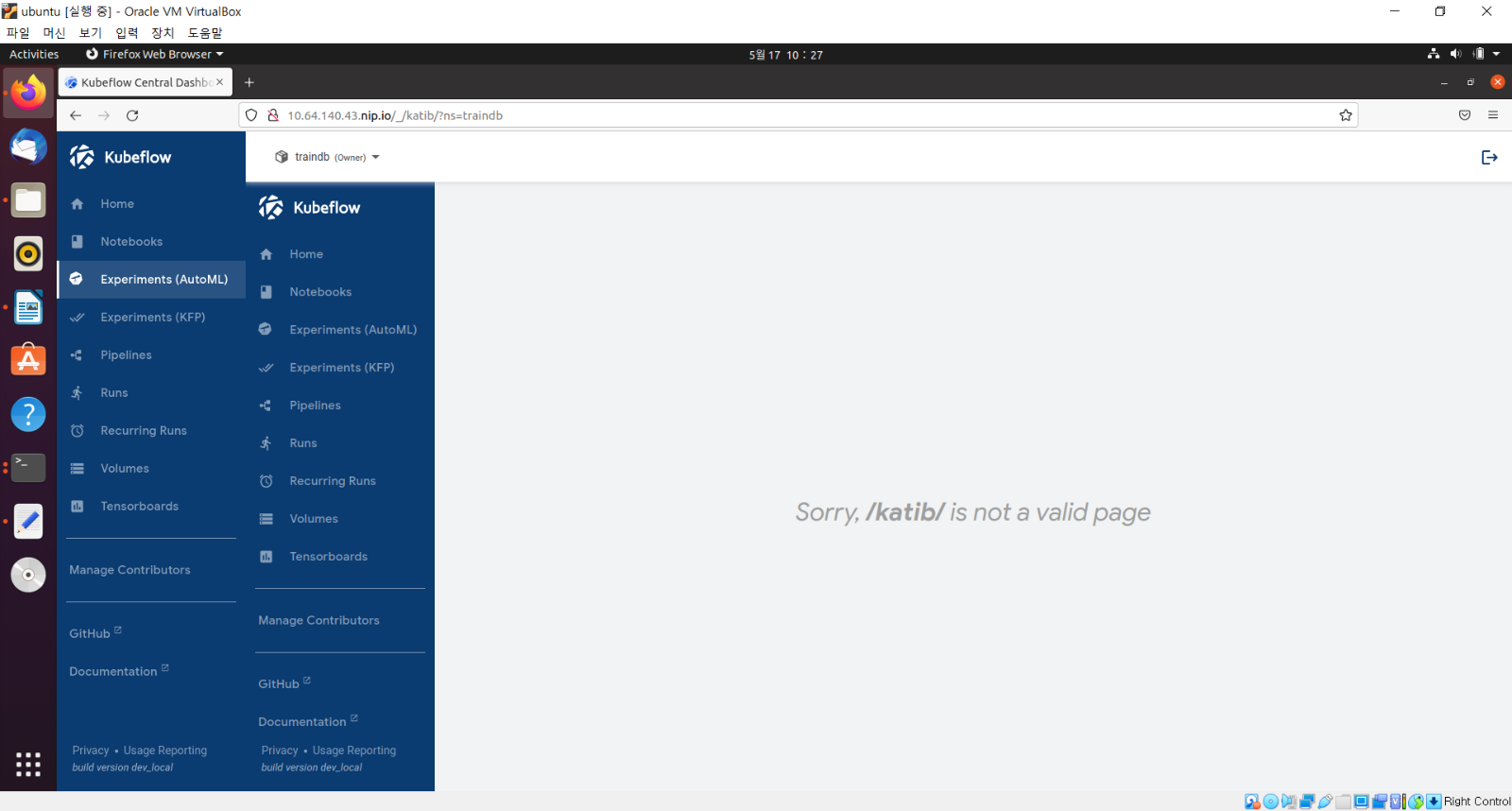
**traindb@traindb-VirtualBox:~/Desktop$** **juju config dex-auth static-password=traindb**

# **5. Accessing the Dashboard**

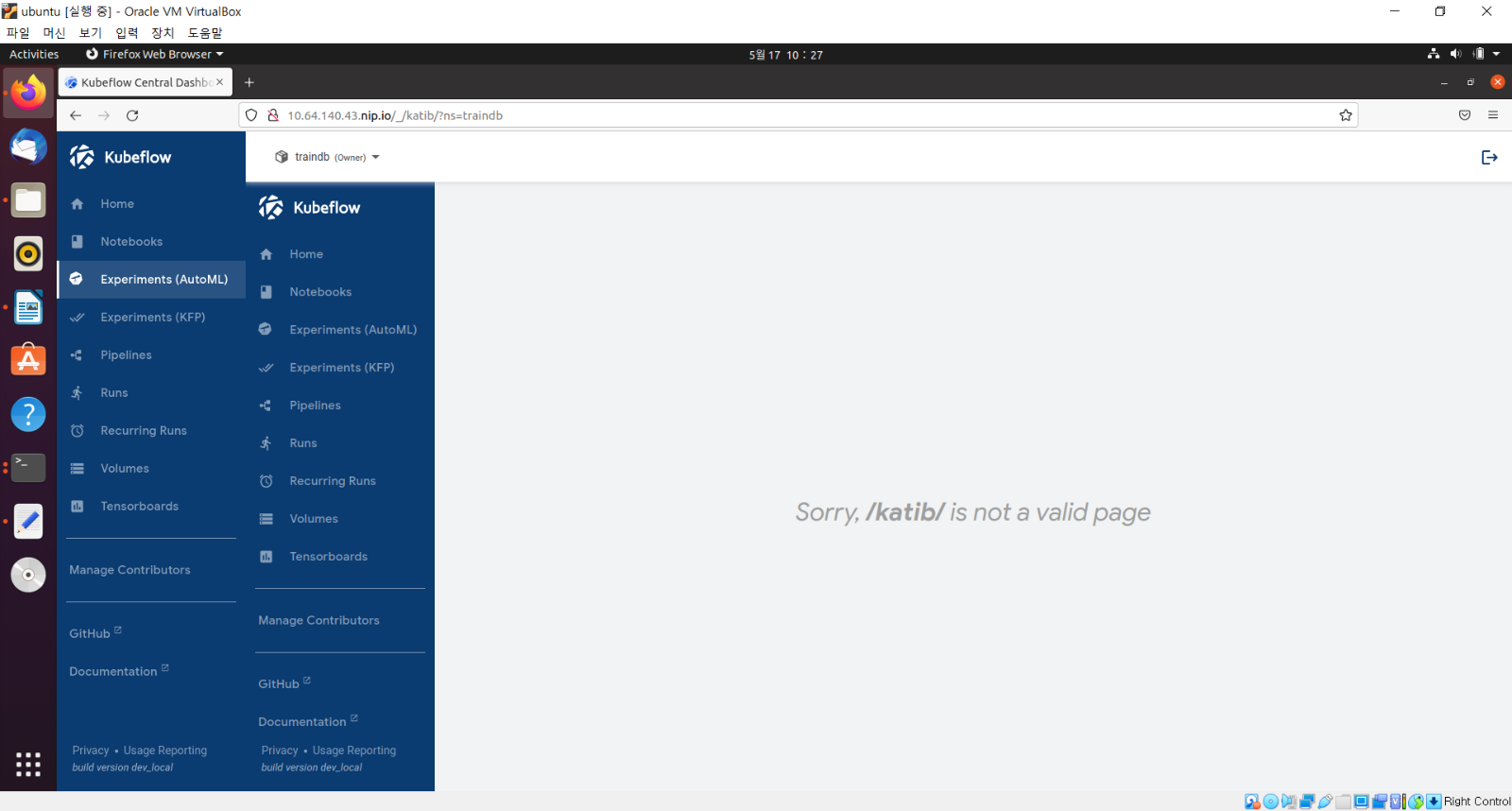
[**http://10.64.140.43.nip.io**](http://10.64.140.43.nip.io)







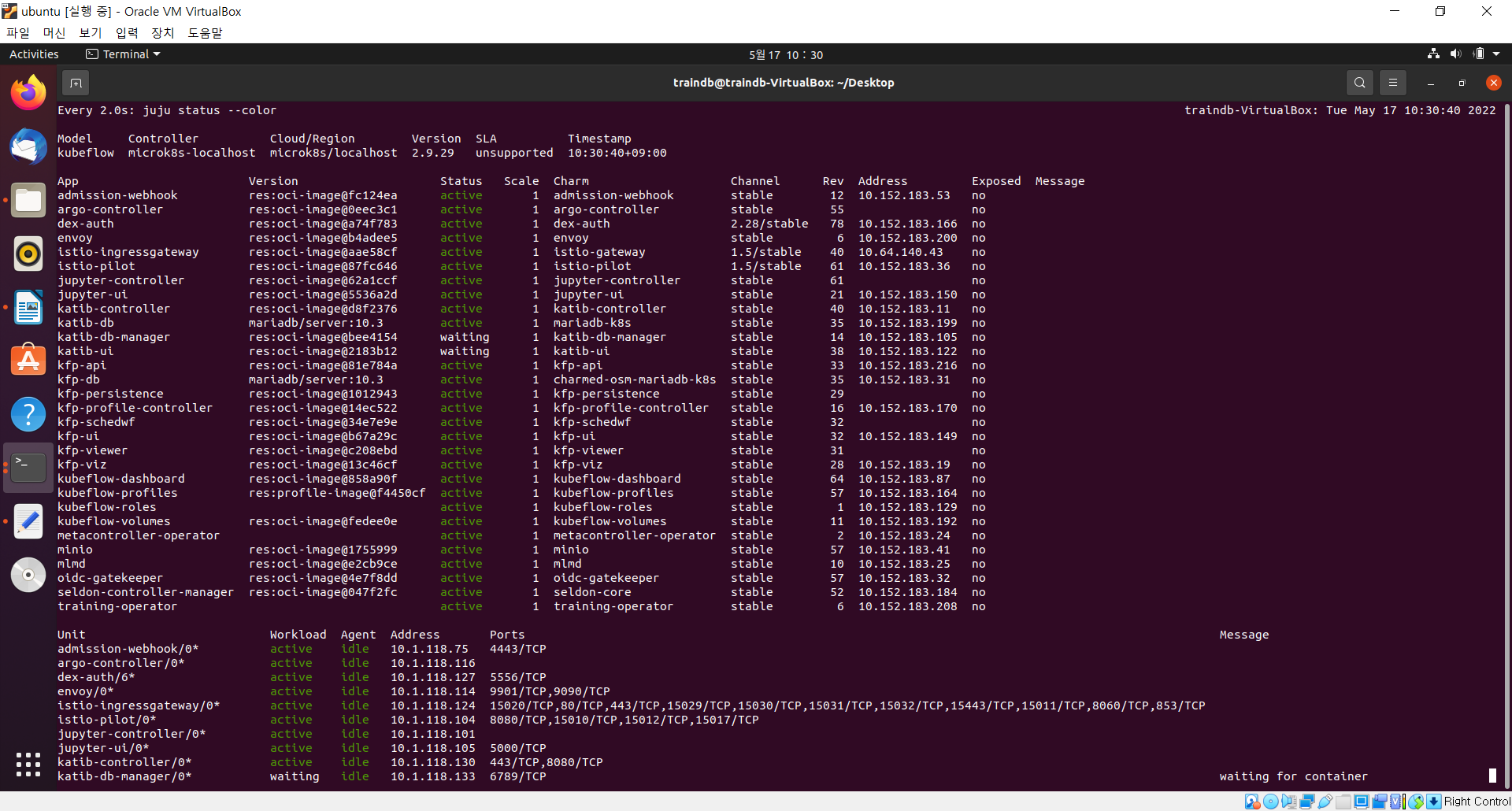
# **6. Katib Operators**

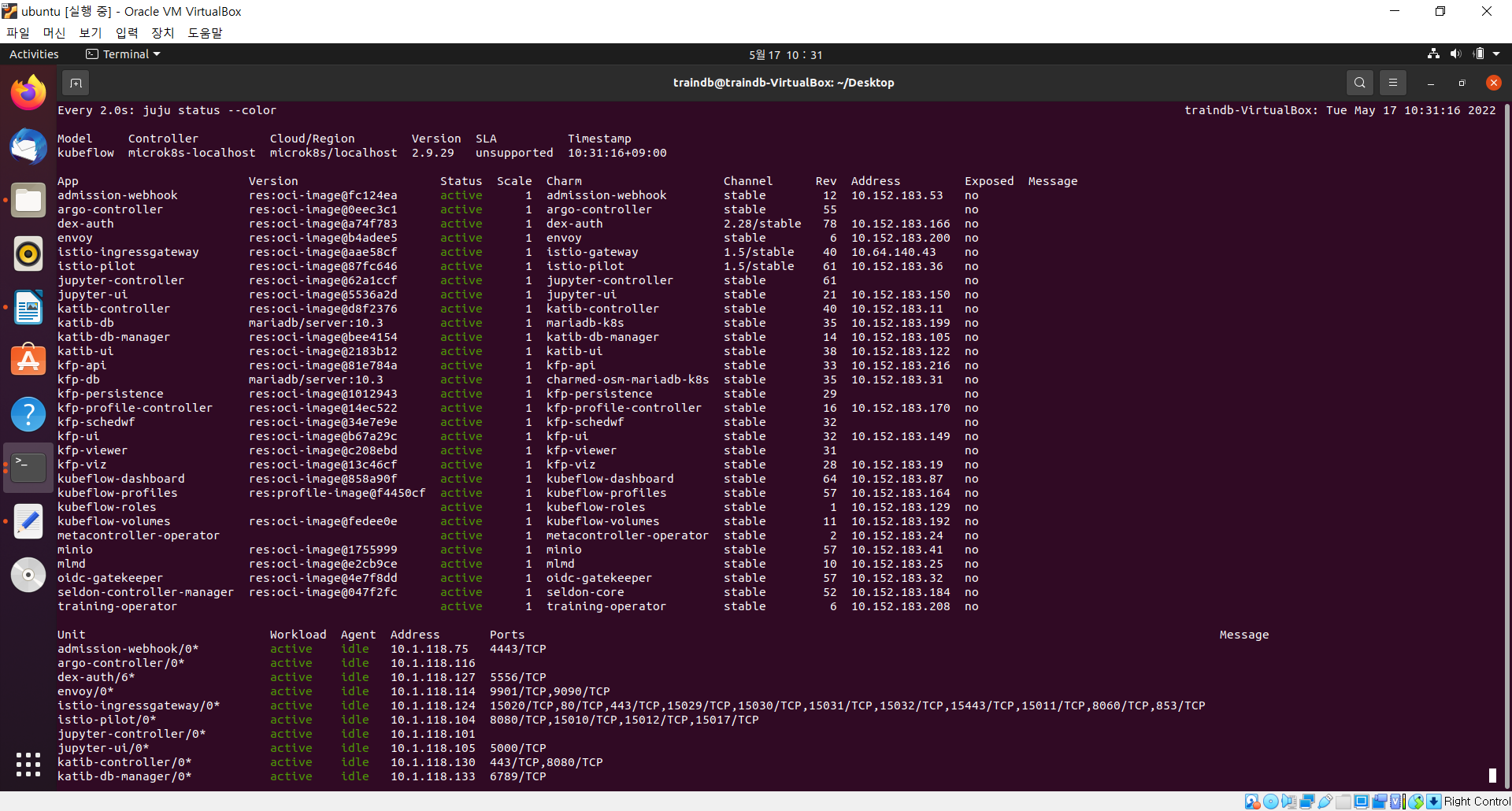


**traindb@traindb-VirtualBox:~/Desktop$** **juju deploy katib**

|  |
| --- |
| Located bundle "katib" in charm-hub, revision 10  Located charm "katib-controller" in charm-hub, channel stable  Located charm "mariadb-k8s" in charm-store, channel stable  Located charm "katib-db-manager" in charm-hub, channel stable  Located charm "katib-ui" in charm-hub, channel stable  Executing changes:  - upload charm katib-controller from charm-hub from channel stable with architecture=amd64  - deploy application katib-controller from charm-hub with 1 unit with stable  added resource oci-image  - set annotations for katib-controller  - upload charm mariadb-k8s from charm-store with architecture=amd64  - deploy application katib-db from charm-store with 1 unit using mariadb-k8s  - set annotations for katib-db  - upload charm katib-db-manager from charm-hub from channel stable with architecture=amd64  - deploy application katib-db-manager from charm-hub with 1 unit with stable  added resource oci-image  - set annotations for katib-db-manager  - upload charm katib-ui from charm-hub from channel stable with architecture=amd64  - deploy application katib-ui from charm-hub with 1 unit with stable  added resource oci-image  - set annotations for katib-ui  - add relation katib-db-manager - katib-db  Deploy of bundle completed. |

**traindb@traindb-VirtualBox:~/Desktop$** **watch -c juju status –color**



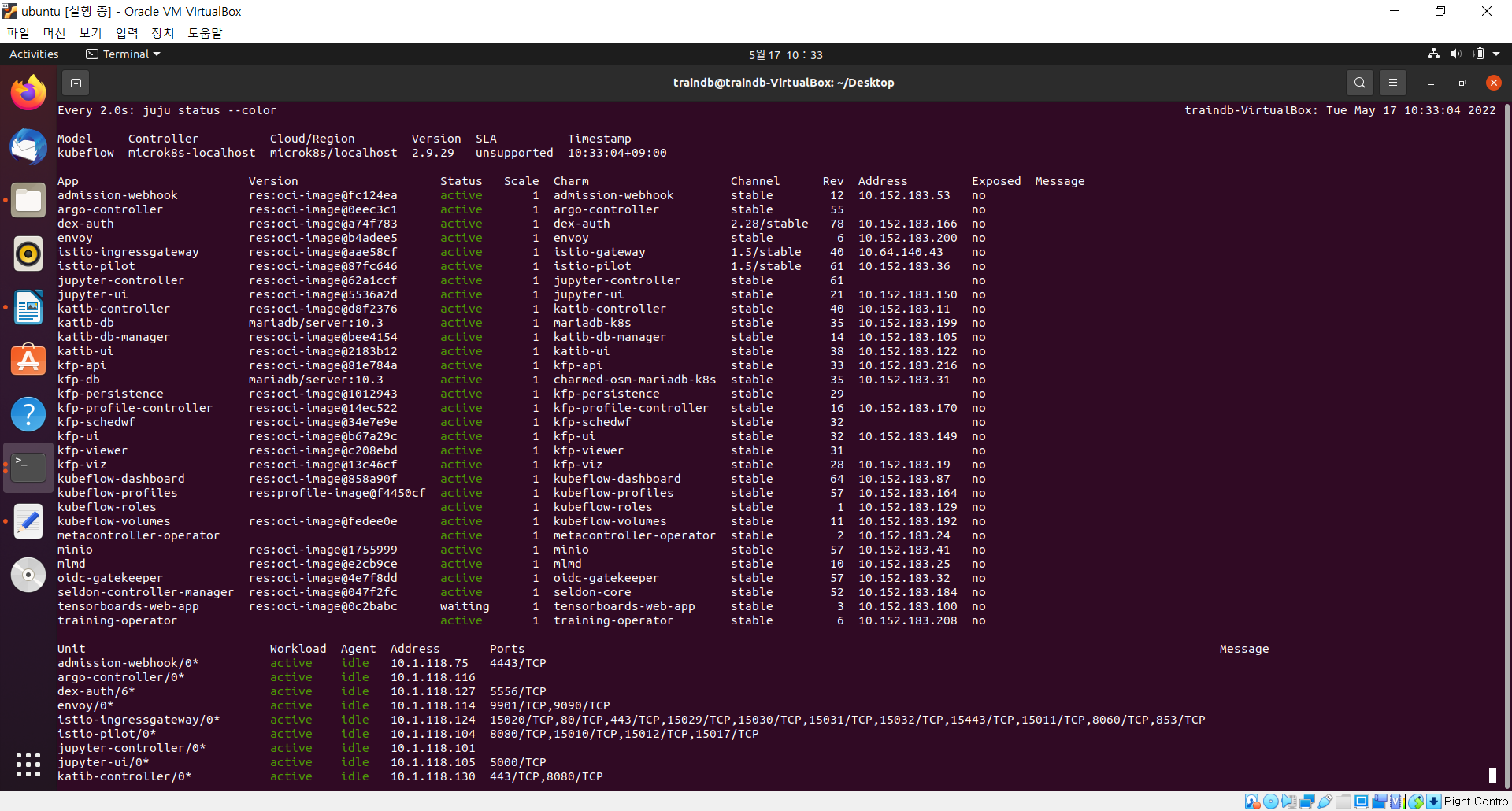


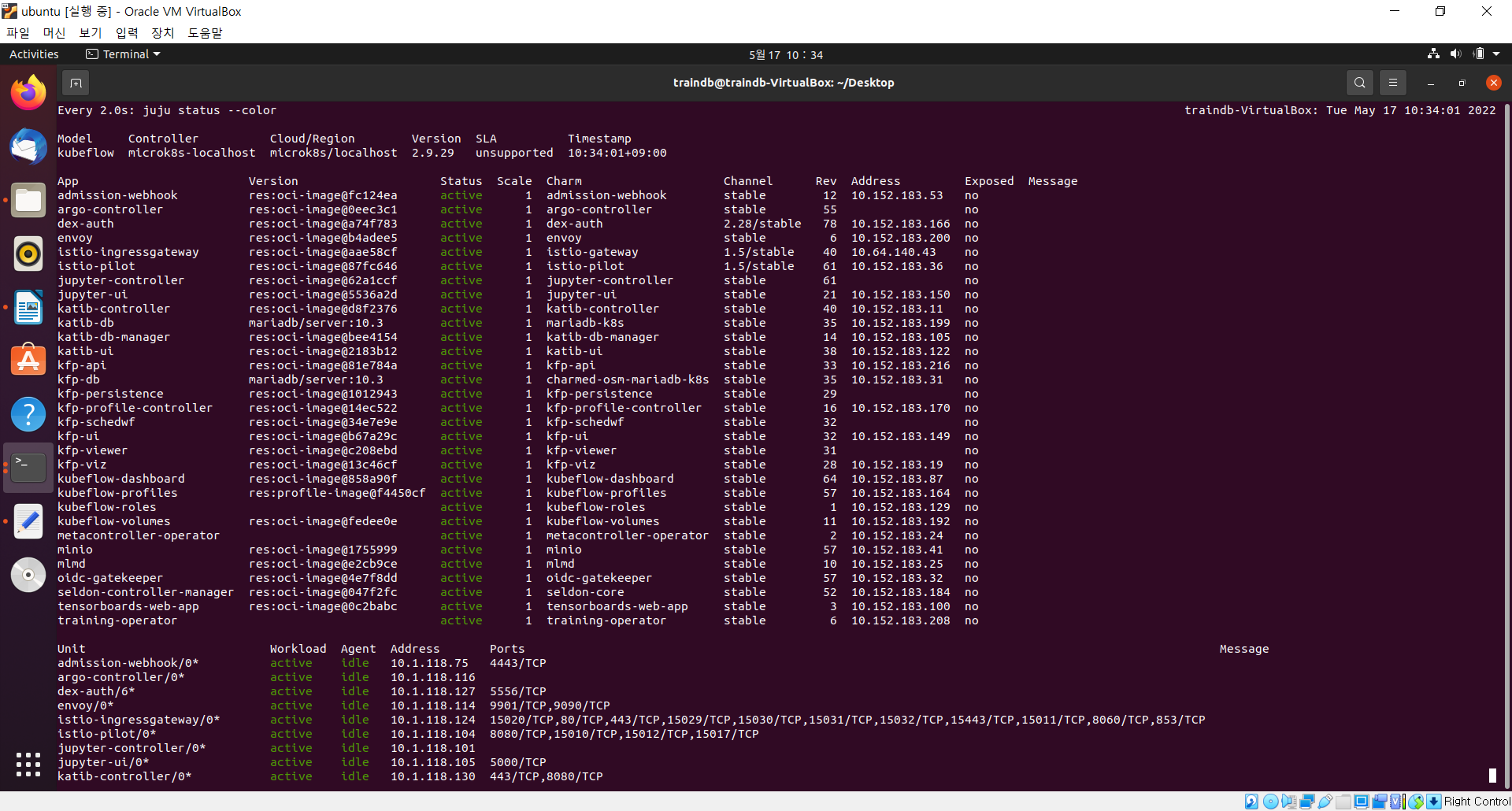
**traindb@traindb-VirtualBox:~/Desktop$** **juju relate istio-pilot katib-ui**

**traindb@traindb-VirtualBox:~/Desktop$ juju deploy tensorboards-web-app**

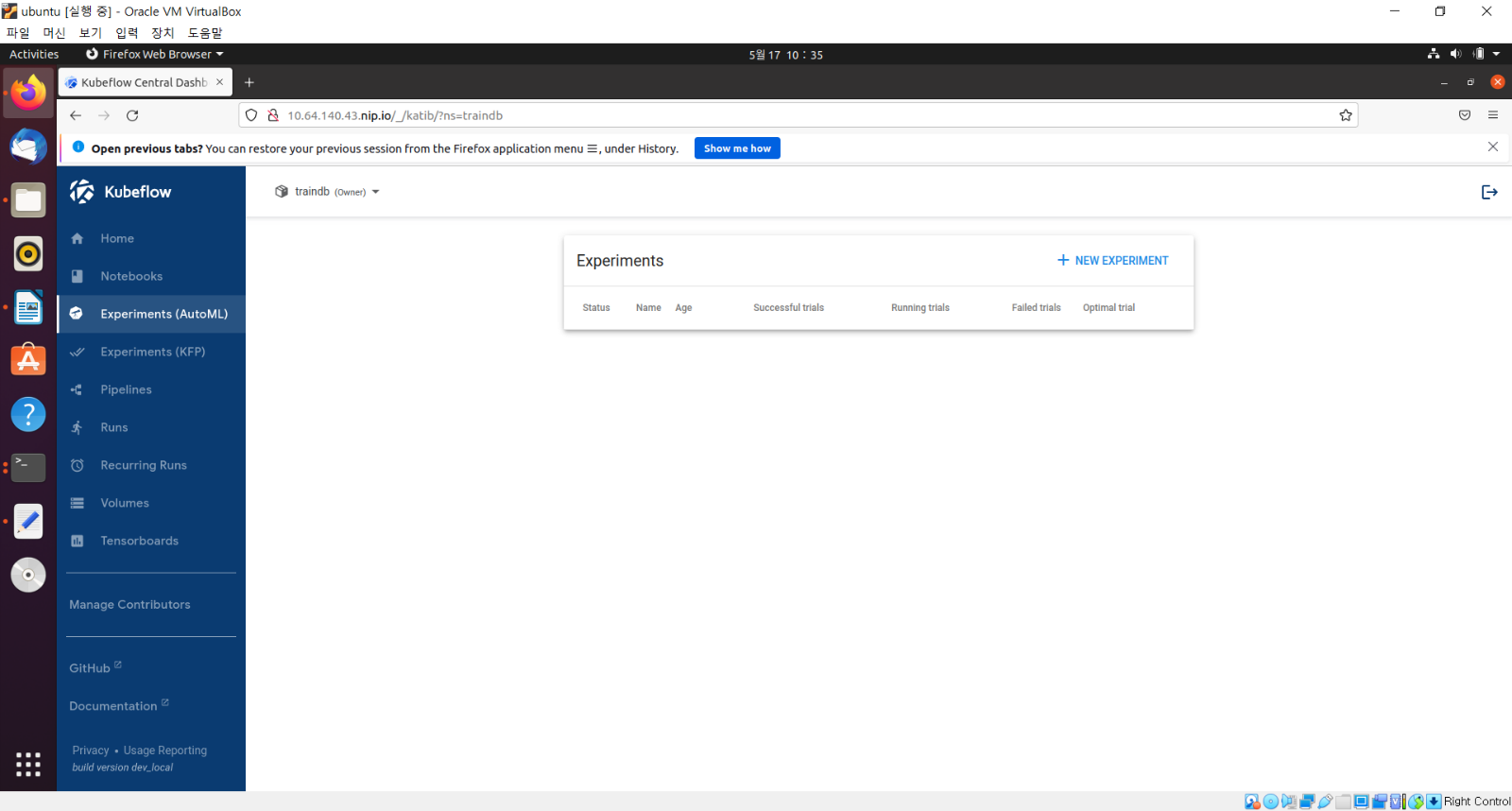
|  |
| --- |
| Located charm "tensorboards-web-app" in charm-hub, revision 3  Deploying "tensorboards-web-app" from charm-hub charm "tensorboards-web-app", revision 3 in channel stable on focal |

**traindb@traindb-VirtualBox:~/Desktop$** **watch -c juju status --color**





**traindb@traindb-VirtualBox:~/Desktop$** **juju relate istio-pilot tensorboards-web-app**



# **7. Install docker and container**

**traindb@traindb-VirtualBox:~/Desktop$** **sudo apt remove docker docker-engine docker.io containerd**

|  |
| --- |
| [sudo] password for traindb:  Reading package lists... Done  Building dependency tree  Reading state information... Done  E: Unable to locate package docker-engine |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo apt update**

|  |
| --- |
| Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]  Hit:2 http://kr.archive.ubuntu.com/ubuntu focal InRelease  Get:3 http://kr.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]  Get:4 http://kr.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]  Fetched 336 kB in 3s (131 kB/s)  Reading package lists... Done  Building dependency tree  Reading state information... Done  182 packages can be upgraded. Run 'apt list --upgradable' to see them. |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo apt install -y apt-transport-https ca-certificates curl gnupg lsb-release**

|  |
| --- |
| Reading package lists... Done  Building dependency tree  Reading state information... Done  lsb-release is already the newest version (11.1.0ubuntu2).  lsb-release set to manually installed.  ca-certificates is already the newest version (20210119~20.04.2).  ca-certificates set to manually installed.  The following additional packages will be installed:  dirmngr gnupg-l10n gnupg-utils gpg gpg-agent gpg-wks-client gpg-wks-server gpgconf gpgsm gpgv  Suggested packages:  tor parcimonie xloadimage scdaemon  The following NEW packages will be installed:  apt-transport-https curl  The following packages will be upgraded:  dirmngr gnupg gnupg-l10n gnupg-utils gpg gpg-agent gpg-wks-client gpg-wks-server gpgconf gpgsm  gpgv  11 upgraded, 2 newly installed, 0 to remove and 171 not upgraded.  Need to get 2,729 kB of archives.  After this operation, 573 kB of additional disk space will be used.  Get:1 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gpg-wks-client amd64 2.2.19-3ubuntu2.1 [97.6 kB]  Get:2 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 dirmngr amd64 2.2.19-3ubuntu2.1 [329 kB]  Get:3 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gnupg-utils amd64 2.2.19-3ubuntu2.1 [480 kB]  Get:4 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gpg-wks-server amd64 2.2.19-3ubuntu2.1 [90.3 kB]  Get:5 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gpg-agent amd64 2.2.19-3ubuntu2.1 [232 kB]  Get:6 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gpg amd64 2.2.19-3ubuntu2.1 [483 kB]  Get:7 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gpgconf amd64 2.2.19-3ubuntu2.1 [124 kB]  Get:8 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gnupg-l10n all 2.2.19-3ubuntu2.1 [51.7 kB]  Get:9 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gnupg all 2.2.19-3ubuntu2.1 [259 kB]  Get:10 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gpgsm amd64 2.2.19-3ubuntu2.1 [217 kB]  Get:11 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 gpgv amd64 2.2.19-3ubuntu2.1 [199 kB]  Get:12 http://kr.archive.ubuntu.com/ubuntu focal-updates/universe amd64 apt-transport-https all 2.0.6 [4,680 B]  Get:13 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 curl amd64 7.68.0-1ubuntu2.11 [162 kB]  Fetched 2,729 kB in 13s (218 kB/s)  (Reading database ... 187081 files and directories currently installed.)  Preparing to unpack .../00-gpg-wks-client\_2.2.19-3ubuntu2.1\_amd64.deb ...  Unpacking gpg-wks-client (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../01-dirmngr\_2.2.19-3ubuntu2.1\_amd64.deb ...  Unpacking dirmngr (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../02-gnupg-utils\_2.2.19-3ubuntu2.1\_amd64.deb ...  Unpacking gnupg-utils (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../03-gpg-wks-server\_2.2.19-3ubuntu2.1\_amd64.deb ...  Unpacking gpg-wks-server (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../04-gpg-agent\_2.2.19-3ubuntu2.1\_amd64.deb ...  Unpacking gpg-agent (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../05-gpg\_2.2.19-3ubuntu2.1\_amd64.deb ...  Unpacking gpg (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../06-gpgconf\_2.2.19-3ubuntu2.1\_amd64.deb ...  Unpacking gpgconf (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../07-gnupg-l10n\_2.2.19-3ubuntu2.1\_all.deb ...  Unpacking gnupg-l10n (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../08-gnupg\_2.2.19-3ubuntu2.1\_all.deb ...  Unpacking gnupg (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../09-gpgsm\_2.2.19-3ubuntu2.1\_amd64.deb ...  Unpacking gpgsm (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Preparing to unpack .../10-gpgv\_2.2.19-3ubuntu2.1\_amd64.deb ...  Unpacking gpgv (2.2.19-3ubuntu2.1) over (2.2.19-3ubuntu2) ...  Setting up gpgv (2.2.19-3ubuntu2.1) ...  Selecting previously unselected package apt-transport-https.  (Reading database ... 187081 files and directories currently installed.)  Preparing to unpack .../apt-transport-https\_2.0.6\_all.deb ...  Unpacking apt-transport-https (2.0.6) ...  Selecting previously unselected package curl.  Preparing to unpack .../curl\_7.68.0-1ubuntu2.11\_amd64.deb ...  Unpacking curl (7.68.0-1ubuntu2.11) ...  Setting up apt-transport-https (2.0.6) ...  Setting up gnupg-l10n (2.2.19-3ubuntu2.1) ...  Setting up gpgconf (2.2.19-3ubuntu2.1) ...  Setting up curl (7.68.0-1ubuntu2.11) ...  Setting up gpg (2.2.19-3ubuntu2.1) ...  Setting up gnupg-utils (2.2.19-3ubuntu2.1) ...  Setting up gpg-agent (2.2.19-3ubuntu2.1) ...  Setting up gpgsm (2.2.19-3ubuntu2.1) ...  Setting up dirmngr (2.2.19-3ubuntu2.1) ...  Setting up gpg-wks-server (2.2.19-3ubuntu2.1) ...  Setting up gpg-wks-client (2.2.19-3ubuntu2.1) ...  Setting up gnupg (2.2.19-3ubuntu2.1) ...  Processing triggers for man-db (2.9.1-1) ...  Processing triggers for install-info (6.7.0.dfsg.2-5) ... |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /usr/share/keyrings/docker-archive-keyring.gpg**

**traindb@traindb-VirtualBox:~/Desktop$** **sudo echo "deb [arch=amd64 signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] https://download.docker.com/linux/ubuntu $(lsb\_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null**

**traindb@traindb-VirtualBox:~/Desktop$** **sudo apt update**

|  |
| --- |
| Hit:1 http://kr.archive.ubuntu.com/ubuntu focal InRelease  Get:2 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]  Get:3 http://kr.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]  Get:4 https://download.docker.com/linux/ubuntu focal InRelease [57.7 kB]  Get:5 https://download.docker.com/linux/ubuntu focal/stable amd64 Packages [16.7 kB]  Get:6 http://kr.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]  Fetched 410 kB in 2s (238 kB/s)  Reading package lists... Done  Building dependency tree  Reading state information... Done  171 packages can be upgraded. Run 'apt list --upgradable' to see them. |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo apt install docker-ce containerd.io**

|  |
| --- |
| Reading package lists... Done  Building dependency tree  Reading state information... Done  The following additional packages will be installed:  docker-ce-cli docker-ce-rootless-extras docker-scan-plugin git git-man liberror-perl pigz  slirp4netns  Suggested packages:  aufs-tools cgroupfs-mount | cgroup-lite git-daemon-run | git-daemon-sysvinit git-doc git-el  git-email git-gui gitk gitweb git-cvs git-mediawiki git-svn  The following NEW packages will be installed:  containerd.io docker-ce docker-ce-cli docker-ce-rootless-extras docker-scan-plugin git git-man  liberror-perl pigz slirp4netns  0 upgraded, 10 newly installed, 0 to remove and 171 not upgraded.  Need to get 107 MB of archives.  After this operation, 460 MB of additional disk space will be used.  Do you want to continue? [Y/n] y  Get:1 https://download.docker.com/linux/ubuntu focal/stable amd64 containerd.io amd64 1.6.4-1 [28.1 MB]  Get:2 http://kr.archive.ubuntu.com/ubuntu focal/universe amd64 pigz amd64 2.4-1 [57.4 kB]  Get:3 http://kr.archive.ubuntu.com/ubuntu focal/main amd64 liberror-perl all 0.17029-1 [26.5 kB]  Get:4 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 git-man all 1:2.25.1-1ubuntu3.4 [885 kB]  Get:5 https://download.docker.com/linux/ubuntu focal/stable amd64 docker-ce-cli amd64 5:20.10.16~3-0~ubuntu-focal [40.6 MB]  Get:6 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 git amd64 1:2.25.1-1ubuntu3.4 [4,560 kB]  Get:7 https://download.docker.com/linux/ubuntu focal/stable amd64 docker-ce amd64 5:20.10.16~3-0~ubuntu-focal [21.0 MB]  Get:8 https://download.docker.com/linux/ubuntu focal/stable amd64 docker-ce-rootless-extras amd64 5:20.10.16~3-0~ubuntu-focal [8,168 kB]  Get:9 https://download.docker.com/linux/ubuntu focal/stable amd64 docker-scan-plugin amd64 0.17.0~ubuntu-focal [3,521 kB]  Get:10 http://kr.archive.ubuntu.com/ubuntu focal/universe amd64 slirp4netns amd64 0.4.3-1 [74.3 kB]  Fetched 107 MB in 19s (5,723 kB/s)  Selecting previously unselected package pigz.  (Reading database ... 187092 files and directories currently installed.)  Preparing to unpack .../0-pigz\_2.4-1\_amd64.deb ...  Unpacking pigz (2.4-1) ...  Selecting previously unselected package containerd.io.  Preparing to unpack .../1-containerd.io\_1.6.4-1\_amd64.deb ...  Unpacking containerd.io (1.6.4-1) ...  Selecting previously unselected package docker-ce-cli.  Preparing to unpack .../2-docker-ce-cli\_5%3a20.10.16~3-0~ubuntu-focal\_amd64.deb ...  Unpacking docker-ce-cli (5:20.10.16~3-0~ubuntu-focal) ...  Selecting previously unselected package docker-ce.  Preparing to unpack .../3-docker-ce\_5%3a20.10.16~3-0~ubuntu-focal\_amd64.deb ...  Unpacking docker-ce (5:20.10.16~3-0~ubuntu-focal) ...  Selecting previously unselected package docker-ce-rootless-extras.  Preparing to unpack .../4-docker-ce-rootless-extras\_5%3a20.10.16~3-0~ubuntu-focal\_amd64.deb ...  Unpacking docker-ce-rootless-extras (5:20.10.16~3-0~ubuntu-focal) ...  Selecting previously unselected package docker-scan-plugin.  Preparing to unpack .../5-docker-scan-plugin\_0.17.0~ubuntu-focal\_amd64.deb ...  Unpacking docker-scan-plugin (0.17.0~ubuntu-focal) ...  Selecting previously unselected package liberror-perl.  Preparing to unpack .../6-liberror-perl\_0.17029-1\_all.deb ...  Unpacking liberror-perl (0.17029-1) ...  Selecting previously unselected package git-man.  Preparing to unpack .../7-git-man\_1%3a2.25.1-1ubuntu3.4\_all.deb ...  Unpacking git-man (1:2.25.1-1ubuntu3.4) ...  Selecting previously unselected package git.  Preparing to unpack .../8-git\_1%3a2.25.1-1ubuntu3.4\_amd64.deb ...  Unpacking git (1:2.25.1-1ubuntu3.4) ...  Selecting previously unselected package slirp4netns.  Preparing to unpack .../9-slirp4netns\_0.4.3-1\_amd64.deb ...  Unpacking slirp4netns (0.4.3-1) ...  Setting up slirp4netns (0.4.3-1) ...  Setting up docker-scan-plugin (0.17.0~ubuntu-focal) ...  Setting up liberror-perl (0.17029-1) ...  Setting up containerd.io (1.6.4-1) ...  Created symlink /etc/systemd/system/multi-user.target.wants/containerd.service → /lib/systemd/syste  m/containerd.service.  Setting up docker-ce-cli (5:20.10.16~3-0~ubuntu-focal) ...  Setting up pigz (2.4-1) ...  Setting up git-man (1:2.25.1-1ubuntu3.4) ...  Setting up docker-ce-rootless-extras (5:20.10.16~3-0~ubuntu-focal) ...  Setting up docker-ce (5:20.10.16~3-0~ubuntu-focal) ...  Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /lib/systemd/system/do  cker.service.  Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /lib/systemd/system/docker  .socket.  Setting up git (1:2.25.1-1ubuntu3.4) ...  Processing triggers for man-db (2.9.1-1) ...  Processing triggers for systemd (245.4-4ubuntu3.15) ... |

**traindb@traindb-VirtualBox:~/Desktop$** **cat <<EOF | sudo tee /etc/modules-load.d/containerd.conf**

|  |
| --- |
| **> overlay**  **> br\_netfilter**  **> EOF**  overlay  br\_netfilter |

**traindb@traindb-VirtualBox:~/Desktop$ cat <<EOF | sudo tee /etc/sysctl.d/99-kubernetes-cri.conf**

|  |
| --- |
| **> net.bridge.bridge-nf-call-iptables = 1**  **> net.ipv4.ip\_forward = 1**  **> net.bridge.bridge-nf-call-ip6tables = 1**  **> EOF**  net.bridge.bridge-nf-call-iptables = 1  net.ipv4.ip\_forward = 1  net.bridge.bridge-nf-call-ip6tables = 1 |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo mkdir -p /etc/containerd**

**traindb@traindb-VirtualBox:~/Desktop$** **containerd config default | sudo tee /etc/containerd/config.toml**

|  |
| --- |
| disabled\_plugins = []  imports = []  oom\_score = 0  plugin\_dir = ""  required\_plugins = []  root = "/var/lib/containerd"  state = "/run/containerd"  temp = ""  version = 2  [cgroup]  path = ""  [debug]  address = ""  format = ""  gid = 0  level = ""  uid = 0  [grpc]  address = "/run/containerd/containerd.sock"  gid = 0  max\_recv\_message\_size = 16777216  max\_send\_message\_size = 16777216  tcp\_address = ""  tcp\_tls\_ca = ""  tcp\_tls\_cert = ""  tcp\_tls\_key = ""  uid = 0  [metrics]  address = ""  grpc\_histogram = false  [plugins]  [plugins."io.containerd.gc.v1.scheduler"]  deletion\_threshold = 0  mutation\_threshold = 100  pause\_threshold = 0.02  schedule\_delay = "0s"  startup\_delay = "100ms"  [plugins."io.containerd.grpc.v1.cri"]  device\_ownership\_from\_security\_context = false  disable\_apparmor = false  disable\_cgroup = false  disable\_hugetlb\_controller = true  disable\_proc\_mount = false  disable\_tcp\_service = true  enable\_selinux = false  enable\_tls\_streaming = false  enable\_unprivileged\_icmp = false  enable\_unprivileged\_ports = false  ignore\_image\_defined\_volumes = false  max\_concurrent\_downloads = 3  max\_container\_log\_line\_size = 16384  netns\_mounts\_under\_state\_dir = false  restrict\_oom\_score\_adj = false  sandbox\_image = "k8s.gcr.io/pause:3.6"  selinux\_category\_range = 1024  stats\_collect\_period = 10  stream\_idle\_timeout = "4h0m0s"  stream\_server\_address = "127.0.0.1"  stream\_server\_port = "0"  systemd\_cgroup = false  tolerate\_missing\_hugetlb\_controller = true  unset\_seccomp\_profile = ""  [plugins."io.containerd.grpc.v1.cri".cni]  bin\_dir = "/opt/cni/bin"  conf\_dir = "/etc/cni/net.d"  conf\_template = ""  ip\_pref = ""  max\_conf\_num = 1  [plugins."io.containerd.grpc.v1.cri".containerd]  default\_runtime\_name = "runc"  disable\_snapshot\_annotations = true  discard\_unpacked\_layers = false  ignore\_rdt\_not\_enabled\_errors = false  no\_pivot = false  snapshotter = "overlayfs"  [plugins."io.containerd.grpc.v1.cri".containerd.default\_runtime]  base\_runtime\_spec = ""  cni\_conf\_dir = ""  cni\_max\_conf\_num = 0  container\_annotations = []  pod\_annotations = []  privileged\_without\_host\_devices = false  runtime\_engine = ""  runtime\_path = ""  runtime\_root = ""  runtime\_type = ""  [plugins."io.containerd.grpc.v1.cri".containerd.default\_runtime.options]  [plugins."io.containerd.grpc.v1.cri".containerd.runtimes]  [plugins."io.containerd.grpc.v1.cri".containerd.runtimes.runc]  base\_runtime\_spec = ""  cni\_conf\_dir = ""  cni\_max\_conf\_num = 0  container\_annotations = []  pod\_annotations = []  privileged\_without\_host\_devices = false  runtime\_engine = ""  runtime\_path = ""  runtime\_root = ""  runtime\_type = "io.containerd.runc.v2"  [plugins."io.containerd.grpc.v1.cri".containerd.runtimes.runc.options]  BinaryName = ""  CriuImagePath = ""  CriuPath = ""  CriuWorkPath = ""  IoGid = 0  IoUid = 0  NoNewKeyring = false  NoPivotRoot = false  Root = ""  ShimCgroup = ""  SystemdCgroup = false  [plugins."io.containerd.grpc.v1.cri".containerd.untrusted\_workload\_runtime]  base\_runtime\_spec = ""  cni\_conf\_dir = ""  cni\_max\_conf\_num = 0  container\_annotations = []  pod\_annotations = []  privileged\_without\_host\_devices = false  runtime\_engine = ""  runtime\_path = ""  runtime\_root = ""  runtime\_type = ""  [plugins."io.containerd.grpc.v1.cri".containerd.untrusted\_workload\_runtime.options]  [plugins."io.containerd.grpc.v1.cri".image\_decryption]  key\_model = "node"  [plugins."io.containerd.grpc.v1.cri".registry]  config\_path = ""  [plugins."io.containerd.grpc.v1.cri".registry.auths]  [plugins."io.containerd.grpc.v1.cri".registry.configs]  [plugins."io.containerd.grpc.v1.cri".registry.headers]  [plugins."io.containerd.grpc.v1.cri".registry.mirrors]  [plugins."io.containerd.grpc.v1.cri".x509\_key\_pair\_streaming]  tls\_cert\_file = ""  tls\_key\_file = ""  [plugins."io.containerd.internal.v1.opt"]  path = "/opt/containerd"  [plugins."io.containerd.internal.v1.restart"]  interval = "10s"  [plugins."io.containerd.internal.v1.tracing"]  sampling\_ratio = 1.0  service\_name = "containerd"  [plugins."io.containerd.metadata.v1.bolt"]  content\_sharing\_policy = "shared"  [plugins."io.containerd.monitor.v1.cgroups"]  no\_prometheus = false  [plugins."io.containerd.runtime.v1.linux"]  no\_shim = false  runtime = "runc"  runtime\_root = ""  shim = "containerd-shim"  shim\_debug = false  [plugins."io.containerd.runtime.v2.task"]  platforms = ["linux/amd64"]  sched\_core = false  [plugins."io.containerd.service.v1.diff-service"]  default = ["walking"]  [plugins."io.containerd.service.v1.tasks-service"]  rdt\_config\_file = ""  [plugins."io.containerd.snapshotter.v1.aufs"]  root\_path = ""  [plugins."io.containerd.snapshotter.v1.btrfs"]  root\_path = ""  [plugins."io.containerd.snapshotter.v1.devmapper"]  async\_remove = false  base\_image\_size = ""  discard\_blocks = false  fs\_options = ""  fs\_type = ""  pool\_name = ""  root\_path = ""  [plugins."io.containerd.snapshotter.v1.native"]  root\_path = ""  [plugins."io.containerd.snapshotter.v1.overlayfs"]  root\_path = ""  upperdir\_label = false  [plugins."io.containerd.snapshotter.v1.zfs"]  root\_path = ""  [plugins."io.containerd.tracing.processor.v1.otlp"]  endpoint = ""  insecure = false  protocol = ""  [proxy\_plugins]  [stream\_processors]  [stream\_processors."io.containerd.ocicrypt.decoder.v1.tar"]  accepts = ["application/vnd.oci.image.layer.v1.tar+encrypted"]  args = ["--decryption-keys-path", "/etc/containerd/ocicrypt/keys"]  env = ["OCICRYPT\_KEYPROVIDER\_CONFIG=/etc/containerd/ocicrypt/ocicrypt\_keyprovider.conf"]  path = "ctd-decoder"  returns = "application/vnd.oci.image.layer.v1.tar"  [stream\_processors."io.containerd.ocicrypt.decoder.v1.tar.gzip"]  accepts = ["application/vnd.oci.image.layer.v1.tar+gzip+encrypted"]  args = ["--decryption-keys-path", "/etc/containerd/ocicrypt/keys"]  env = ["OCICRYPT\_KEYPROVIDER\_CONFIG=/etc/containerd/ocicrypt/ocicrypt\_keyprovider.conf"]  path = "ctd-decoder"  returns = "application/vnd.oci.image.layer.v1.tar+gzip"  [timeouts]  "io.containerd.timeout.bolt.open" = "0s"  "io.containerd.timeout.shim.cleanup" = "5s"  "io.containerd.timeout.shim.load" = "5s"  "io.containerd.timeout.shim.shutdown" = "3s"  "io.containerd.timeout.task.state" = "2s"  [ttrpc]  address = ""  gid = 0  uid = 0 |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo systemctl restart containerd**

**traindb@traindb-VirtualBox:~/Desktop$** **sudo vi /etc/containerd/config.toml**

|  |
| --- |
| - [plugins."io.containerd.grpc.v1.cri".containerd.runtimes.runc]  - ...  - [plugins."io.containerd.grpc.v1.cri".containerd.runtimes.runc.options]  - SystemdCgroup = **true** 변경  **traindb@traindb-VirtualBox:~/Desktop$** **sudo systemctl restart containerd**  **traindb@traindb-VirtualBox:~/Desktop$ sudo vi /etc/docker/daemon.json**  {  "exec-opts": ["native.cgroupdriver=systemd"],  "log-driver": "json-file",  "log-opts": {  "max-size": "100m"  },  "storage-driver": "overlay2"  } |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo mkdir -p /etc/systemd/system/docker.service.d**

**traindb@traindb-VirtualBox:~/Desktop$ sudo systemctl daemon-reload**

**traindb@traindb-VirtualBox:~/Desktop$** **sudo systemctl restart docker**

**traindb@traindb-VirtualBox:~/Desktop$** **docker images**

|  |
| --- |
| Got permission denied while trying to connect to the Docker daemon socket at unix:///var/run/docker.sock: Get "http://%2Fvar%2Frun%2Fdocker.sock/v1.24/images/json": dial unix /var/run/docker.sock: connect: permission denied |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo docker images**

|  |
| --- |
| REPOSITORY TAG IMAGE ID CREATED SIZE |

sudo usermod -aG docker $USER

sudo su $USER

# **8. Install miniconda**

**traindb@traindb-VirtualBox:~/Desktop$** **apt-get update**

|  |
| --- |
| Reading package lists... Done  E: List directory /var/lib/apt/lists/partial is missing. - Acquire (2: No such file or directory)  W: Problem unlinking the file /var/cache/apt/srcpkgcache.bin - RemoveCaches (13: Permission denied) |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo apt-get update**

|  |
| --- |
| Get:1 https://download.docker.com/linux/ubuntu focal InRelease [57.7 kB]  Get:2 https://download.docker.com/linux/ubuntu focal/stable amd64 Packages [16.7 kB]  Get:3 http://kr.archive.ubuntu.com/ubuntu focal InRelease [265 kB]  Get:4 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]  Get:5 http://kr.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]  Get:6 http://security.ubuntu.com/ubuntu focal-security/main i386 Packages [432 kB]  Get:7 http://kr.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]  Get:8 http://kr.archive.ubuntu.com/ubuntu focal/main i386 Packages [718 kB]  Get:9 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [1,451 kB]  Get:10 http://kr.archive.ubuntu.com/ubuntu focal/main amd64 Packages [970 kB]  Get:11 http://kr.archive.ubuntu.com/ubuntu focal/main Translation-en [506 kB]  Get:12 http://kr.archive.ubuntu.com/ubuntu focal/main amd64 DEP-11 Metadata [494 kB]  Get:13 http://security.ubuntu.com/ubuntu 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Done |

**traindb@traindb-VirtualBox:~/Desktop$** **sudo apt-get install -y wget bzip2**

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| Reading package lists... Done  Building dependency tree  Reading state information... Done  bzip2 is already the newest version (1.0.8-2).  bzip2 set to manually installed.  The following packages will be upgraded:  wget  1 upgraded, 0 newly installed, 0 to remove and 170 not upgraded.  Need to get 348 kB of archives.  After this operation, 4,096 B disk space will be freed.  Get:1 http://kr.archive.ubuntu.com/ubuntu focal-updates/main amd64 wget amd64 1.20.3-1ubuntu2 [348 kB]  Fetched 348 kB in 3s (136 kB/s)  (Reading database ... 188277 files and directories currently installed.)  Preparing to unpack .../wget\_1.20.3-1ubuntu2\_amd64.deb ...  Unpacking wget (1.20.3-1ubuntu2) over (1.20.3-1ubuntu1) ...  Setting up wget (1.20.3-1ubuntu2) ...  Processing triggers for install-info (6.7.0.dfsg.2-5) ...  Processing triggers for man-db (2.9.1-1) ... |

**traindb@traindb-VirtualBox:~/Desktop$** **wget https://repo.continuum.io/miniconda/Miniconda3-latest-Linux-x86\_64.sh**

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| --2022-05-17 12:09:20-- https://repo.continuum.io/miniconda/Miniconda3-latest-Linux-x86\_64.sh  Resolving repo.continuum.io (repo.continuum.io)... 104.18.201.79, 104.18.200.79, 2606:4700::6812:c94f, ...  Connecting to repo.continuum.io (repo.continuum.io)|104.18.201.79|:443... connected.  HTTP request sent, awaiting response... 301 Moved Permanently  Location: https://repo.anaconda.com/miniconda/Miniconda3-latest-Linux-x86\_64.sh [following]  --2022-05-17 12:09:20-- https://repo.anaconda.com/miniconda/Miniconda3-latest-Linux-x86\_64.sh  Resolving repo.anaconda.com (repo.anaconda.com)... 104.16.130.3, 104.16.131.3, 2606:4700::6810:8303, ...  Connecting to repo.anaconda.com (repo.anaconda.com)|104.16.130.3|:443... connected.  HTTP request sent, awaiting response... 200 OK  Length: 76607678 (73M) [application/x-sh]  Saving to: ‘Miniconda3-latest-Linux-x86\_64.sh’  Miniconda3-latest-Linux- 100%[===============================>] 73.06M 11.2MB/s in 6.6s  2022-05-17 12:09:27 (11.1 MB/s) - ‘Miniconda3-latest-Linux-x86\_64.sh’ saved [76607678/76607678] |

**traindb@traindb-VirtualBox:~/Desktop$** **bash Miniconda3-latest-Linux-x86\_64.sh**

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| Welcome to Miniconda3 py39\_4.12.0  In order to continue the installation process, please review the license  agreement.  Please, press ENTER to continue  >>>  ======================================  End User License Agreement - Miniconda  ======================================  Copyright 2015-2022, Anaconda, Inc.  All rights reserved under the 3-clause BSD License:  This End User License Agreement (the "Agreement") is a legal agreement between you and Anaconda,  Inc. ("Anaconda") and governs your use of Miniconda.  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BEFORE using  any encryption software, please check your country's laws, regulations and policies concerning t  he import, possession, or use, and re-export of encryption software, to see if this is permitted.  See the Wassenaar Arrangement http://www.wassenaar.org/ for more information.  Anaconda has self-classified this software as Export Commodity Control Number (ECCN) EAR99, which  includes mass market information security software using or performing cryptographic functions w  ith asymmetric algorithms. No license is required for export of this software to non-embargoed co  untries.  The Intel Math Kernel Library contained in Miniconda is classified by Intel as ECCN 5D992.c with  no license required for export to non-embargoed countries.  The following packages listed on https://www.anaconda.com/cryptography are included in the Reposi  tory accessible through Miniconda that relate to cryptography.  Last updated March 21, 2022  Do you accept the license terms? [yes|no]  **[no] >>> yes**  Miniconda3 will now be installed into this location:  /home/traindb/miniconda3  - Press ENTER to confirm the location  - Press CTRL-C to abort the installation  - Or specify a different location below  [/home/traindb/miniconda3] >>>  PREFIX=/home/traindb/miniconda3  Unpacking payload ...  Collecting package metadata (current\_repodata.json): done  Solving environment: done  ## Package Plan ##  environment location: /home/traindb/miniconda3  added / updated specs:  - \_libgcc\_mutex==0.1=main  - \_openmp\_mutex==4.5=1\_gnu  - brotlipy==0.7.0=py39h27cfd23\_1003  - ca-certificates==2022.3.29=h06a4308\_1  - certifi==2021.10.8=py39h06a4308\_2  - cffi==1.15.0=py39hd667e15\_1  - charset-normalizer==2.0.4=pyhd3eb1b0\_0  - colorama==0.4.4=pyhd3eb1b0\_0  - conda-content-trust==0.1.1=pyhd3eb1b0\_0  - conda-package-handling==1.8.1=py39h7f8727e\_0  - conda==4.12.0=py39h06a4308\_0  - cryptography==36.0.0=py39h9ce1e76\_0  - idna==3.3=pyhd3eb1b0\_0  - ld\_impl\_linux-64==2.35.1=h7274673\_9  - libffi==3.3=he6710b0\_2  - libgcc-ng==9.3.0=h5101ec6\_17  - libgomp==9.3.0=h5101ec6\_17  - libstdcxx-ng==9.3.0=hd4cf53a\_17  - ncurses==6.3=h7f8727e\_2  - openssl==1.1.1n=h7f8727e\_0  - pip==21.2.4=py39h06a4308\_0  - pycosat==0.6.3=py39h27cfd23\_0  - pycparser==2.21=pyhd3eb1b0\_0  - pyopenssl==22.0.0=pyhd3eb1b0\_0  - pysocks==1.7.1=py39h06a4308\_0  - python==3.9.12=h12debd9\_0  - readline==8.1.2=h7f8727e\_1  - requests==2.27.1=pyhd3eb1b0\_0  - ruamel\_yaml==0.15.100=py39h27cfd23\_0  - setuptools==61.2.0=py39h06a4308\_0  - six==1.16.0=pyhd3eb1b0\_1  - sqlite==3.38.2=hc218d9a\_0  - tk==8.6.11=h1ccaba5\_0  - tqdm==4.63.0=pyhd3eb1b0\_0  - tzdata==2022a=hda174b7\_0  - urllib3==1.26.8=pyhd3eb1b0\_0  - wheel==0.37.1=pyhd3eb1b0\_0  - xz==5.2.5=h7b6447c\_0  - yaml==0.2.5=h7b6447c\_0  - zlib==1.2.12=h7f8727e\_1  The following NEW packages will be INSTALLED:  \_libgcc\_mutex pkgs/main/linux-64::\_libgcc\_mutex-0.1-main  \_openmp\_mutex pkgs/main/linux-64::\_openmp\_mutex-4.5-1\_gnu  brotlipy pkgs/main/linux-64::brotlipy-0.7.0-py39h27cfd23\_1003  ca-certificates pkgs/main/linux-64::ca-certificates-2022.3.29-h06a4308\_1  certifi pkgs/main/linux-64::certifi-2021.10.8-py39h06a4308\_2  cffi pkgs/main/linux-64::cffi-1.15.0-py39hd667e15\_1  charset-normalizer pkgs/main/noarch::charset-normalizer-2.0.4-pyhd3eb1b0\_0  colorama pkgs/main/noarch::colorama-0.4.4-pyhd3eb1b0\_0  conda pkgs/main/linux-64::conda-4.12.0-py39h06a4308\_0  conda-content-tru~ pkgs/main/noarch::conda-content-trust-0.1.1-pyhd3eb1b0\_0  conda-package-han~ pkgs/main/linux-64::conda-package-handling-1.8.1-py39h7f8727e\_0  cryptography pkgs/main/linux-64::cryptography-36.0.0-py39h9ce1e76\_0  idna pkgs/main/noarch::idna-3.3-pyhd3eb1b0\_0  ld\_impl\_linux-64 pkgs/main/linux-64::ld\_impl\_linux-64-2.35.1-h7274673\_9  libffi pkgs/main/linux-64::libffi-3.3-he6710b0\_2  libgcc-ng pkgs/main/linux-64::libgcc-ng-9.3.0-h5101ec6\_17  libgomp pkgs/main/linux-64::libgomp-9.3.0-h5101ec6\_17  libstdcxx-ng pkgs/main/linux-64::libstdcxx-ng-9.3.0-hd4cf53a\_17  ncurses pkgs/main/linux-64::ncurses-6.3-h7f8727e\_2  openssl pkgs/main/linux-64::openssl-1.1.1n-h7f8727e\_0  pip pkgs/main/linux-64::pip-21.2.4-py39h06a4308\_0  pycosat pkgs/main/linux-64::pycosat-0.6.3-py39h27cfd23\_0  pycparser pkgs/main/noarch::pycparser-2.21-pyhd3eb1b0\_0  pyopenssl pkgs/main/noarch::pyopenssl-22.0.0-pyhd3eb1b0\_0  pysocks pkgs/main/linux-64::pysocks-1.7.1-py39h06a4308\_0  python pkgs/main/linux-64::python-3.9.12-h12debd9\_0  readline pkgs/main/linux-64::readline-8.1.2-h7f8727e\_1  requests pkgs/main/noarch::requests-2.27.1-pyhd3eb1b0\_0  ruamel\_yaml pkgs/main/linux-64::ruamel\_yaml-0.15.100-py39h27cfd23\_0  setuptools pkgs/main/linux-64::setuptools-61.2.0-py39h06a4308\_0  six pkgs/main/noarch::six-1.16.0-pyhd3eb1b0\_1  sqlite pkgs/main/linux-64::sqlite-3.38.2-hc218d9a\_0  tk pkgs/main/linux-64::tk-8.6.11-h1ccaba5\_0  tqdm pkgs/main/noarch::tqdm-4.63.0-pyhd3eb1b0\_0  tzdata pkgs/main/noarch::tzdata-2022a-hda174b7\_0  urllib3 pkgs/main/noarch::urllib3-1.26.8-pyhd3eb1b0\_0  wheel pkgs/main/noarch::wheel-0.37.1-pyhd3eb1b0\_0  xz pkgs/main/linux-64::xz-5.2.5-h7b6447c\_0  yaml pkgs/main/linux-64::yaml-0.2.5-h7b6447c\_0  zlib pkgs/main/linux-64::zlib-1.2.12-h7f8727e\_1  Preparing transaction: done  Executing transaction: done  installation finished.  Do you wish the installer to initialize Miniconda3  by running conda init? [yes|no]  [no] >>> yes  no change /home/traindb/miniconda3/condabin/conda  no change /home/traindb/miniconda3/bin/conda  no change /home/traindb/miniconda3/bin/conda-env  no change /home/traindb/miniconda3/bin/activate  no change /home/traindb/miniconda3/bin/deactivate  no change /home/traindb/miniconda3/etc/profile.d/conda.sh  no change /home/traindb/miniconda3/etc/fish/conf.d/conda.fish  no change /home/traindb/miniconda3/shell/condabin/Conda.psm1  no change /home/traindb/miniconda3/shell/condabin/conda-hook.ps1  no change /home/traindb/miniconda3/lib/python3.9/site-packages/xontrib/conda.xsh  no change /home/traindb/miniconda3/etc/profile.d/conda.csh  modified /home/traindb/.bashrc  ==> For changes to take effect, close and re-open your current shell. <==  If you'd prefer that conda's base environment not be activated on startup,  set the auto\_activate\_base parameter to false:  conda config --set auto\_activate\_base false  Thank you for installing Miniconda3! |

**traindb@traindb-VirtualBox:~/Desktop$** **which conda**

**traindb@traindb-VirtualBox:~/Desktop$** **export PATH=/home/traindb/miniconda3/bin/:$PATH**

**traindb@traindb-VirtualBox:~/Desktop$** **which conda**

|  |
| --- |
| /home/traindb/miniconda3/bin//conda |

**traindb@traindb-VirtualBox:~/Desktop$** **conda create --name mlpipeline python=3.6**

|  |
| --- |
| Collecting package metadata (current\_repodata.json): done  Solving environment: failed with repodata from current\_repodata.json, will retry with next repodata source.  Collecting package metadata (repodata.json): done  Solving environment: done  ## Package Plan ##  environment location: /home/traindb/miniconda3/envs/mlpipeline  added / updated specs:  - python=3.6  The following packages will be downloaded:  package | build  ---------------------------|-----------------  ca-certificates-2022.4.26 | h06a4308\_0 124 KB  certifi-2021.5.30 | py36h06a4308\_0 139 KB  ld\_impl\_linux-64-2.38 | h1181459\_0 654 KB  openssl-1.1.1o | h7f8727e\_0 2.5 MB  pip-21.2.2 | py36h06a4308\_0 1.8 MB  python-3.6.13 | h12debd9\_1 32.5 MB  setuptools-58.0.4 | py36h06a4308\_0 788 KB  sqlite-3.38.3 | hc218d9a\_0 1.0 MB  tk-8.6.11 | h1ccaba5\_1 3.0 MB  xz-5.2.5 | h7f8727e\_1 339 KB  zlib-1.2.12 | h7f8727e\_2 106 KB  ------------------------------------------------------------  Total: 43.0 MB  The following NEW packages will be INSTALLED:  \_libgcc\_mutex pkgs/main/linux-64::\_libgcc\_mutex-0.1-main  \_openmp\_mutex pkgs/main/linux-64::\_openmp\_mutex-4.5-1\_gnu  ca-certificates pkgs/main/linux-64::ca-certificates-2022.4.26-h06a4308\_0  certifi pkgs/main/linux-64::certifi-2021.5.30-py36h06a4308\_0  ld\_impl\_linux-64 pkgs/main/linux-64::ld\_impl\_linux-64-2.38-h1181459\_0  libffi pkgs/main/linux-64::libffi-3.3-he6710b0\_2  libgcc-ng pkgs/main/linux-64::libgcc-ng-9.3.0-h5101ec6\_17  libgomp pkgs/main/linux-64::libgomp-9.3.0-h5101ec6\_17  libstdcxx-ng pkgs/main/linux-64::libstdcxx-ng-9.3.0-hd4cf53a\_17  ncurses pkgs/main/linux-64::ncurses-6.3-h7f8727e\_2  openssl pkgs/main/linux-64::openssl-1.1.1o-h7f8727e\_0  pip pkgs/main/linux-64::pip-21.2.2-py36h06a4308\_0  python pkgs/main/linux-64::python-3.6.13-h12debd9\_1  readline pkgs/main/linux-64::readline-8.1.2-h7f8727e\_1  setuptools pkgs/main/linux-64::setuptools-58.0.4-py36h06a4308\_0  sqlite pkgs/main/linux-64::sqlite-3.38.3-hc218d9a\_0  tk pkgs/main/linux-64::tk-8.6.11-h1ccaba5\_1  wheel pkgs/main/noarch::wheel-0.37.1-pyhd3eb1b0\_0  xz pkgs/main/linux-64::xz-5.2.5-h7f8727e\_1  zlib pkgs/main/linux-64::zlib-1.2.12-h7f8727e\_2  Proceed ([y]/n)? y  Downloading and Extracting Packages  ca-certificates-2022 | 124 KB | ###################################################### | 100%  ld\_impl\_linux-64-2.3 | 654 KB | ###################################################### | 100%  setuptools-58.0.4 | 788 KB | ###################################################### | 100%  python-3.6.13 | 32.5 MB | ###################################################### | 100%  pip-21.2.2 | 1.8 MB | ###################################################### | 100%  sqlite-3.38.3 | 1.0 MB | ###################################################### | 100%  certifi-2021.5.30 | 139 KB | ###################################################### | 100%  xz-5.2.5 | 339 KB | ###################################################### | 100%  tk-8.6.11 | 3.0 MB | ###################################################### | 100%  openssl-1.1.1o | 2.5 MB | ###################################################### | 100%  zlib-1.2.12 | 106 KB | ###################################################### | 100%  Preparing transaction: done  Verifying transaction: done  Executing transaction: done  #  # To activate this environment, use  #  # $ conda activate mlpipeline  #  # To deactivate an active environment, use  #  # $ conda deactivate |

**traindb@traindb-VirtualBox:~/Desktop$** **conda activate mlpipeline**

|  |
| --- |
| CommandNotFoundError: Your shell has not been properly configured to use 'conda activate'.  To initialize your shell, run  $ conda init <SHELL\_NAME>  Currently supported shells are:  - bash  - fish  - tcsh  - xonsh  - zsh  - powershell  See 'conda init --help' for more information and options.  IMPORTANT: You may need to close and restart your shell after running 'conda init'. |

**traindb@traindb-VirtualBox:~/Desktop$** **source ~/miniconda3/etc/profile.d/conda.sh**

**traindb@traindb-VirtualBox:~/Desktop$** **conda activate mlpipeline**

# **9. Install kfp and dsl-compile**

(**mlpipeline) traindb@traindb-VirtualBox:~/Desktop$** **pip install kfp --upgrade**

|  |
| --- |
| Collecting kfp  Downloading kfp-1.8.12.tar.gz (301 kB)  |████████████████████████████████| 301 kB 7.2 MB/s  Collecting absl-py<2,>=0.9  Downloading absl\_py-1.0.0-py3-none-any.whl (126 kB)  |████████████████████████████████| 126 kB 8.5 MB/s  Collecting PyYAML<6,>=5.3  Downloading PyYAML-5.4.1-cp36-cp36m-manylinux1\_x86\_64.whl (640 kB)  |████████████████████████████████| 640 kB 8.2 MB/s  Collecting google-api-core!=2.0.\*,!=2.1.\*,!=2.2.\*,!=2.3.0,<3.0.0dev,>=1.31.5  Downloading google\_api\_core-2.7.3-py3-none-any.whl (114 kB)  |████████████████████████████████| 114 kB 7.5 MB/s  Collecting google-cloud-storage<2,>=1.20.0  Downloading google\_cloud\_storage-1.44.0-py2.py3-none-any.whl (106 kB)  |████████████████████████████████| 106 kB 10.2 MB/s  Collecting kubernetes<19,>=8.0.0  Downloading kubernetes-18.20.0-py2.py3-none-any.whl (1.6 MB)  |████████████████████████████████| 1.6 MB 8.0 MB/s  Collecting google-api-python-client<2,>=1.7.8  Downloading google\_api\_python\_client-1.12.11-py2.py3-none-any.whl (62 kB)  |████████████████████████████████| 62 kB 2.4 MB/s  Collecting google-auth<2,>=1.6.1  Downloading google\_auth-1.35.0-py2.py3-none-any.whl (152 kB)  |████████████████████████████████| 152 kB 11.1 MB/s  Collecting requests-toolbelt<1,>=0.8.0  Downloading requests\_toolbelt-0.9.1-py2.py3-none-any.whl (54 kB)  |████████████████████████████████| 54 kB 4.9 MB/s  Collecting cloudpickle<3,>=2.0.0  Downloading cloudpickle-2.0.0-py3-none-any.whl (25 kB)  Collecting kfp-server-api<2.0.0,>=1.1.2  Downloading kfp-server-api-1.8.1.tar.gz (54 kB)  |████████████████████████████████| 54 kB 4.7 MB/s  Collecting jsonschema<4,>=3.0.1  Downloading jsonschema-3.2.0-py2.py3-none-any.whl (56 kB)  |████████████████████████████████| 56 kB 7.1 MB/s  Collecting tabulate<1,>=0.8.6  Downloading tabulate-0.8.9-py3-none-any.whl (25 kB)  Collecting click<9,>=7.1.2  Downloading click-8.0.4-py3-none-any.whl (97 kB)  |████████████████████████████████| 97 kB 9.0 MB/s  Collecting Deprecated<2,>=1.2.7  Downloading Deprecated-1.2.13-py2.py3-none-any.whl (9.6 kB)  Collecting strip-hints<1,>=0.1.8  Downloading strip-hints-0.1.10.tar.gz (29 kB)  Collecting docstring-parser<1,>=0.7.3  Downloading docstring\_parser-0.14.1-py3-none-any.whl (33 kB)  Collecting kfp  Downloading kfp-1.8.11.tar.gz (298 kB)  |████████████████████████████████| 298 kB 7.0 MB/s  Collecting kfp-pipeline-spec<0.2.0,>=0.1.13  Downloading kfp\_pipeline\_spec-0.1.13-py3-none-any.whl (18 kB)  Collecting fire<1,>=0.3.1  Downloading fire-0.4.0.tar.gz (87 kB)  |████████████████████████████████| 87 kB 8.5 MB/s  Collecting protobuf<4,>=3.13.0  Downloading protobuf-3.19.4-cp36-cp36m-manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl (1.1 MB)  |████████████████████████████████| 1.1 MB 7.3 MB/s  Collecting uritemplate<4,>=3.0.1  Downloading uritemplate-3.0.1-py2.py3-none-any.whl (15 kB)  Collecting pydantic<2,>=1.8.2  Downloading pydantic-1.9.0-cp36-cp36m-manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl (11.0 MB)  |████████████████████████████████| 11.0 MB 5.0 MB/s  Collecting typer<1.0,>=0.3.2  Downloading typer-0.4.1-py3-none-any.whl (27 kB)  Collecting dataclasses  Downloading dataclasses-0.8-py3-none-any.whl (19 kB)  Collecting typing-extensions<4,>=3.7.4  Downloading typing\_extensions-3.10.0.2-py3-none-any.whl (26 kB)  Collecting six  Downloading six-1.16.0-py2.py3-none-any.whl (11 kB)  Collecting importlib-metadata  Downloading importlib\_metadata-4.8.3-py3-none-any.whl (17 kB)  Collecting wrapt<2,>=1.10  Downloading wrapt-1.14.1-cp36-cp36m-manylinux\_2\_5\_x86\_64.manylinux1\_x86\_64.manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl (74 kB)  |████████████████████████████████| 74 kB 7.5 MB/s  Collecting termcolor  Downloading termcolor-1.1.0.tar.gz (3.9 kB)  Collecting httplib2<1dev,>=0.15.0  Downloading httplib2-0.20.4-py3-none-any.whl (96 kB)  |████████████████████████████████| 96 kB 2.6 MB/s  Collecting google-auth-httplib2>=0.0.3  Downloading google\_auth\_httplib2-0.1.0-py2.py3-none-any.whl (9.3 kB)  Collecting requests<3.0.0dev,>=2.18.0  Downloading requests-2.27.1-py2.py3-none-any.whl (63 kB)  |████████████████████████████████| 63 kB 4.4 MB/s  Collecting googleapis-common-protos<2.0dev,>=1.52.0  Downloading googleapis\_common\_protos-1.56.1-py2.py3-none-any.whl (211 kB)  |████████████████████████████████| 211 kB 11.6 MB/s  Collecting rsa<5,>=3.1.4  Downloading rsa-4.8-py3-none-any.whl (39 kB)  Collecting cachetools<5.0,>=2.0.0  Downloading cachetools-4.2.4-py3-none-any.whl (10 kB)  Requirement already satisfied: setuptools>=40.3.0 in /home/traindb/miniconda3/envs/mlpipeline/lib/python3.6/site-packages (from google-auth<2,>=1.6.1->kfp) (58.0.4)  Collecting pyasn1-modules>=0.2.1  Downloading pyasn1\_modules-0.2.8-py2.py3-none-any.whl (155 kB)  |████████████████████████████████| 155 kB 7.8 MB/s  Collecting google-cloud-core<3.0dev,>=1.6.0  Downloading google\_cloud\_core-2.3.0-py2.py3-none-any.whl (29 kB)  Collecting google-resumable-media<3.0dev,>=1.3.0  Downloading google\_resumable\_media-2.3.2-py2.py3-none-any.whl (76 kB)  |████████████████████████████████| 76 kB 5.6 MB/s  Collecting google-crc32c<2.0dev,>=1.0  Downloading google\_crc32c-1.3.0-cp36-cp36m-manylinux\_2\_12\_x86\_64.manylinux2010\_x86\_64.whl (37 kB)  Collecting pyparsing!=3.0.0,!=3.0.1,!=3.0.2,!=3.0.3,<4,>=2.4.2  Downloading pyparsing-3.0.9-py3-none-any.whl (98 kB)  |████████████████████████████████| 98 kB 5.8 MB/s  Collecting pyrsistent>=0.14.0  Downloading pyrsistent-0.18.0-cp36-cp36m-manylinux1\_x86\_64.whl (117 kB)  |████████████████████████████████| 117 kB 6.9 MB/s  Collecting attrs>=17.4.0  Downloading attrs-21.4.0-py2.py3-none-any.whl (60 kB)  |████████████████████████████████| 60 kB 7.3 MB/s  Collecting urllib3>=1.15  Downloading urllib3-1.26.9-py2.py3-none-any.whl (138 kB)  |████████████████████████████████| 138 kB 4.4 MB/s  Requirement already satisfied: certifi in /home/traindb/miniconda3/envs/mlpipeline/lib/python3.6/site-packages (from kfp-server-api<2.0.0,>=1.1.2->kfp) (2021.5.30)  Collecting python-dateutil  Downloading python\_dateutil-2.8.2-py2.py3-none-any.whl (247 kB)  |████████████████████████████████| 247 kB 5.7 MB/s  Collecting requests-oauthlib  Downloading requests\_oauthlib-1.3.1-py2.py3-none-any.whl (23 kB)  Collecting websocket-client!=0.40.0,!=0.41.\*,!=0.42.\*,>=0.32.0  Downloading websocket\_client-1.3.1-py3-none-any.whl (54 kB)  |████████████████████████████████| 54 kB 3.4 MB/s  Collecting pyasn1<0.5.0,>=0.4.6  Downloading pyasn1-0.4.8-py2.py3-none-any.whl (77 kB)  |████████████████████████████████| 77 kB 6.4 MB/s  Collecting charset-normalizer~=2.0.0  Downloading charset\_normalizer-2.0.12-py3-none-any.whl (39 kB)  Collecting idna<4,>=2.5  Downloading idna-3.3-py3-none-any.whl (61 kB)  |████████████████████████████████| 61 kB 9.7 MB/s  Requirement already satisfied: wheel in /home/traindb/miniconda3/envs/mlpipeline/lib/python3.6/site-packages (from strip-hints<1,>=0.1.8->kfp) (0.37.1)  Collecting zipp>=0.5  Downloading zipp-3.6.0-py3-none-any.whl (5.3 kB)  Collecting oauthlib>=3.0.0  Downloading oauthlib-3.2.0-py3-none-any.whl (151 kB)  |████████████████████████████████| 151 kB 11.8 MB/s  Building wheels for collected packages: kfp, fire, kfp-server-api, strip-hints, termcolor  Building wheel for kfp (setup.py) ... done  Created wheel for kfp: filename=kfp-1.8.11-py3-none-any.whl size=414450 sha256=4295d10a028dd2b8b433f40689abdd7dca3de7e7ee5eab81dea132c038a2b843  Stored in directory: /home/traindb/.cache/pip/wheels/14/13/2b/d523aae4f2f763b856cba40fb4aaaf31fe1c5379df082b7276  Building wheel for fire (setup.py) ... done  Created wheel for fire: filename=fire-0.4.0-py2.py3-none-any.whl size=115942 sha256=82f981a9207ab127e15fdc558b4b22bb129712268c0cf7ec8016111ff94d0382  Stored in directory: /home/traindb/.cache/pip/wheels/a6/12/74/ce0728e3990845862240349a12d7179a262e388ec73938024b  Building wheel for kfp-server-api (setup.py) ... done  Created wheel for kfp-server-api: filename=kfp\_server\_api-1.8.1-py3-none-any.whl size=95549 sha256=e949a2b2aefedfcc1a673f405590e4b49b6b4a84fd9163842204dc10d1346f1b  Stored in directory: /home/traindb/.cache/pip/wheels/e6/cb/23/13613f351eb2c8b0f99237a43160208eb88239cb54566337e4  Building wheel for strip-hints (setup.py) ... done  Created wheel for strip-hints: filename=strip\_hints-0.1.10-py2.py3-none-any.whl size=22302 sha256=e1ab1551092fb5948a4ce3599c2eb7bee112d408d50983989451dd4e972446b2  Stored in directory: /home/traindb/.cache/pip/wheels/22/84/8f/4973c3ee999690ce7efb3f36b90c4556bd9f50d995b7daf063  Building wheel for termcolor (setup.py) ... done  Created wheel for termcolor: filename=termcolor-1.1.0-py3-none-any.whl size=4848 sha256=582a3858e014fcb0a5865adb592602661b2553e53a7634a14c06c36e7a6ddf07  Stored in directory: /home/traindb/.cache/pip/wheels/93/2a/eb/e58dbcbc963549ee4f065ff80a59f274cc7210b6eab962acdc  Successfully built kfp fire kfp-server-api strip-hints termcolor  Installing collected packages: pyasn1, urllib3, six, rsa, pyasn1-modules, protobuf, idna, charset-normalizer, cachetools, zipp, typing-extensions, requests, pyparsing, googleapis-common-protos, google-auth, oauthlib, importlib-metadata, httplib2, google-crc32c, google-api-core, wrapt, websocket-client, uritemplate, termcolor, requests-oauthlib, PyYAML, python-dateutil, pyrsistent, google-resumable-media, google-cloud-core, google-auth-httplib2, dataclasses, click, attrs, typer, tabulate, strip-hints, requests-toolbelt, pydantic, kubernetes, kfp-server-api, kfp-pipeline-spec, jsonschema, google-cloud-storage, google-api-python-client, fire, docstring-parser, Deprecated, cloudpickle, absl-py, kfp  Successfully installed Deprecated-1.2.13 PyYAML-5.4.1 absl-py-1.0.0 attrs-21.4.0 cachetools-4.2.4 charset-normalizer-2.0.12 click-8.0.4 cloudpickle-2.0.0 dataclasses-0.8 docstring-parser-0.14.1 fire-0.4.0 google-api-core-2.7.3 google-api-python-client-1.12.11 google-auth-1.35.0 google-auth-httplib2-0.1.0 google-cloud-core-2.3.0 google-cloud-storage-1.44.0 google-crc32c-1.3.0 google-resumable-media-2.3.2 googleapis-common-protos-1.56.1 httplib2-0.20.4 idna-3.3 importlib-metadata-4.8.3 jsonschema-3.2.0 kfp-1.8.11 kfp-pipeline-spec-0.1.13 kfp-server-api-1.8.1 kubernetes-18.20.0 oauthlib-3.2.0 protobuf-3.19.4 pyasn1-0.4.8 pyasn1-modules-0.2.8 pydantic-1.9.0 pyparsing-3.0.9 pyrsistent-0.18.0 python-dateutil-2.8.2 requests-2.27.1 requests-oauthlib-1.3.1 requests-toolbelt-0.9.1 rsa-4.8 six-1.16.0 strip-hints-0.1.10 tabulate-0.8.9 termcolor-1.1.0 typer-0.4.1 typing-extensions-3.10.0.2 uritemplate-3.0.1 urllib3-1.26.9 websocket-client-1.3.1 wrapt-1.14.1 zipp-3.6.0 |

(**mlpipeline) traindb@traindb-VirtualBox:~/Desktop$** **which dsl-compile**

(**mlpipeline) traindb@traindb-VirtualBox:~/Desktop$** **export PATH=$PATH:~/.local/bin**

(**mlpipeline) traindb@traindb-VirtualBox:~/Desktop$** **which dsl-compile**

|  |
| --- |
| /home/traindb/miniconda3/envs/mlpipeline/bin/dsl-compile |

# **10. Generating pipeline images**

(**mlpipeline) traindb@traindb-VirtualBox:~/Desktop$** **sudo docker login**

|  |
| --- |
| Login with your Docker ID to push and pull images from Docker Hub. If you don't have a Docker ID, head over to https://hub.docker.com to create one.  **Username: joleedocker**  **Password:** **jst1234!!**  WARNING! Your password will be stored unencrypted in /root/.docker/config.json.  Configure a credential helper to remove this warning. See  https://docs.docker.com/engine/reference/commandline/login/#credentials-store  Login Succeeded |

(**mlpipeline) traindb@traindb-VirtualBox:~$** cd **kubeflow\_example-master/**

(**mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master$** **ls**

|  |
| --- |
| iris metrics\_evaluation\_and\_check\_condition README.md titanic |

(**mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master$** **cd iris/**

(**mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris$** **ls**

|  |
| --- |
| 1\_data\_load 2\_model\_training kf\_iris\_pipeline3.tar.gz pipeline.py \_\_pycache\_\_ |

(**mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris$** **cd 1\_data\_load/**

(**mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/1\_data\_load$ ls**

|  |
| --- |
| Dockerfile Iris.csv load\_data.py requirements.txt |

* **Dockfile**

|  |
| --- |
| FROM python:3  ENV PYTHONUNBUFFERED 1  RUN mkdir /code  WORKDIR /code  COPY . /code/  RUN pip install -r requirements.txt  ENTRYPOINT ["python", "load\_data.py"] |

* **requirements.txt**

|  |
| --- |
| pandas==1.2.4  argparse==1.4.0 |

* **load\_data.py**

|  |
| --- |
| import pandas as pd  import argparse  if \_\_name\_\_ == "\_\_main\_\_":    argument\_parser = argparse.ArgumentParser()  argument\_parser.add\_argument(  '--data\_path', type=str,  help="Input data path"  )  args = argument\_parser.parse\_args()  data = pd.read\_csv(args.data\_path)  print(data.shape)  print("load data")  data.to\_csv('/iris.csv', index=False) |

**Iris.csv**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Id | SepalLengthCm | SepalWidthCm | PetalLengthCm | PetalWidthCm | Species | | 1 | 5.1 | 3.5 | 1.4 | 0.2 | Iris-setosa | | 2 | 4.9 | 3 | 1.4 | 0.2 | Iris-setosa | | 3 | 4.7 | 3.2 | 1.3 | 0.2 | Iris-setosa | |

**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/1\_data\_load$** **sudo docker build -t kf\_iris\_preprocessing .**

|  |
| --- |
| uild -t kf\_iris\_preprocessing .  Sending build context to Docker daemon 9.728kB  Step 1/7 : FROM python:3  ---> bda19bf988a7  Step 2/7 : ENV PYTHONUNBUFFERED 1  ---> Running in 3094052250c4  Removing intermediate container 3094052250c4  ---> 8c89871342ac  Step 3/7 : RUN mkdir /code  ---> Running in 47295c3f29f7  Removing intermediate container 47295c3f29f7  ---> ba704a8b6508  Step 4/7 : WORKDIR /code  ---> Running in f7ab924fff54  Removing intermediate container f7ab924fff54  ---> 3d15bd03bd10  Step 5/7 : COPY . /code/  ---> d2f4447f2f6c  Step 6/7 : RUN pip install -r requirements.txt  ---> Running in d65917006a21  Collecting pandas==1.2.4  Downloading pandas-1.2.4.tar.gz (5.5 MB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 5.5/5.5 MB 10.9 MB/s eta 0:00:00  Installing build dependencies: started  Installing build dependencies: finished with status 'done'  Getting requirements to build wheel: started  Getting requirements to build wheel: finished with status 'done'  Preparing metadata (pyproject.toml): started  Preparing metadata (pyproject.toml): finished with status 'done'  Collecting argparse==1.4.0  Downloading argparse-1.4.0-py2.py3-none-any.whl (23 kB)  Collecting numpy>=1.16.5  Using cached numpy-1.22.3-cp310-cp310-manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl (16.8 MB)  Collecting pytz>=2017.3  Downloading pytz-2022.1-py2.py3-none-any.whl (503 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 503.5/503.5 KB 10.9 MB/s eta 0:00:00  Collecting python-dateutil>=2.7.3  Downloading python\_dateutil-2.8.2-py2.py3-none-any.whl (247 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 247.7/247.7 KB 10.1 MB/s eta 0:00:00  Collecting six>=1.5  Downloading six-1.16.0-py2.py3-none-any.whl (11 kB)  Building wheels for collected packages: pandas  Building wheel for pandas (pyproject.toml): started  Building wheel for pandas (pyproject.toml): still running...  Building wheel for pandas (pyproject.toml): still running...  Building wheel for pandas (pyproject.toml): still running...  Building wheel for pandas (pyproject.toml): still running...  Building wheel for pandas (pyproject.toml): finished with status 'done'  Created wheel for pandas: filename=pandas-1.2.4-cp310-cp310-linux\_x86\_64.whl size=41555267 sha256=bcd9f07da117309ab85c74a86db31b0ce759baa0162be1c819e7ea319a6a3257  Stored in directory: /root/.cache/pip/wheels/1b/10/28/2a37b26cf3e4dc59d82430e3812f8571518d2c1d81c288af98  Successfully built pandas  Installing collected packages: pytz, argparse, six, numpy, python-dateutil, pandas  Successfully installed argparse-1.4.0 numpy-1.22.3 pandas-1.2.4 python-dateutil-2.8.2 pytz-2022.1 six-1.16.0  WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv  WARNING: You are using pip version 22.0.4; however, version 22.1 is available.  You should consider upgrading via the '/usr/local/bin/python -m pip install --upgrade pip' command.  Removing intermediate container d65917006a21  ---> d90eca8928db  Step 7/7 : ENTRYPOINT ["python", "load\_data.py"]  ---> Running in 86df393cd92f  Removing intermediate container 86df393cd92f  ---> 1962173c4ec9  Successfully built 1962173c4ec9  Successfully tagged kf\_iris\_preprocessing:latest |

**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/1\_data\_load$ sudo docker images**

|  |
| --- |
| REPOSITORY TAG IMAGE ID CREATED SIZE  kf\_iris\_preprocessing latest 1962173c4ec9 About a minute ago 1.24GB  python 3 bda19bf988a7 5 days ago 919MB |

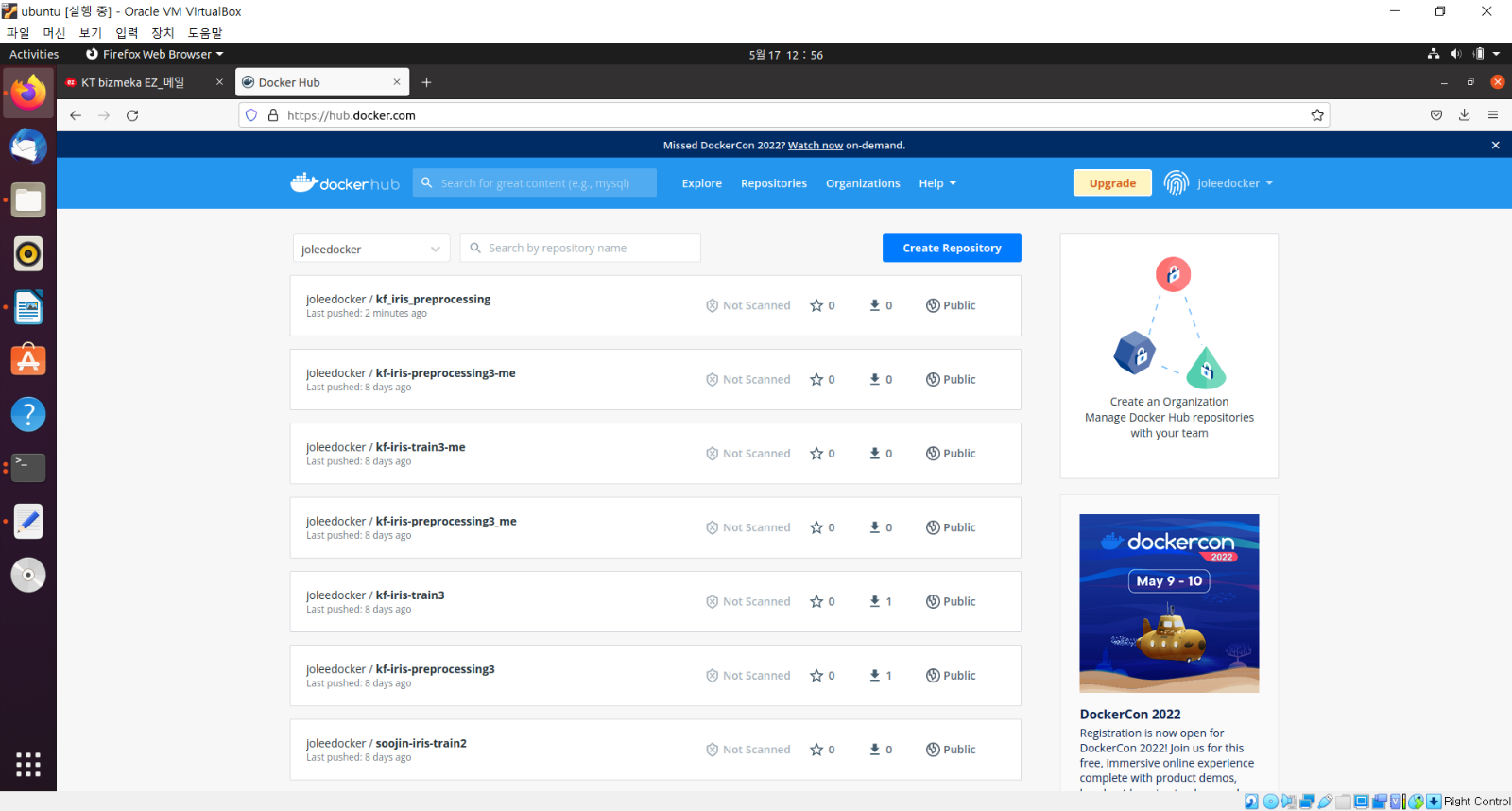
**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/1\_data\_load$** **sudo docker tag kf\_iris\_preprocessing:latest joleedocker/kf\_iris\_preprocessing:0.5**

**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/1\_data\_load$** **sudo docker images**

|  |
| --- |
| REPOSITORY TAG IMAGE ID CREATED SIZE  joleedocker/kf\_iris\_preprocessing 0.5 1962173c4ec9 2 minutes ago 1.24GB  kf\_iris\_preprocessing latest 1962173c4ec9 2 minutes ago 1.24GB  python 3 bda19bf988a7 5 days ago 919MB |

**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/1\_data\_load$** **sudo docker push joleedocker/kf\_iris\_preprocessing:0.5**

|  |
| --- |
| The push refers to repository [docker.io/joleedocker/kf\_iris\_preprocessing]  9e94461658de: Pushed  433599967ad5: Pushed  2433fc18a726: Pushed  d63526a5d12e: Mounted from library/python  d35a703f2b0a: Mounted from library/python  db7f8cc44a42: Mounted from library/python  b889a93a79dd: Mounted from library/python  9d4550089a93: Mounted from library/python  a7934564e6b9: Mounted from library/python  1b7cceb6a07c: Mounted from library/python  b274e8788e0c: Mounted from library/python  78658088978a: Mounted from library/python  0.5: digest: sha256:1b3e2fb608c68b5d2501fba669f2d8f511c39a261d29909ecb6c0bd323626617 size: 2846 |



**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris$** **cd 2\_model\_training/**

(**mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/2\_model\_training$** **ls**

|  |
| --- |
| Dockerfile requirements.txt training\_model.py |

* **Dockfile**

|  |
| --- |
| #FROM frolvlad/alpine-python-machinelearning  FROM python:3  ENV PYTHONUNBUFFERED 1  RUN mkdir /code  WORKDIR /code  COPY . /code/  RUN pip install --upgrade pip  #RUN adduser -D myuser  #USER myuser  #WORKDIR /home/myuser  #COPY --chown=myuser:myuser requirements.txt requirements.txt  #RUN pip install --user -r requirements.txt  #ENV PATH="/home/user/.local/bin:${PATH}"  #COPY --chown=myuser:myuser . .  RUN pip install --upgrade wheel  RUN pip install --upgrade setuptools  #RUN pip install gensim  #RUN pip uninstall -y numpy  RUN pip install -r requirements.txt  ENTRYPOINT ["python", "training\_model.py"] |

* **requirements.txt**

|  |
| --- |
| attrs==21.2.0  cachetools==4.2.4  certifi==2021.10.8  charset-normalizer==2.0.7  click==8.0.3  cloudpickle==2.0.0  Deprecated==1.2.13  docstring-parser==0.12  fire==0.4.0  google-api-core==1.31.3  google-api-python-client==1.12.8  google-auth==1.35.0  google-auth-httplib2==0.1.0  google-cloud-core==2.1.0  google-cloud-storage==1.42.3  google-crc32c==1.3.0  google-resumable-media==2.1.0  googleapis-common-protos==1.53.0  httplib2==0.20.2  idna==3.3  importlib-metadata==4.8.1  joblib==1.1.0  jsonschema==3.2.0  kfp==1.8.9  kfp-pipeline-spec==0.1.13  kfp-server-api==1.7.1  kubernetes==18.20.0  numpy==1.21.4  oauthlib==3.1.1  packaging==21.2  protobuf==3.17.3  pyasn1==0.4.8  pyasn1-modules==0.2.8  pydantic==1.8.2  pyparsing==2.4.7  pyrsistent==0.18.0  python-dateutil==2.8.2  pytz==2021.3  PyYAML==5.4.1  requests==2.26.0  requests-oauthlib==1.3.0  requests-toolbelt==0.9.1  rsa==4.7.2  six==1.16.0  strip-hints==0.1.10  tabulate==0.8.9  termcolor==1.1.0  threadpoolctl==3.0.0  typer==0.4.0  typing-extensions==3.10.0.2  uritemplate==3.0.1  urllib3==1.26.7  websocket-client==1.2.1  wrapt==1.13.3  zipp==3.6.0  pandas==1.3.4  scikit-learn==1.0.1  scipy==1.7.2 |

* **training\_model.py**

|  |
| --- |
| import argparse  import pandas as pd  from sklearn.linear\_model import LogisticRegression  from sklearn.model\_selection import train\_test\_split  from sklearn.preprocessing import LabelEncoder  from sklearn.metrics import accuracy\_score  from io import StringIO  def load\_data(data):  d = StringIO(data)  iris = pd.read\_csv(d, sep=',')  print(iris.shape)  return iris  def get\_train\_test\_data(iris):  encode = LabelEncoder()  iris.Species = encode.fit\_transform(iris.Species)  train , test = train\_test\_split(iris, test\_size=0.2, random\_state=0)  print('shape of training data : ', train.shape)  print('shape of testing data', test.shape)  X\_train = train.drop(columns=['Species'], axis=1)  y\_train = train['Species']  X\_test = test.drop(columns=['Species'], axis=1)  y\_test = test['Species']  return X\_train, X\_test, y\_train, y\_test  if \_\_name\_\_ == "\_\_main\_\_":    argument\_parser = argparse.ArgumentParser()  argument\_parser.add\_argument(  '--data',  type=str,  help="Input data csv"  )  args = argument\_parser.parse\_args()  iris = args.data  iris = load\_data(iris)  X\_train, X\_test, y\_train, y\_test = get\_train\_test\_data(iris)  model = LogisticRegression()  model.fit(X\_train, y\_train)  predict = model.predict(X\_test)  print('\nAccuracy Score on test data : ')  print(accuracy\_score(y\_test, predict)) |

**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/2\_model\_training$** **sudo docker build -t kf\_iris\_train .**

|  |
| --- |
| Sending build context to Docker daemon 12.29kB  Step 1/10 : FROM python:3  ---> bda19bf988a7  Step 2/10 : ENV PYTHONUNBUFFERED 1  ---> Using cache  ---> 8c89871342ac  Step 3/10 : RUN mkdir /code  ---> Using cache  ---> ba704a8b6508  Step 4/10 : WORKDIR /code  ---> Using cache  ---> 3d15bd03bd10  Step 5/10 : COPY . /code/  ---> 89d1148d07ed  Step 6/10 : RUN pip install --upgrade pip  ---> Running in 5b4c98e9900c  Requirement already satisfied: pip in /usr/local/lib/python3.10/site-packages (22.0.4)  Collecting pip  Downloading pip-22.1-py3-none-any.whl (2.1 MB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 2.1/2.1 MB 10.7 MB/s eta 0:00:00  Installing collected packages: pip  Attempting uninstall: pip  Found existing installation: pip 22.0.4  Uninstalling pip-22.0.4:  Successfully uninstalled pip-22.0.4  Successfully installed pip-22.1  WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv  Removing intermediate container 5b4c98e9900c  ---> 0e1dc98e0e10  Step 7/10 : RUN pip install --upgrade wheel  ---> Running in 718aebd8000a  Requirement already satisfied: wheel in /usr/local/lib/python3.10/site-packages (0.37.1)  WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv  Removing intermediate container 718aebd8000a  ---> 3952b30559bd  Step 8/10 : RUN pip install --upgrade setuptools  ---> Running in a394da27b45d  Requirement already satisfied: setuptools in /usr/local/lib/python3.10/site-packages (58.1.0)  Collecting setuptools  Downloading setuptools-62.3.0-py3-none-any.whl (1.2 MB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.2/1.2 MB 9.2 MB/s eta 0:00:00  Installing collected packages: setuptools  Attempting uninstall: setuptools  Found existing installation: setuptools 58.1.0  Uninstalling setuptools-58.1.0:  Successfully uninstalled setuptools-58.1.0  Successfully installed setuptools-62.3.0  WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv  Removing intermediate container a394da27b45d  ---> 1c5e4aa89abd  Step 9/10 : RUN pip install -r requirements.txt  ---> Running in 52907c187e31  Collecting attrs==21.2.0  Downloading attrs-21.2.0-py2.py3-none-any.whl (53 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 53.7/53.7 kB 6.0 MB/s eta 0:00:00  Collecting cachetools==4.2.4  Downloading cachetools-4.2.4-py3-none-any.whl (10 kB)  Collecting certifi==2021.10.8  Downloading certifi-2021.10.8-py2.py3-none-any.whl (149 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 149.2/149.2 kB 9.8 MB/s eta 0:00:00  Collecting charset-normalizer==2.0.7  Downloading charset\_normalizer-2.0.7-py3-none-any.whl (38 kB)  Collecting click==8.0.3  Downloading click-8.0.3-py3-none-any.whl (97 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 97.5/97.5 kB 3.5 MB/s eta 0:00:00  Collecting cloudpickle==2.0.0  Downloading cloudpickle-2.0.0-py3-none-any.whl (25 kB)  Collecting Deprecated==1.2.13  Downloading Deprecated-1.2.13-py2.py3-none-any.whl (9.6 kB)  Collecting docstring-parser==0.12  Downloading docstring\_parser-0.12.tar.gz (23 kB)  Installing build dependencies: started  Installing build dependencies: finished with status 'done'  Getting requirements to build wheel: started  Getting requirements to build wheel: finished with status 'done'  Preparing metadata (pyproject.toml): started  Preparing metadata (pyproject.toml): finished with status 'done'  Collecting fire==0.4.0  Downloading fire-0.4.0.tar.gz (87 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 87.7/87.7 kB 7.5 MB/s eta 0:00:00  Preparing metadata (setup.py): started  Preparing metadata (setup.py): finished with status 'done'  Collecting google-api-core==1.31.3  Downloading google\_api\_core-1.31.3-py2.py3-none-any.whl (93 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 93.3/93.3 kB 11.2 MB/s eta 0:00:00  Collecting google-api-python-client==1.12.8  Downloading google\_api\_python\_client-1.12.8-py2.py3-none-any.whl (61 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 61.5/61.5 kB 8.9 MB/s eta 0:00:00  Collecting google-auth==1.35.0  Downloading google\_auth-1.35.0-py2.py3-none-any.whl (152 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 152.9/152.9 kB 10.7 MB/s eta 0:00:00  Collecting google-auth-httplib2==0.1.0  Downloading google\_auth\_httplib2-0.1.0-py2.py3-none-any.whl (9.3 kB)  Collecting google-cloud-core==2.1.0  Downloading google\_cloud\_core-2.1.0-py2.py3-none-any.whl (27 kB)  Collecting google-cloud-storage==1.42.3  Downloading google\_cloud\_storage-1.42.3-py2.py3-none-any.whl (105 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 106.0/106.0 kB 10.5 MB/s eta 0:00:00  Collecting google-crc32c==1.3.0  Downloading google\_crc32c-1.3.0-cp310-cp310-manylinux\_2\_12\_x86\_64.manylinux2010\_x86\_64.whl (37 kB)  Collecting google-resumable-media==2.1.0  Downloading google\_resumable\_media-2.1.0-py2.py3-none-any.whl (75 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 75.6/75.6 kB 10.6 MB/s eta 0:00:00  Collecting googleapis-common-protos==1.53.0  Downloading googleapis\_common\_protos-1.53.0-py2.py3-none-any.whl (198 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 198.2/198.2 kB 10.2 MB/s eta 0:00:00  Collecting httplib2==0.20.2  Downloading httplib2-0.20.2-py3-none-any.whl (96 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 96.7/96.7 kB 8.5 MB/s eta 0:00:00  Collecting idna==3.3  Downloading idna-3.3-py3-none-any.whl (61 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 61.2/61.2 kB 12.2 MB/s eta 0:00:00  Collecting importlib-metadata==4.8.1  Downloading importlib\_metadata-4.8.1-py3-none-any.whl (17 kB)  Collecting joblib==1.1.0  Downloading joblib-1.1.0-py2.py3-none-any.whl (306 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 307.0/307.0 kB 6.2 MB/s eta 0:00:00  Collecting jsonschema==3.2.0  Downloading jsonschema-3.2.0-py2.py3-none-any.whl (56 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 56.3/56.3 kB 4.2 MB/s eta 0:00:00  Collecting kfp==1.8.9  Downloading kfp-1.8.9.tar.gz (296 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 296.3/296.3 kB 9.0 MB/s eta 0:00:00  Preparing metadata (setup.py): started  Preparing metadata (setup.py): finished with status 'done'  Collecting kfp-pipeline-spec==0.1.13  Downloading kfp\_pipeline\_spec-0.1.13-py3-none-any.whl (18 kB)  Collecting kfp-server-api==1.7.1  Downloading kfp-server-api-1.7.1.tar.gz (52 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 52.8/52.8 kB 4.7 MB/s eta 0:00:00  Preparing metadata (setup.py): started  Preparing metadata (setup.py): finished with status 'done'  Collecting kubernetes==18.20.0  Downloading kubernetes-18.20.0-py2.py3-none-any.whl (1.6 MB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.6/1.6 MB 6.7 MB/s eta 0:00:00  Collecting numpy==1.21.4  Downloading numpy-1.21.4-cp310-cp310-manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl (15.9 MB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 15.9/15.9 MB 11.4 MB/s eta 0:00:00  Collecting oauthlib==3.1.1  Downloading oauthlib-3.1.1-py2.py3-none-any.whl (146 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 146.2/146.2 kB 9.6 MB/s eta 0:00:00  Collecting packaging==21.2  Downloading packaging-21.2-py3-none-any.whl (40 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 40.7/40.7 kB 4.6 MB/s eta 0:00:00  Collecting protobuf==3.17.3  Downloading protobuf-3.17.3-py2.py3-none-any.whl (173 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 173.9/173.9 kB 8.6 MB/s eta 0:00:00  Collecting pyasn1==0.4.8  Downloading pyasn1-0.4.8-py2.py3-none-any.whl (77 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 77.1/77.1 kB 8.8 MB/s eta 0:00:00  Collecting pyasn1-modules==0.2.8  Downloading pyasn1\_modules-0.2.8-py2.py3-none-any.whl (155 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 155.3/155.3 kB 10.1 MB/s eta 0:00:00  Collecting pydantic==1.8.2  Downloading pydantic-1.8.2-py3-none-any.whl (126 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 126.0/126.0 kB 10.0 MB/s eta 0:00:00  Collecting pyparsing==2.4.7  Downloading pyparsing-2.4.7-py2.py3-none-any.whl (67 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 67.8/67.8 kB 9.0 MB/s eta 0:00:00  Collecting pyrsistent==0.18.0  Downloading pyrsistent-0.18.0.tar.gz (104 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 104.2/104.2 kB 16.0 MB/s eta 0:00:00  Installing build dependencies: started  Installing build dependencies: finished with status 'done'  Getting requirements to build wheel: started  Getting requirements to build wheel: finished with status 'done'  Preparing metadata (pyproject.toml): started  Preparing metadata (pyproject.toml): finished with status 'done'  Collecting python-dateutil==2.8.2  Downloading python\_dateutil-2.8.2-py2.py3-none-any.whl (247 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 247.7/247.7 kB 7.0 MB/s eta 0:00:00  Collecting pytz==2021.3  Downloading pytz-2021.3-py2.py3-none-any.whl (503 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 503.5/503.5 kB 7.3 MB/s eta 0:00:00  Collecting PyYAML==5.4.1  Downloading PyYAML-5.4.1.tar.gz (175 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 175.1/175.1 kB 6.1 MB/s eta 0:00:00  Installing build dependencies: started  Installing build dependencies: finished with status 'done'  Getting requirements to build wheel: started  Getting requirements to build wheel: finished with status 'done'  Preparing metadata (pyproject.toml): started  Preparing metadata (pyproject.toml): finished with status 'done'  Collecting requests==2.26.0  Downloading requests-2.26.0-py2.py3-none-any.whl (62 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 62.3/62.3 kB 6.3 MB/s eta 0:00:00  Collecting requests-oauthlib==1.3.0  Downloading requests\_oauthlib-1.3.0-py2.py3-none-any.whl (23 kB)  Collecting requests-toolbelt==0.9.1  Downloading requests\_toolbelt-0.9.1-py2.py3-none-any.whl (54 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 54.3/54.3 kB 7.1 MB/s eta 0:00:00  Collecting rsa==4.7.2  Downloading rsa-4.7.2-py3-none-any.whl (34 kB)  Collecting six==1.16.0  Downloading six-1.16.0-py2.py3-none-any.whl (11 kB)  Collecting strip-hints==0.1.10  Downloading strip-hints-0.1.10.tar.gz (29 kB)  Preparing metadata (setup.py): started  Preparing metadata (setup.py): finished with status 'done'  Collecting tabulate==0.8.9  Downloading tabulate-0.8.9-py3-none-any.whl (25 kB)  Collecting termcolor==1.1.0  Downloading termcolor-1.1.0.tar.gz (3.9 kB)  Preparing metadata (setup.py): started  Preparing metadata (setup.py): finished with status 'done'  Collecting threadpoolctl==3.0.0  Downloading threadpoolctl-3.0.0-py3-none-any.whl (14 kB)  Collecting typer==0.4.0  Downloading typer-0.4.0-py3-none-any.whl (27 kB)  Collecting typing-extensions==3.10.0.2  Downloading typing\_extensions-3.10.0.2-py3-none-any.whl (26 kB)  Collecting uritemplate==3.0.1  Downloading uritemplate-3.0.1-py2.py3-none-any.whl (15 kB)  Collecting urllib3==1.26.7  Downloading urllib3-1.26.7-py2.py3-none-any.whl (138 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 138.8/138.8 kB 11.2 MB/s eta 0:00:00  Collecting websocket-client==1.2.1  Downloading websocket\_client-1.2.1-py2.py3-none-any.whl (52 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 52.8/52.8 kB 9.9 MB/s eta 0:00:00  Collecting wrapt==1.13.3  Downloading wrapt-1.13.3-cp310-cp310-manylinux\_2\_5\_x86\_64.manylinux1\_x86\_64.manylinux\_2\_12\_x86\_64.manylinux2010\_x86\_64.whl (81 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 81.5/81.5 kB 8.8 MB/s eta 0:00:00  Collecting zipp==3.6.0  Downloading zipp-3.6.0-py3-none-any.whl (5.3 kB)  Collecting pandas==1.3.4  Downloading pandas-1.3.4-cp310-cp310-manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl (11.5 MB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 11.5/11.5 MB 11.2 MB/s eta 0:00:00  Collecting scikit-learn==1.0.1  Downloading scikit-learn-1.0.1.tar.gz (6.6 MB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 6.6/6.6 MB 11.5 MB/s eta 0:00:00  Installing build dependencies: started  Installing build dependencies: finished with status 'done'  Getting requirements to build wheel: started  Getting requirements to build wheel: finished with status 'done'  Preparing metadata (pyproject.toml): started  Preparing metadata (pyproject.toml): finished with status 'done'  Collecting scipy==1.7.2  Downloading scipy-1.7.2-cp310-cp310-manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl (39.9 MB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 39.9/39.9 MB 9.4 MB/s eta 0:00:00  Requirement already satisfied: setuptools>=40.3.0 in /usr/local/lib/python3.10/site-packages (from google-api-core==1.31.3->-r requirements.txt (line 10)) (62.3.0)  Collecting absl-py<=0.11,>=0.9  Downloading absl\_py-0.11.0-py3-none-any.whl (127 kB)  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 127.8/127.8 kB 9.9 MB/s eta 0:00:00  Requirement already satisfied: wheel in /usr/local/lib/python3.10/site-packages (from strip-hints==0.1.10->-r requirements.txt (line 45)) (0.37.1)  Building wheels for collected packages: docstring-parser, fire, kfp, kfp-server-api, pyrsistent, PyYAML, strip-hints, termcolor, scikit-learn  Building wheel for docstring-parser (pyproject.toml): started  Building wheel for docstring-parser (pyproject.toml): finished with status 'done'  Created wheel for docstring-parser: filename=docstring\_parser-0.12-py3-none-any.whl size=31750 sha256=ff9ebb6466f58c827c39cdb0960714e9a7d65461b4cff11f862a3c6d0d904873  Stored in directory: /root/.cache/pip/wheels/15/79/47/3e7b25bb22e824142721caa80d20bf025ce9f8e1ccce51f58d  Building wheel for fire (setup.py): started  Building wheel for fire (setup.py): finished with status 'done'  Created wheel for fire: filename=fire-0.4.0-py2.py3-none-any.whl size=115926 sha256=40b5288d3293cbe1a4f75b5cec4e1195b8c38241a91572881c2caca638e7a340  Stored in directory: /root/.cache/pip/wheels/26/9a/dd/2818b1b023daf077ec3e625c47ae446aca587a5abe48e05212  Building wheel for kfp (setup.py): started  Building wheel for kfp (setup.py): finished with status 'done'  Created wheel for kfp: filename=kfp-1.8.9-py3-none-any.whl size=409625 sha256=a6d36c3e4f61b0eadad8cc075be5d4ba670dccfd105d23b5a6bb973fee219272  Stored in directory: /root/.cache/pip/wheels/f2/c8/fe/b8938f9b2f303ae2fa418cfd64ff50841551d26b9a99fac115  Building wheel for kfp-server-api (setup.py): started  Building wheel for kfp-server-api (setup.py): finished with status 'done'  Created wheel for kfp-server-api: filename=kfp\_server\_api-1.7.1-py3-none-any.whl size=92607 sha256=9ae776593820218e88f99a318f6810d87e569136606bd275cbfdc8810d55fb06  Stored in directory: /root/.cache/pip/wheels/77/eb/09/fe6b25c980db6511fe1bc9015a082672c01f477ac7152d0fe6  Building wheel for pyrsistent (pyproject.toml): started  Building wheel for pyrsistent (pyproject.toml): finished with status 'done'  Created wheel for pyrsistent: filename=pyrsistent-0.18.0-cp310-cp310-linux\_x86\_64.whl size=115437 sha256=ba3e33a65ecc7ae9c41ceb836de64184258ca99e4d137cebe7e4bcf39296f71a  Stored in directory: /root/.cache/pip/wheels/bf/ee/17/b548a960bb9e20daf7987f316c326e8a368603809ace3b2374  Building wheel for PyYAML (pyproject.toml): started  Building wheel for PyYAML (pyproject.toml): finished with status 'done'  Created wheel for PyYAML: filename=PyYAML-5.4.1-cp310-cp310-linux\_x86\_64.whl size=562044 sha256=2526b712b22a2d6f4127ad85aa9499b8bf95f133e46de44fa71aa2a393e0ac0c  Stored in directory: /root/.cache/pip/wheels/c7/0d/22/696ee92245ad710f506eee79bb05c740d8abccd3ecdb778683  Building wheel for strip-hints (setup.py): started  Building wheel for strip-hints (setup.py): finished with status 'done'  Created wheel for strip-hints: filename=strip\_hints-0.1.10-py2.py3-none-any.whl size=22284 sha256=956a6e3a01797fb5ad11aeeb9c4d628763b4ce3c6eba3ac9ee5990c2179da0c6  Stored in directory: /root/.cache/pip/wheels/19/fd/dc/1192a4b454695fa9f0c95b17597a44b200d9fcf0eeb771d104  Building wheel for termcolor (setup.py): started  Building wheel for termcolor (setup.py): finished with status 'done'  Created wheel for termcolor: filename=termcolor-1.1.0-py3-none-any.whl size=4832 sha256=6d0d3636dc79153aee1e7ff1a7108b59d386e285f81825c9d5d55c5d21e64ee3  Stored in directory: /root/.cache/pip/wheels/a1/49/46/1b13a65d8da11238af9616b00fdde6d45b0f95d9291bac8452  Building wheel for scikit-learn (pyproject.toml): started  Building wheel for scikit-learn (pyproject.toml): still running...  Building wheel for scikit-learn (pyproject.toml): still running...  Building wheel for scikit-learn (pyproject.toml): still running...  Building wheel for scikit-learn (pyproject.toml): finished with status 'done'  Created wheel for scikit-learn: filename=scikit\_learn-1.0.1-cp310-cp310-linux\_x86\_64.whl size=26454604 sha256=d16a23a53b092dafd32a3d0fa436bcf0ae05dd0ea0e8c02dc2f493ddb1deaaa6  Stored in directory: /root/.cache/pip/wheels/b9/52/71/bb62d82a2b50c3c07fc7595c9cecbc696734d889da56cf0de6  Successfully built docstring-parser fire kfp kfp-server-api pyrsistent PyYAML strip-hints termcolor scikit-learn  Installing collected packages: typing-extensions, termcolor, tabulate, pytz, pyasn1, certifi, zipp, wrapt, websocket-client, urllib3, uritemplate, threadpoolctl, strip-hints, six, rsa, PyYAML, pyrsistent, pyparsing, pydantic, pyasn1-modules, oauthlib, numpy, joblib, idna, google-crc32c, docstring-parser, cloudpickle, click, charset-normalizer, cachetools, attrs, typer, scipy, requests, python-dateutil, protobuf, packaging, jsonschema, importlib-metadata, httplib2, google-resumable-media, google-auth, fire, Deprecated, absl-py, scikit-learn, requests-toolbelt, requests-oauthlib, pandas, kfp-server-api, kfp-pipeline-spec, googleapis-common-protos, google-auth-httplib2, kubernetes, google-api-core, google-cloud-core, google-api-python-client, google-cloud-storage, kfp  Successfully installed Deprecated-1.2.13 PyYAML-5.4.1 absl-py-0.11.0 attrs-21.2.0 cachetools-4.2.4 certifi-2021.10.8 charset-normalizer-2.0.7 click-8.0.3 cloudpickle-2.0.0 docstring-parser-0.12 fire-0.4.0 google-api-core-1.31.3 google-api-python-client-1.12.8 google-auth-1.35.0 google-auth-httplib2-0.1.0 google-cloud-core-2.1.0 google-cloud-storage-1.42.3 google-crc32c-1.3.0 google-resumable-media-2.1.0 googleapis-common-protos-1.53.0 httplib2-0.20.2 idna-3.3 importlib-metadata-4.8.1 joblib-1.1.0 jsonschema-3.2.0 kfp-1.8.9 kfp-pipeline-spec-0.1.13 kfp-server-api-1.7.1 kubernetes-18.20.0 numpy-1.21.4 oauthlib-3.1.1 packaging-21.2 pandas-1.3.4 protobuf-3.17.3 pyasn1-0.4.8 pyasn1-modules-0.2.8 pydantic-1.8.2 pyparsing-2.4.7 pyrsistent-0.18.0 python-dateutil-2.8.2 pytz-2021.3 requests-2.26.0 requests-oauthlib-1.3.0 requests-toolbelt-0.9.1 rsa-4.7.2 scikit-learn-1.0.1 scipy-1.7.2 six-1.16.0 strip-hints-0.1.10 tabulate-0.8.9 termcolor-1.1.0 threadpoolctl-3.0.0 typer-0.4.0 typing-extensions-3.10.0.2 uritemplate-3.0.1 urllib3-1.26.7 websocket-client-1.2.1 wrapt-1.13.3 zipp-3.6.0  WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv  Removing intermediate container 52907c187e31  ---> a29e47c1d623  Step 10/10 : ENTRYPOINT ["python", "training\_model.py"]  ---> Running in 460c99113cf9  Removing intermediate container 460c99113cf9  ---> 92467a64c301  Successfully built 92467a64c301  Successfully tagged kf\_iris\_train:latest |

**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/2\_model\_training$** **sudo docker images**

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| REPOSITORY TAG IMAGE ID CREATED SIZE  kf\_iris\_train latest 92467a64c301 About a minute ago 1.52GB  kf\_iris\_preprocessing latest 1962173c4ec9 14 minutes ago 1.24GB  joleedocker/kf\_iris\_preprocessing 0.5 1962173c4ec9 14 minutes ago 1.24GB  python 3 bda19bf988a7 5 days ago 919MB |

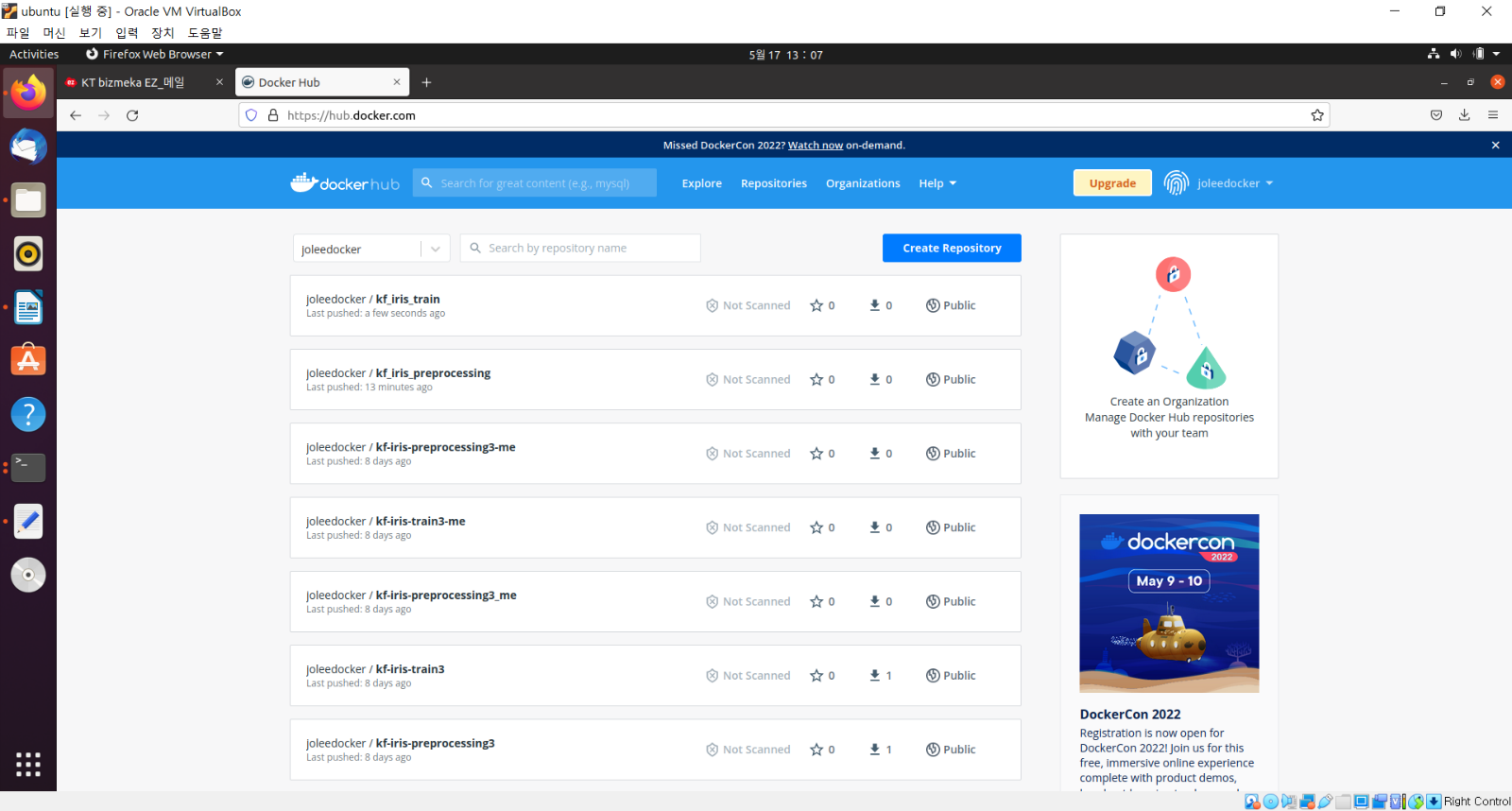
**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/2\_model\_training$** **sudo docker tag kf\_iris\_train:latest joleedocker/kf\_iris\_train:0.5**

**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/2\_model\_training$** **sudo docker images**

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| --- |
| REPOSITORY TAG IMAGE ID CREATED SIZE  joleedocker/kf\_iris\_train 0.5 92467a64c301 2 minutes ago 1.52GB  kf\_iris\_train latest 92467a64c301 2 minutes ago 1.52GB  joleedocker/kf\_iris\_preprocessing 0.5 1962173c4ec9 14 minutes ago 1.24GB  kf\_iris\_preprocessing latest 1962173c4ec9 14 minutes ago 1.24GB  python 3 bda19bf988a7 5 days ago 919MB |

**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/2\_model\_training$** **sudo docker push joleedocker/kf\_iris\_train:0.5**

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| --- |
| The push refers to repository [docker.io/joleedocker/kf\_iris\_train]  05754e285f43: Pushed  223af3d83d4e: Pushed  ef86f338bfec: Pushed  ffe1bd67acf0: Pushed  c276efacdb40: Pushed  2433fc18a726: Mounted from joleedocker/kf\_iris\_preprocessing  d63526a5d12e: Mounted from joleedocker/kf\_iris\_preprocessing  d35a703f2b0a: Mounted from joleedocker/kf\_iris\_preprocessing  db7f8cc44a42: Mounted from joleedocker/kf\_iris\_preprocessing  b889a93a79dd: Mounted from joleedocker/kf\_iris\_preprocessing  9d4550089a93: Mounted from joleedocker/kf\_iris\_preprocessing  a7934564e6b9: Mounted from joleedocker/kf\_iris\_preprocessing  1b7cceb6a07c: Mounted from joleedocker/kf\_iris\_preprocessing  b274e8788e0c: Mounted from joleedocker/kf\_iris\_preprocessing  78658088978a: Mounted from joleedocker/kf\_iris\_preprocessing  0.5: digest: sha256:c58bab4389a4a145adb84187d7d068f0f5f1cf1691339513cabe26753c75ab7b size: 3478 |



**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris/2\_model\_training$** **cd ..**

**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris$** **ls**

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| 1\_data\_load 2\_model\_training pipeline.py \_\_pycache\_\_ |

* **pipeline.py**

|  |
| --- |
| import kfp  import kfp.components as comp  from kfp import dsl  @dsl.pipeline(  name='kf-iris',  description='kubeflow iris test'  )  def kf\_pipeline():  add\_p = dsl.ContainerOp(  name="load iris data pipeline",  #image="lsjsj92/soojin-iris-preprocessing:0.6",  image="joleedocker/kf-iris-preprocessing3:0.5",  arguments=[  '--data\_path', './Iris.csv'  ],  file\_outputs={'iris' : '/iris.csv'}  )  ml = dsl.ContainerOp(  name="training pipeline",  image="joleedocker/kf-iris-train3:0.5",  arguments=[  '--data', add\_p.outputs['iris']  ]  )  ml.after(add\_p)    if \_\_name\_\_ == "\_\_main\_\_":  import kfp.compiler as compiler  compiler.Compiler().compile(kf\_pipeline, \_\_file\_\_ + ".tar.gz") |

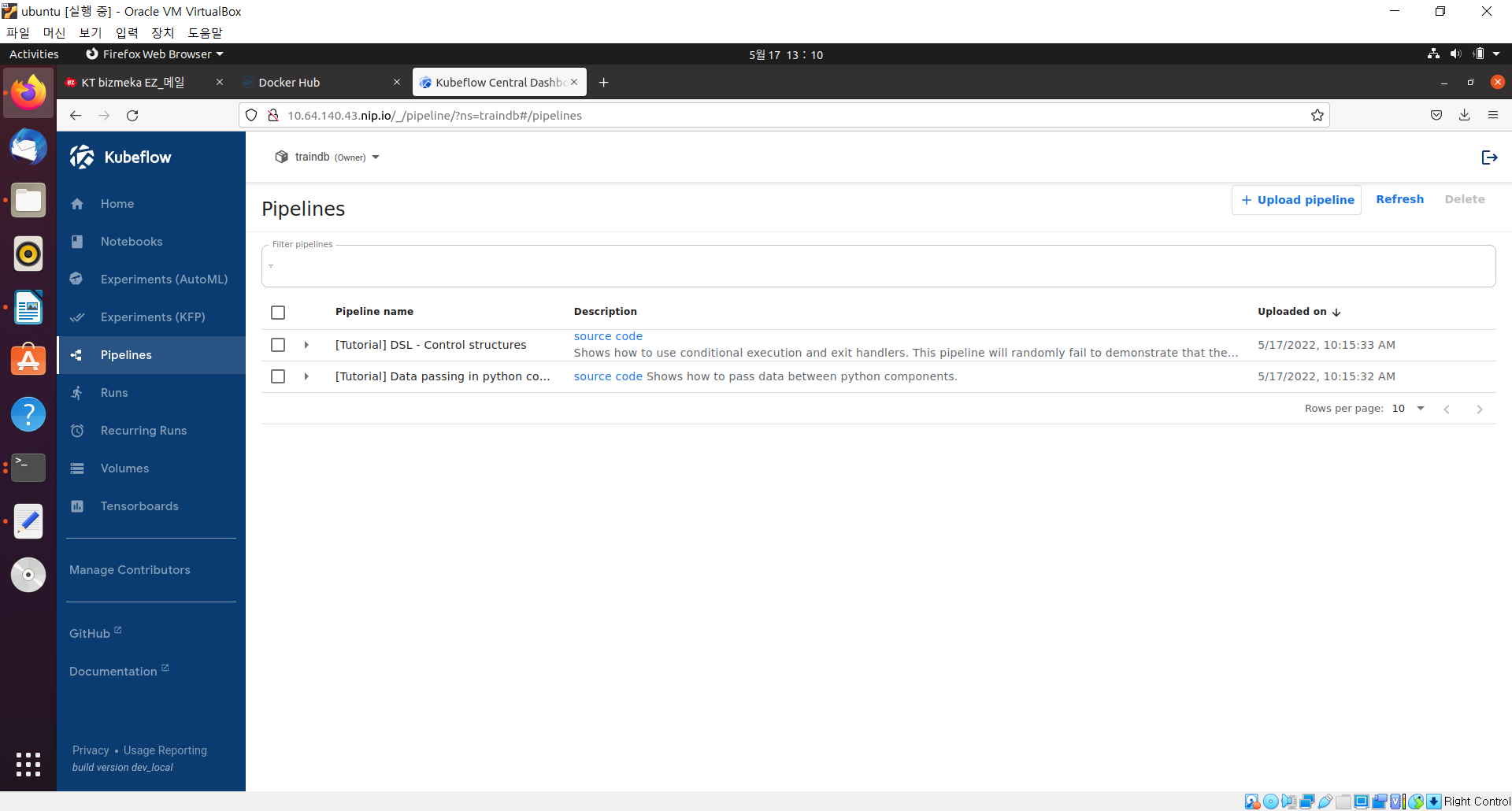
**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris$** **dsl-compile --py pipeline.py --output kf\_iris\_pipeline\_0\_5.tar.gz**

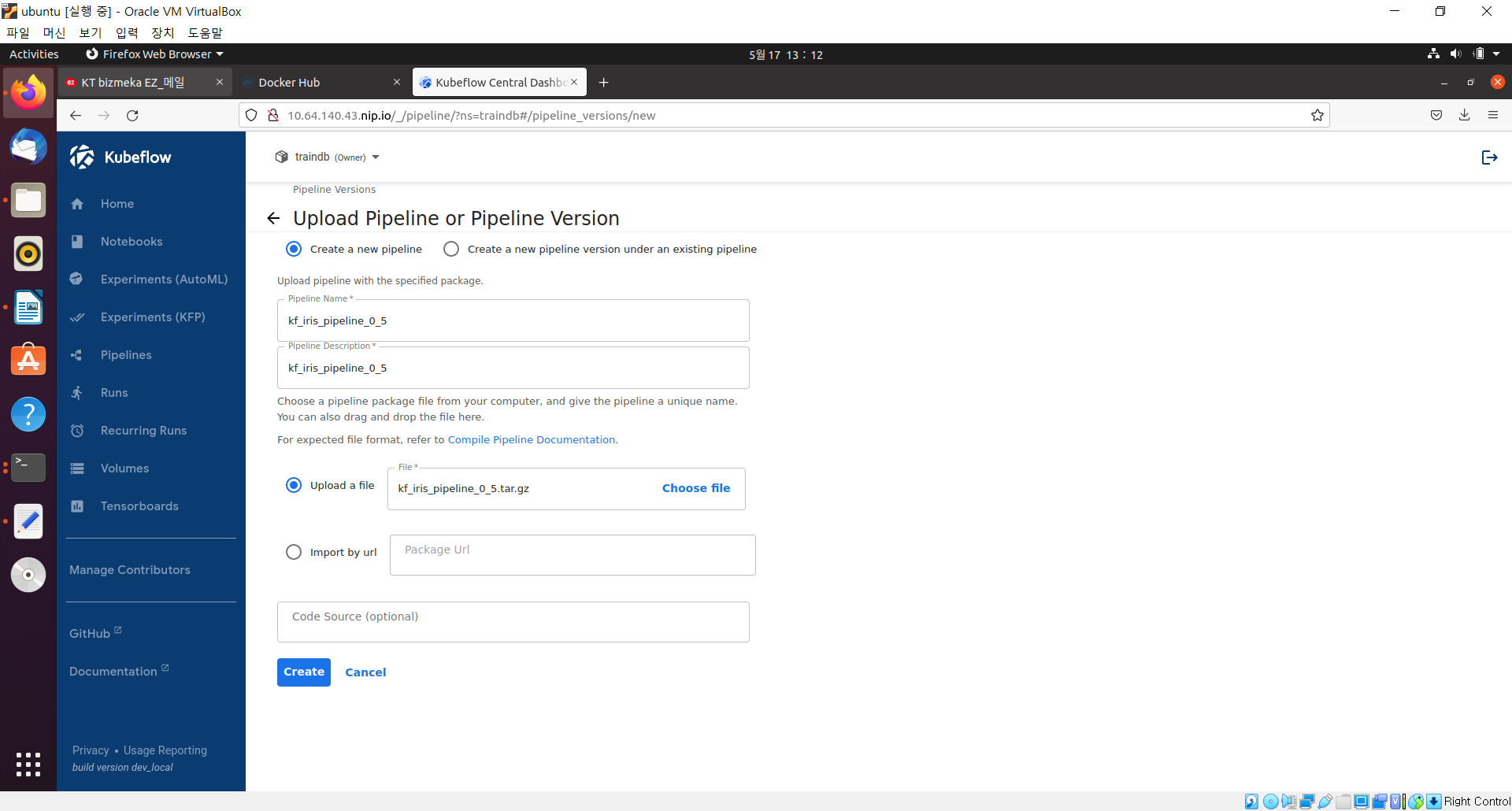
|  |
| --- |
| /home/traindb/miniconda3/envs/mlpipeline/lib/python3.6/site-packages/kfp/dsl/\_container\_op.py:1264: FutureWarning: Please create reusable components instead of constructing ContainerOp instances directly. Reusable components are shareable, portable and have compatibility and support guarantees. Please see the documentation: https://www.kubeflow.org/docs/pipelines/sdk/component-development/#writing-your-component-definition-file The components can be created manually (or, in case of python, using kfp.components.create\_component\_from\_func or func\_to\_container\_op) and then loaded using kfp.components.load\_component\_from\_file, load\_component\_from\_uri or load\_component\_from\_text: https://kubeflow-pipelines.readthedocs.io/en/stable/source/kfp.components.html#kfp.components.load\_component\_from\_file  category=FutureWarning, |

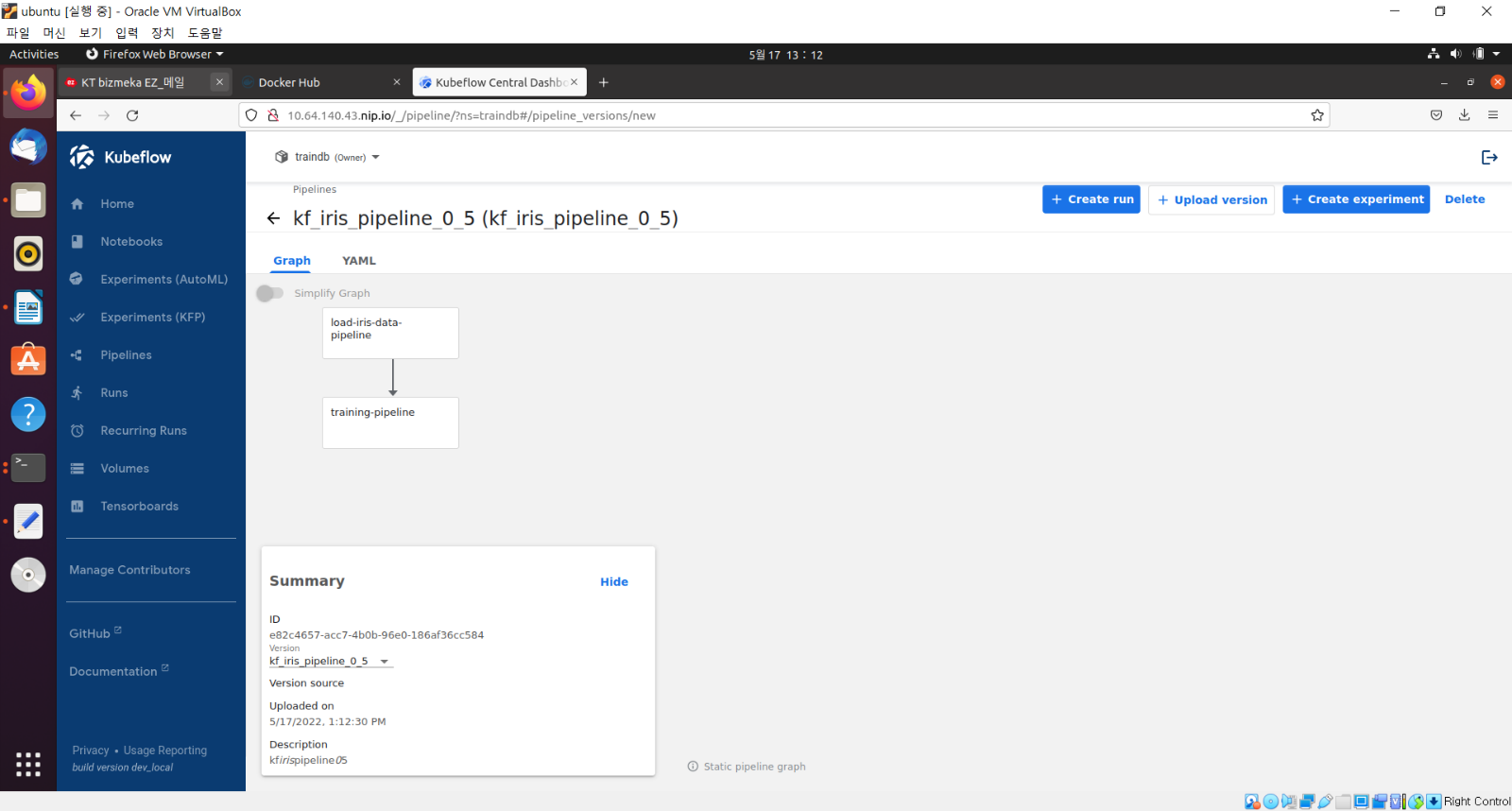
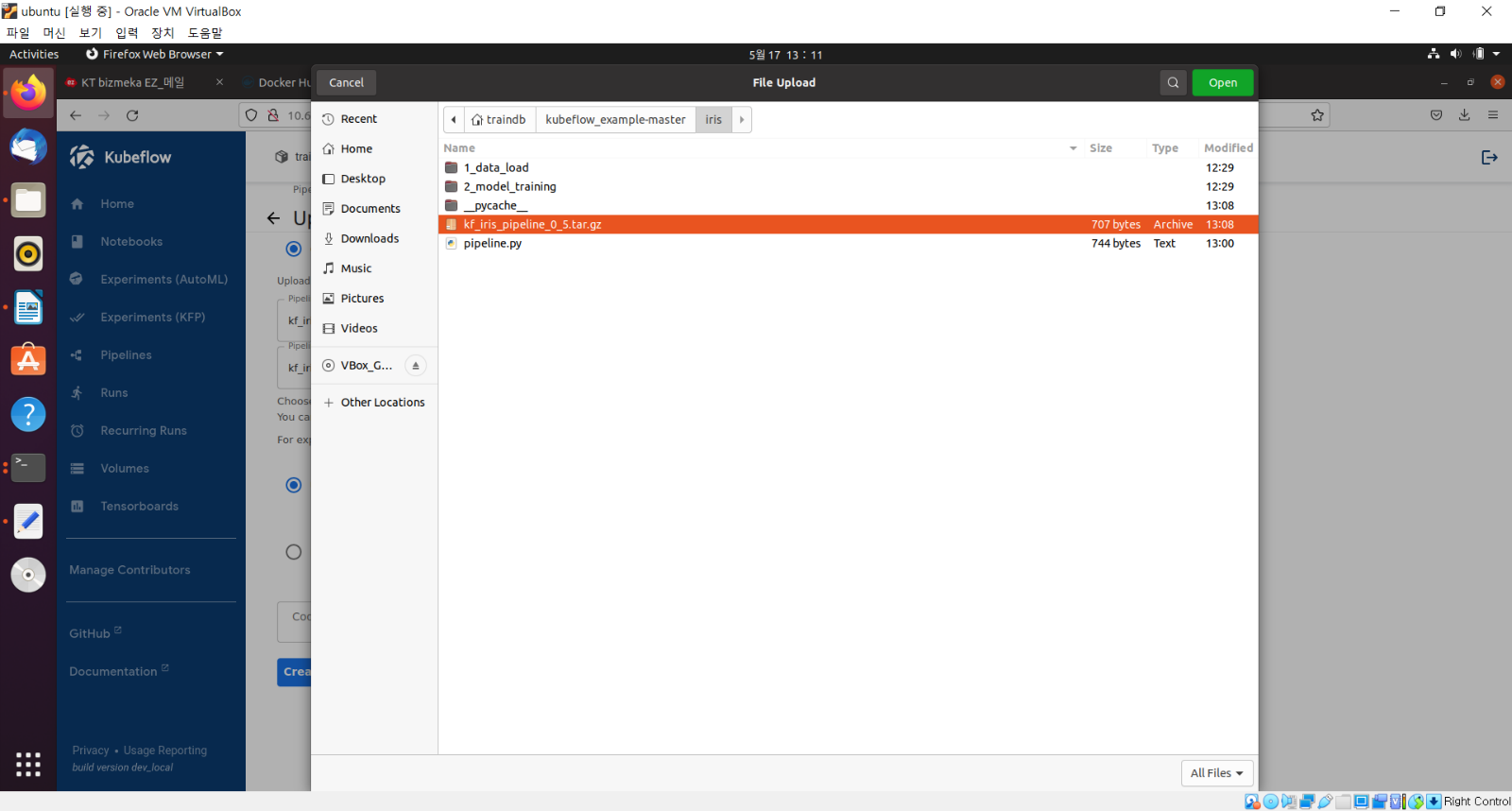
**(mlpipeline) traindb@traindb-VirtualBox:~/kubeflow\_example-master/iris$** **ls**

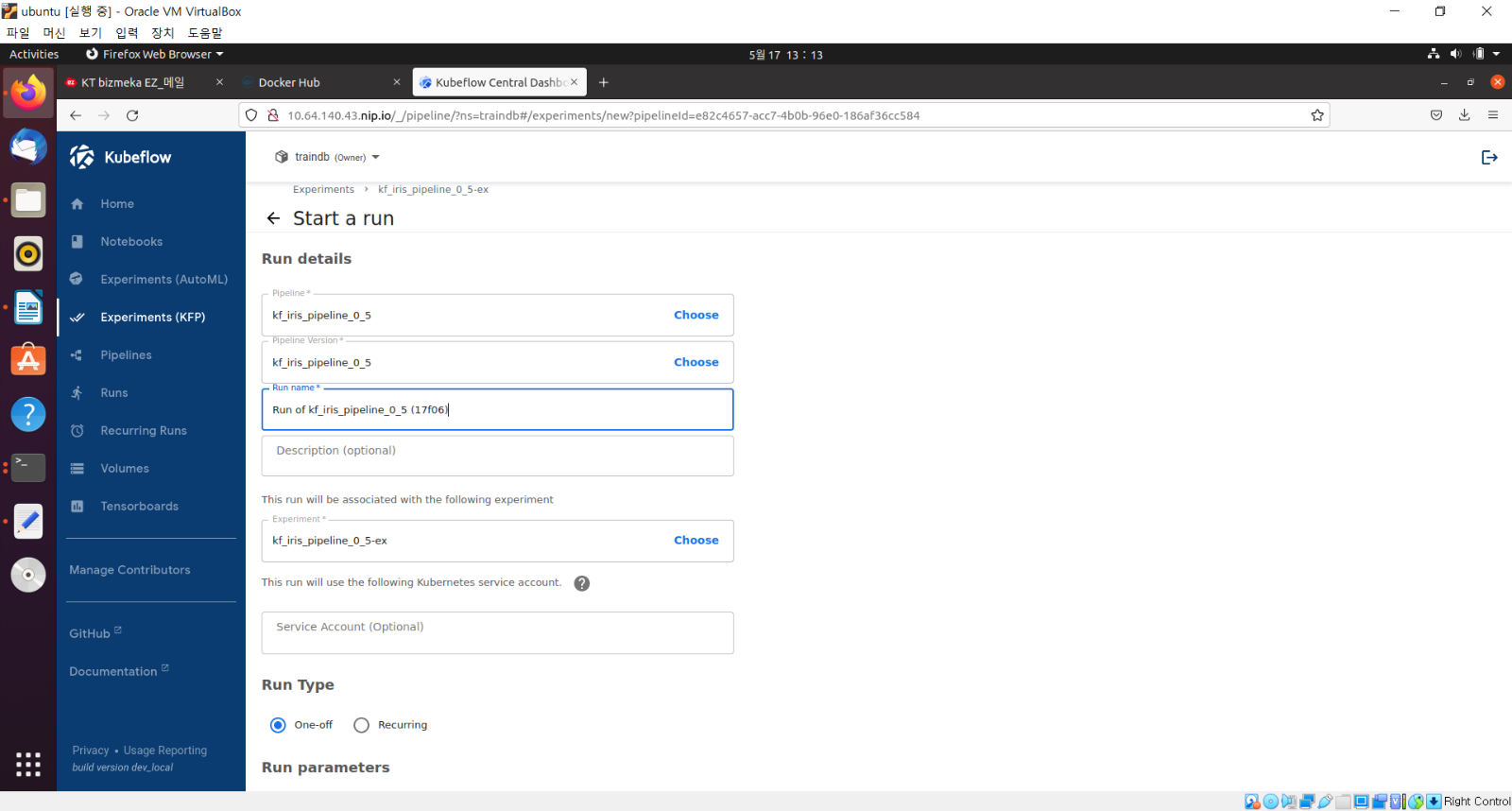
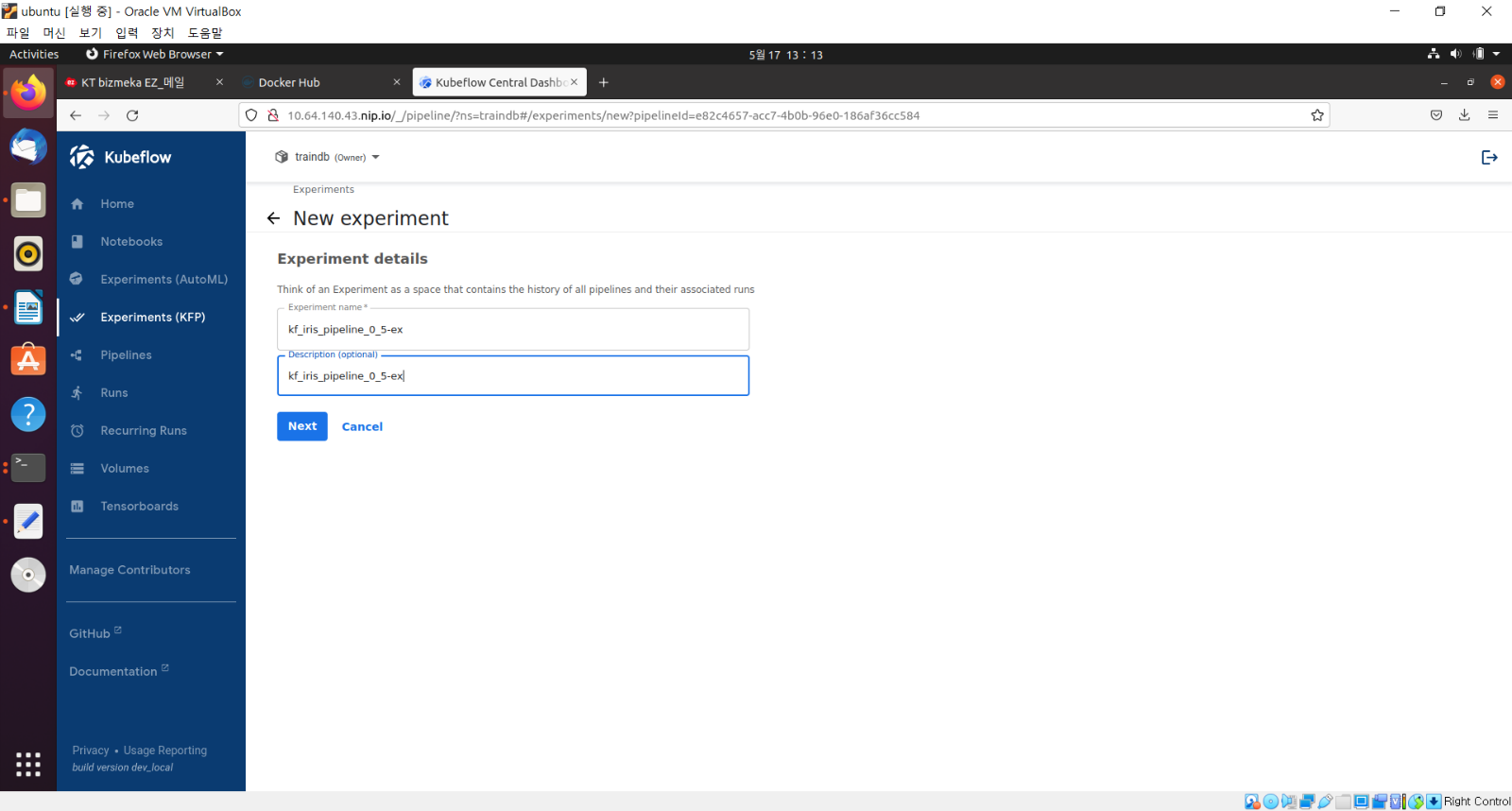
|  |
| --- |
| 1\_data\_load 2\_model\_training kf\_iris\_pipeline\_0\_5.tar.gz pipeline.py \_\_pycache\_\_ |

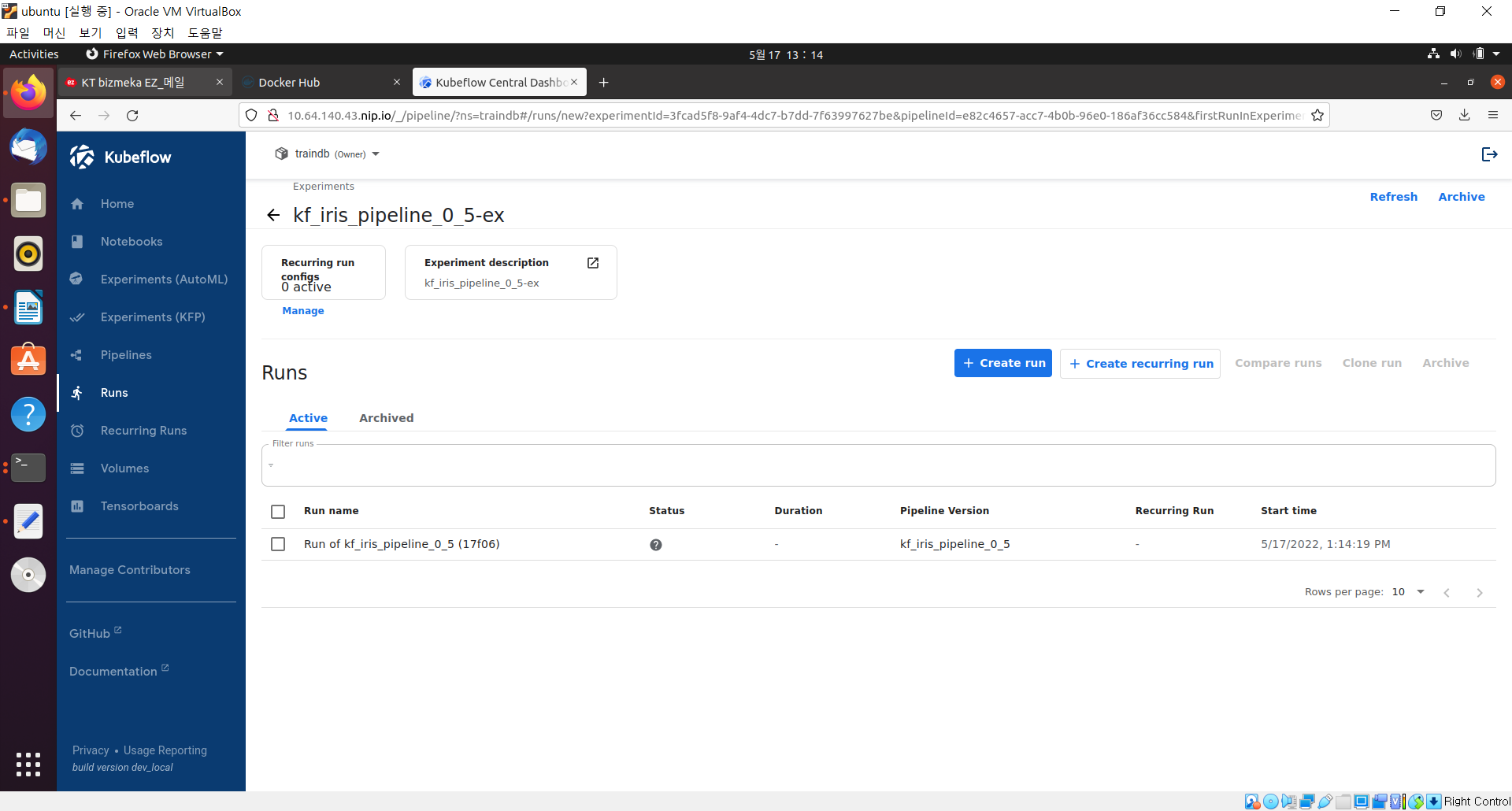
# **11. Deploying pipeline**

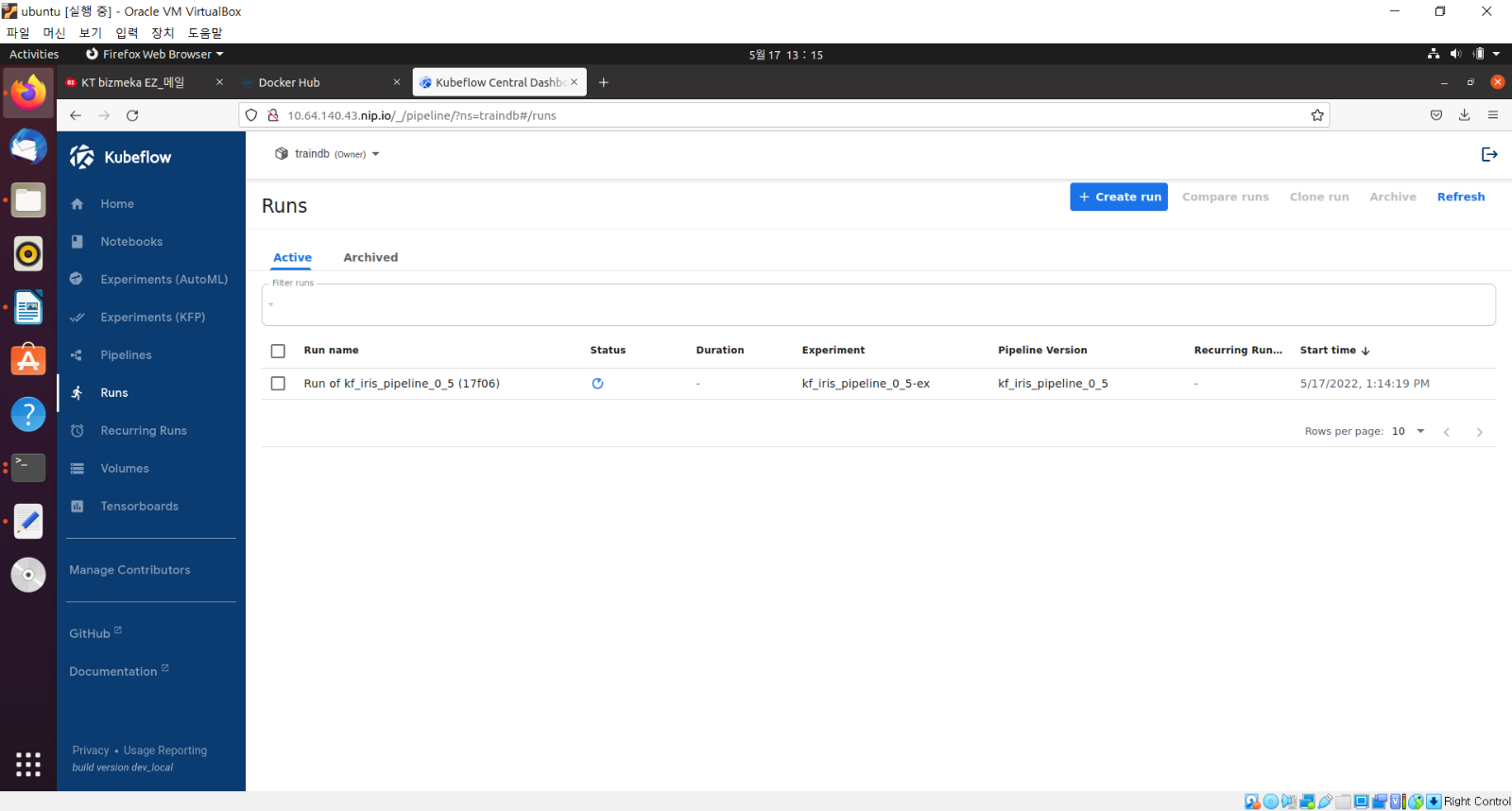
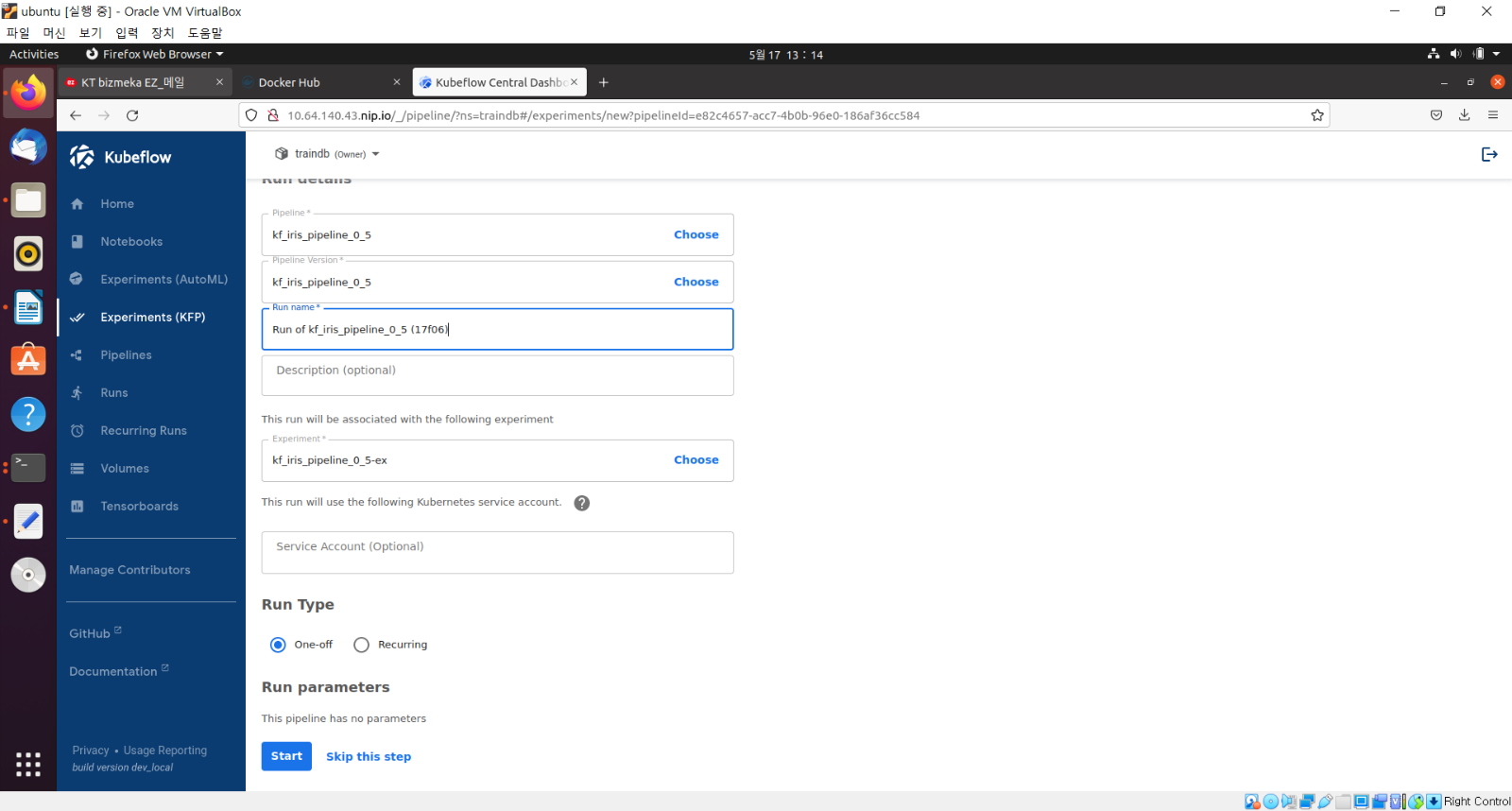


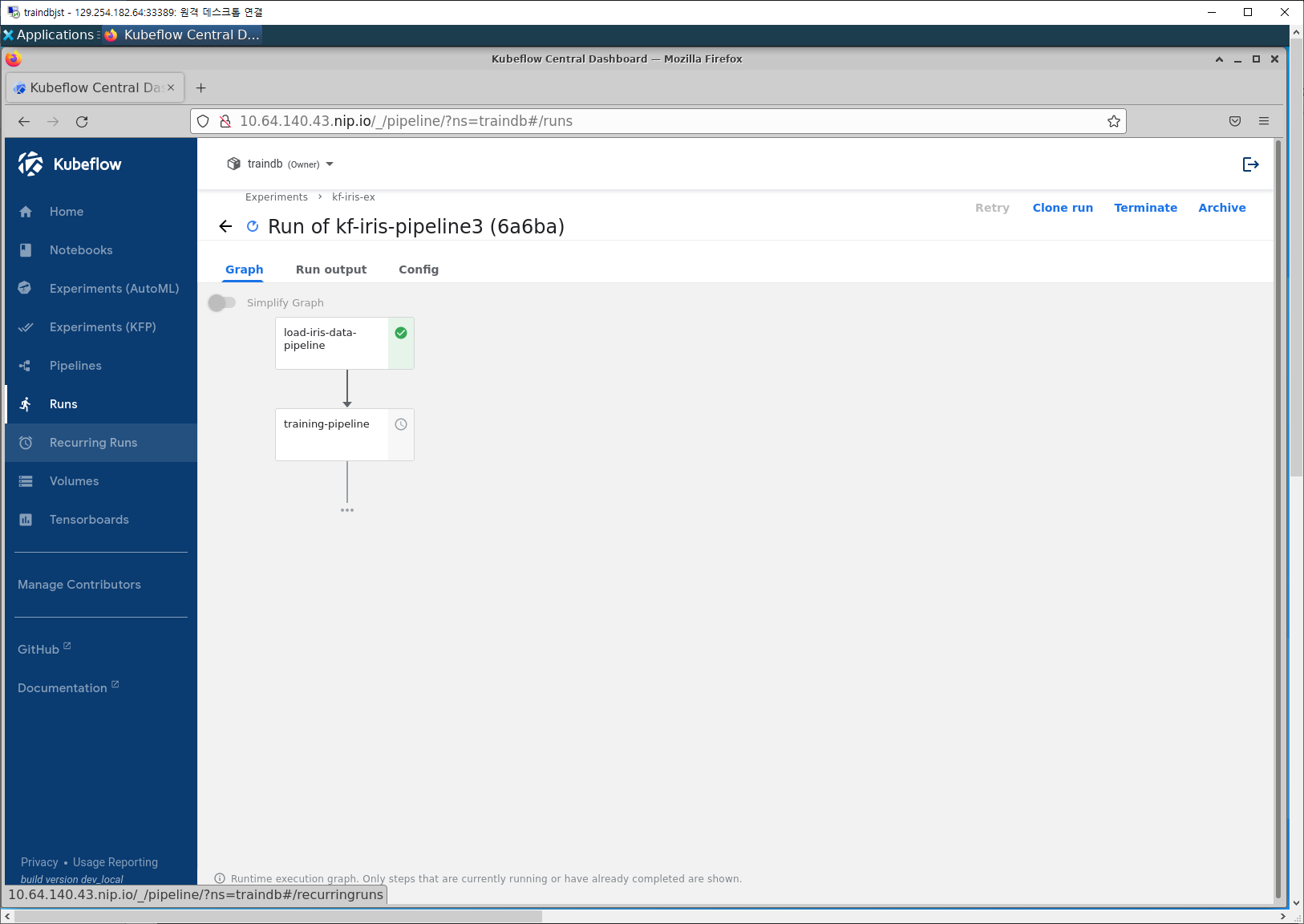


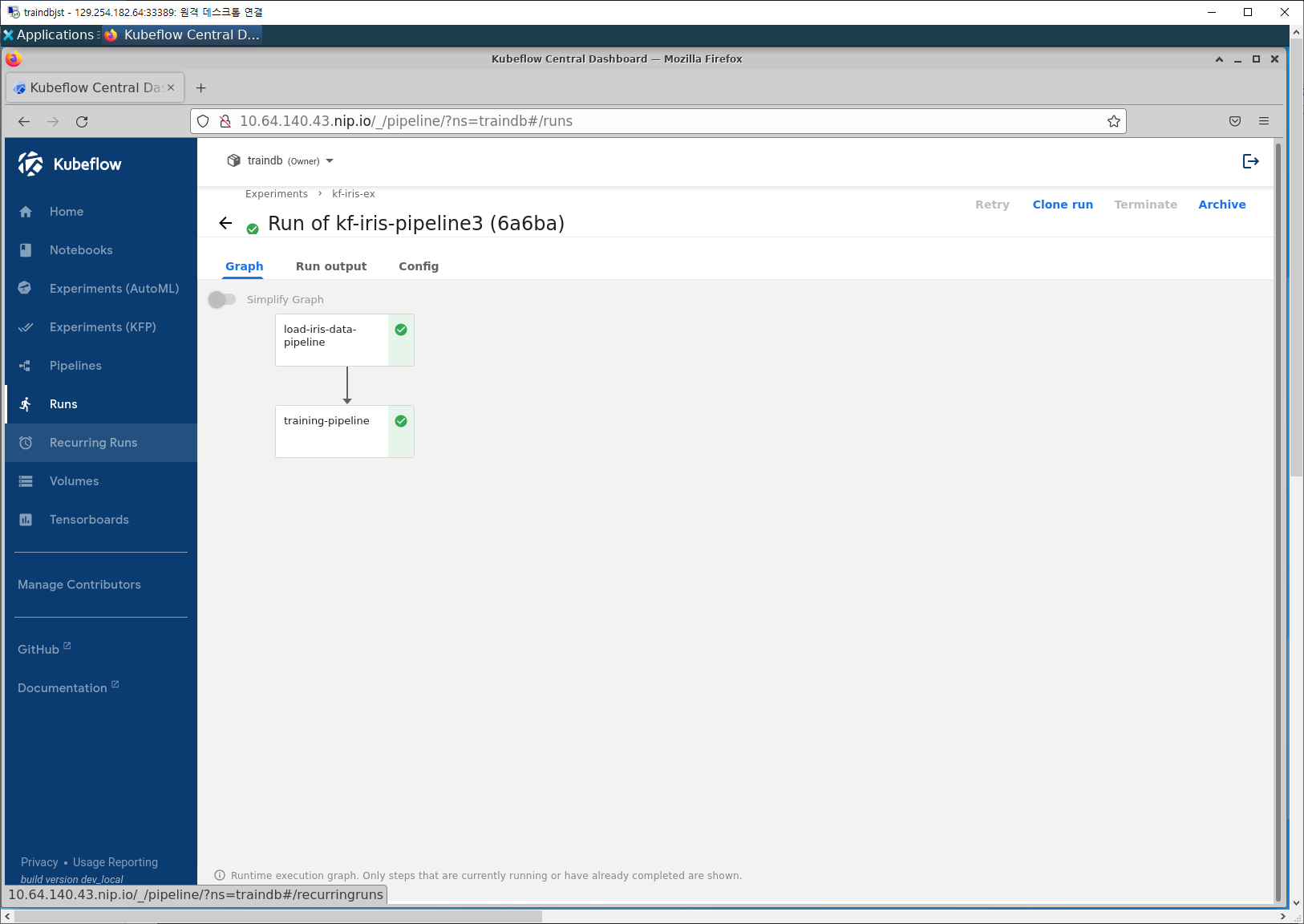


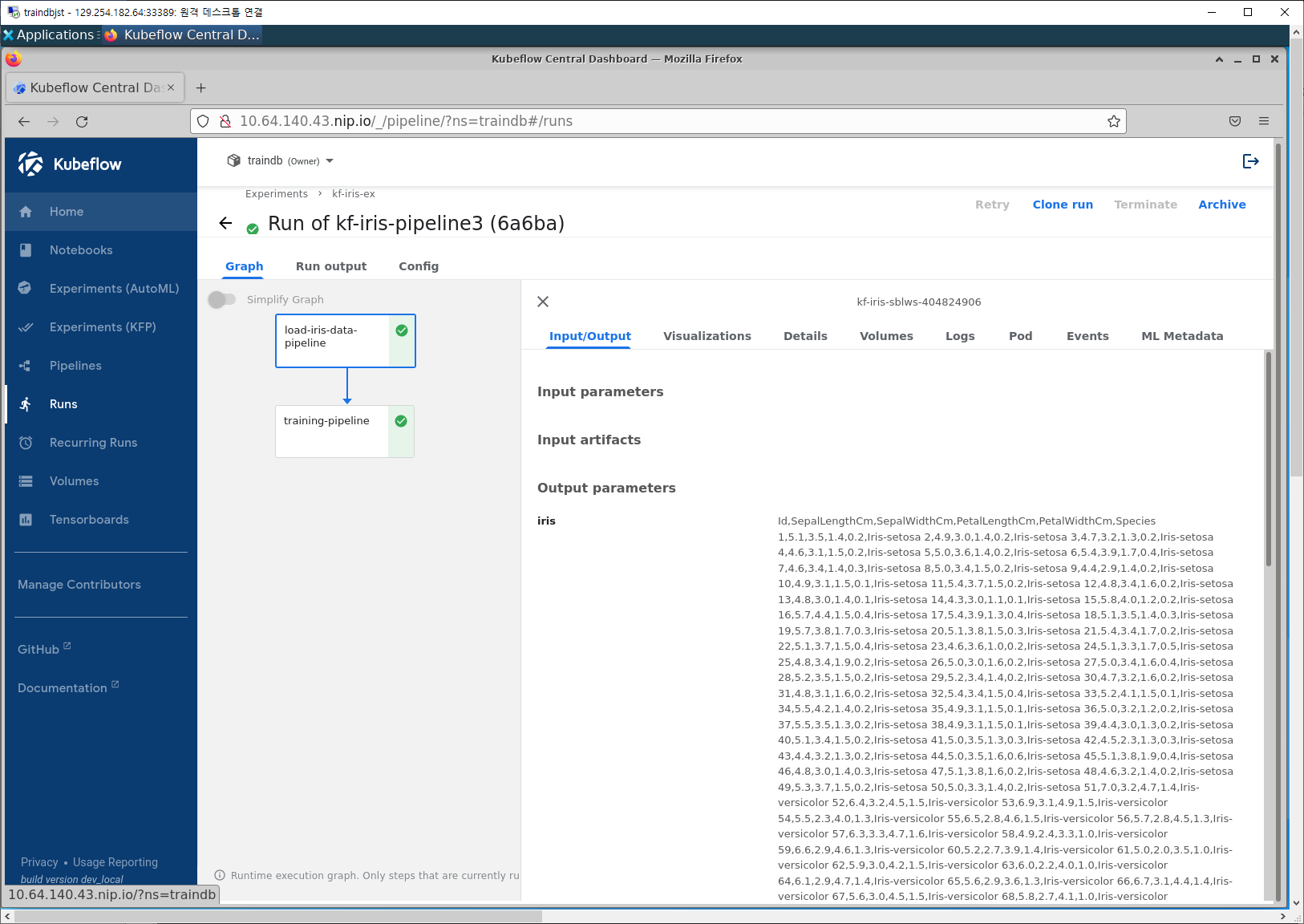




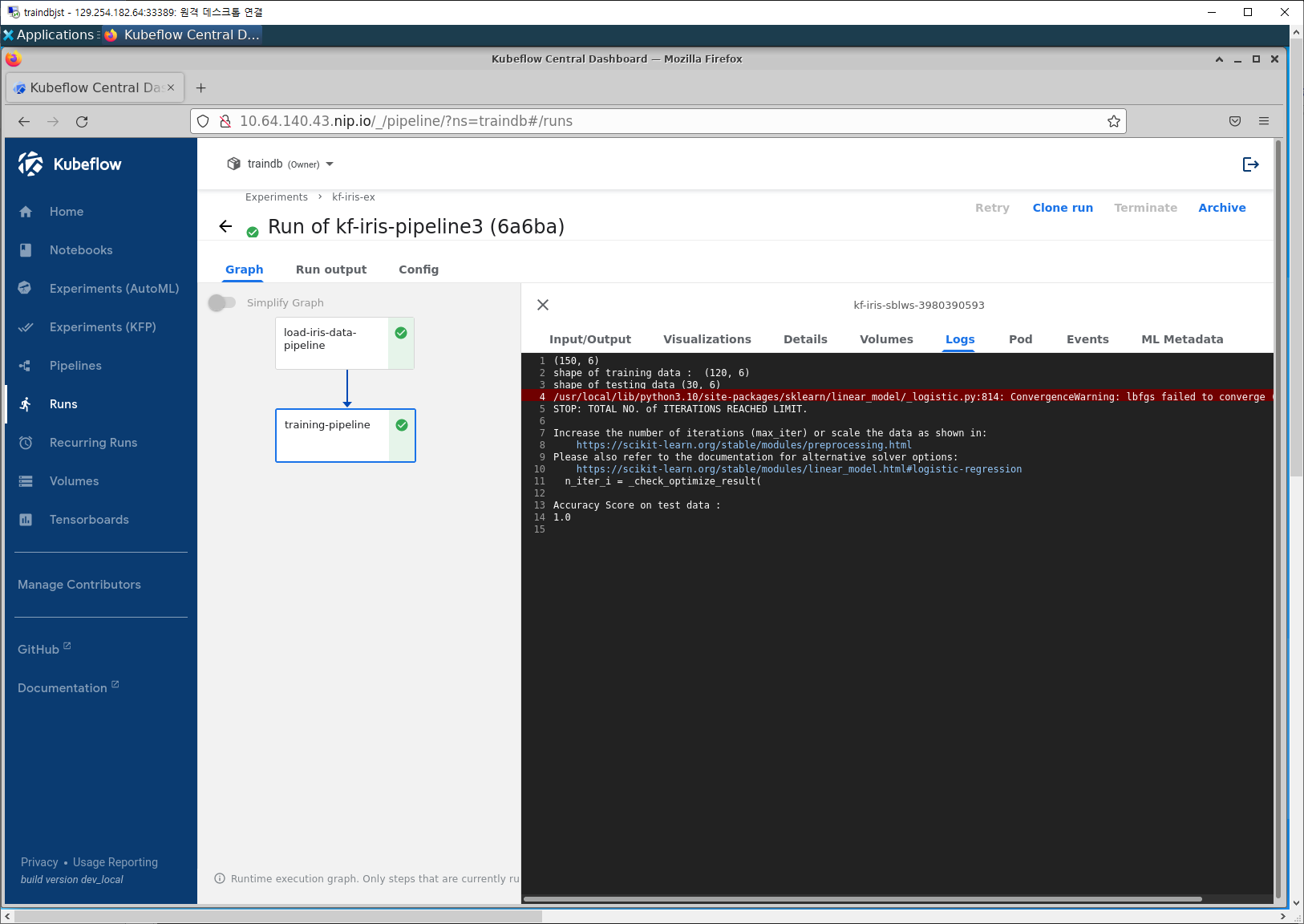












**12. Model Serving**

**13. Experiment(AutoML) - Katib**

**14. Jupyter Notebook Server**

**15. ---**