Kubernetes w praktyce – podręcznik labowy.

Spis treści

Lab 1: Instalacja klastra Kubernetes

Task 1: Instalacja klastra Kubernetes – Control Plane

Przed instalacją klastra dobrze jest dokonać update maszyny.

```
[root@base ~]# virsh list -all

 Identyfikator   Nazwa    Stan
----------------------------------------------------
 -               master   wyłączone
 -               node1    wyłączone
 -               node2    wyłączone

[root@base ~]# virsh start master

Domain 'master' started

[root@base ~]# virsh start node1

Domain 'node1' started

[root@base ~]# virsh start node2

Domain 'node2' started

[root@base ~]# ssh student@master

student@master's password:
Welcome to Ubuntu 20.04.4 LTS (GNU/Linux 5.4.0-121-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Tue 05 Jul 2022 04:18:42 PM UTC

  System load:  0.42              Processes:               152
  Usage of /:   27.1% of 8.90GB   Users logged in:         0
  Memory usage: 5%                IPv4 address for enp1s0: 10.10.1.10
  Swap usage:   0%

 * Super-optimized for small spaces - read how we shrank the memory
   footprint of MicroK8s to make it the smallest full K8s around.

   https://ubuntu.com/blog/microk8s-memory-optimisation

46 updates can be applied immediately.
To see these additional updates run: apt list --upgradable
```

```
Last login: Tue Jul 5 14:55:20 2022 from 10.10.1.1
student@master:~$
```

student@master:~$ sudo apt update && sudo apt upgrade

```
Hit:1 http://pl.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://pl.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://pl.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 http://pl.archive.ubuntu.com/ubuntu focal-security InRelease
Reading package lists... Done
Building dependency tree
Reading state information... Done
41 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
```

Klaster Kubernetes nie będzie poprawnie działał z włączonym mechanizmem SWAP, dlatego należy się upewnić, że jest wyłączony. Brak wyniku komendy sudo swapon -s informuje, że SWAP na serwerze nie jest uruchomiony. W razie gdyby pojawił się jakiś wynik np. partycja /dev/vda3 należy SWAP wyłączyć komendą swapoff, a ponadto usunąć lub zakomentować wpis w pliku /etc/fstab dotyczący partycji wykorzystywanej jako SWAP. Komenda, np. swapoff /dev/vda3 usunie partycję SWAP tylko do kolejnego uruchomienia serwera.

student@master:~$ sudo swapon -s

```
student@master:~$
```

student@master:~$ sudo vim /etc/fstab

```
student@master:~$
```

Dopisz nazwy hostów wchodzących w skład klastra do /etc/hosts, aby były rozpoznawalne w sieci.

student@master:~$ sudo vim /etc/hosts

student@master:~$ sudo cat /etc/hosts

```
127.0.0.1 localhost
127.0.1.1 master

# The following lines are desirable for IPv6 capable hosts
::1     ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
```

10.10.1.10 master
10.10.1.20 node1
10.10.1.30 node2

student@master:~$ ping -c 1 node1

```
PING node1 (10.10.1.20) 56(84) bytes of data.
64 bytes from node1 (10.10.1.20): icmp_seq=1 ttl=64 time=2.30 ms

--- node1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 2.296/2.296/2.296/0.000 ms
```

Kubernetes jako warstwa abstrakcyjna nad technologią konteneryzacji potrzebuje zainstalowanego Runtime Container, np. Docker, CRI-O itp.

student@master:~$ sudo apt install -y docker.io

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base libidn11 pigz runc ubuntu-fan
Suggested packages:
  ifupdown aufs-tools cgroupfs-mount | cgroup-lite debootstrap docker-doc rinse zfs-
fuse | zfsutils
The following NEW packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base docker.io libidn11 pigz runc
ubuntu-fan
0 upgraded, 9 newly installed, 0 to remove and 0 not upgraded.
Need to get 69.2 MB of archives.
After this operation, 334 MB of additional disk space will be used.
Get:1 http://pl.archive.ubuntu.com/ubuntu focal/universe amd64 pigz amd64 2.4-1 [57.4
kB]
Get:2 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 bridge-utils amd64 1.6-
2ubuntu1 [30.5 kB]
Get:3 http://pl.archive.ubuntu.com/ubuntu focal-updates/main amd64 runc amd64 1.1.0-
0ubuntu1~20.04.1 [3,892 kB]
Get:4 http://pl.archive.ubuntu.com/ubuntu focal-updates/main amd64 containerd amd64
1.5.9-0ubuntu1~20.04.4 [33.0 MB]
Get:5 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 dns-root-data all 2019052802
[5,300 B]
Get:6 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 libidn11 amd64 1.33-
2.2ubuntu2 [46.2 kB]
Get:7 http://pl.archive.ubuntu.com/ubuntu focal-updates/main amd64 dnsmasq-base amd64
2.80-1.1ubuntu1.5 [315 kB]
Get:8 http://pl.archive.ubuntu.com/ubuntu focal-updates/universe amd64 docker.io amd64
20.10.12-0ubuntu2~20.04.1 [31.8 MB]
Get:9 http://pl.archive.ubuntu.com/ubuntu focal-updates/main amd64 ubuntu-fan all
0.12.13ubuntu0.1 [34.4 kB]
Fetched 69.2 MB in 6s (10.9 MB/s)
Preconfiguring packages ...
```

```
Selecting previously unselected package pigz.
(Reading database ... 72037 files and directories currently installed.)
Preparing to unpack .../0-pigz_2.4-1_amd64.deb ...
Unpacking pigz (2.4-1) ...
Selecting previously unselected package bridge-utils.
Preparing to unpack .../1-bridge-utils_1.6-2ubuntu1_amd64.deb ...
Unpacking bridge-utils (1.6-2ubuntu1) ...
Selecting previously unselected package runc.
Preparing to unpack .../2-runc_1.1.0-0ubuntu1~20.04.1_amd64.deb ...
Unpacking runc (1.1.0-0ubuntu1~20.04.1) ...
Selecting previously unselected package containerd.
Preparing to unpack .../3-containerd_1.5.9-0ubuntu1~20.04.4_amd64.deb ...
Unpacking containerd (1.5.9-0ubuntu1~20.04.4) ...
Selecting previously unselected package dns-root-data.
Preparing to unpack .../4-dns-root-data_2019052802_all.deb ...
Unpacking dns-root-data (2019052802) ...
Selecting previously unselected package libidn11:amd64.
Preparing to unpack .../5-libidn11_1.33-2.2ubuntu2_amd64.deb ...
Unpacking libidn11:amd64 (1.33-2.2ubuntu2) ...
Selecting previously unselected package dnsmasq-base.
Preparing to unpack .../6-dnsmasq-base_2.80-1.1ubuntu1.5_amd64.deb ...
Unpacking dnsmasq-base (2.80-1.1ubuntu1.5) ...
Selecting previously unselected package docker.io.
Preparing to unpack .../7-docker.io_20.10.12-0ubuntu2~20.04.1_amd64.deb ...
Unpacking docker.io (20.10.12-0ubuntu2~20.04.1) ...
Selecting previously unselected package ubuntu-fan.
Preparing to unpack .../8-ubuntu-fan_0.12.13ubuntu0.1_all.deb ...
Unpacking ubuntu-fan (0.12.13ubuntu0.1) ...
Setting up runc (1.1.0-0ubuntu1~20.04.1) ...
Setting up dns-root-data (2019052802) ...
Setting up libidn11:amd64 (1.33-2.2ubuntu2) ...
Setting up bridge-utils (1.6-2ubuntu1) ...
Setting up pigz (2.4-1) ...
Setting up containerd (1.5.9-0ubuntu1~20.04.4) ...
Created symlink /etc/systemd/system/multi-user.target.wants/containerd.service →
/lib/systemd/system/containerd.service.
Setting up docker.io (20.10.12-0ubuntu2~20.04.1) ...
Adding group `docker' (GID 117) ...
Done.
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service →
/lib/systemd/system/docker.service.
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket →
/lib/systemd/system/docker.socket.
Setting up dnsmasq-base (2.80-1.1ubuntu1.5) ...
Setting up ubuntu-fan (0.12.13ubuntu0.1) ...
Created symlink /etc/systemd/system/multi-user.target.wants/ubuntu-fan.service →
/lib/systemd/system/ubuntu-fan.service.
Processing triggers for systemd (245.4-4ubuntu3.17) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for dbus (1.12.16-2ubuntu2.2) ...
Processing triggers for libc-bin (2.31-0ubuntu9.9) ...
…
student@master:~$ sudo apt -y install curl apt-transport-https

Reading package lists... Done
Building dependency tree
Reading state information... Done
```

```
curl is already the newest version (7.68.0-1ubuntu2.12).
curl set to manually installed.
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
The following NEW packages will be installed:
  apt-transport-https
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 1,704 B of archives.
After this operation, 162 kB of additional disk space will be used.
Get:1 http://pl.archive.ubuntu.com/ubuntu focal-updates/universe amd64 apt-transport-
https all 2.0.9 [1,704 B]
Fetched 1,704 B in 0s (54.1 kB/s)
Selecting previously unselected package apt-transport-https.
(Reading database ... 72393 files and directories currently installed.)
Preparing to unpack .../apt-transport-https_2.0.9_all.deb ...
Unpacking apt-transport-https (2.0.9) ...
Setting up apt-transport-https (2.0.9) …
```

Dodawanie klucza oraz repozytorium z pakietami Kubernetesa.

student@master:~$ curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key add -

```
OK
```

student@master:~$ echo "deb https://apt.kubernetes.io/ kubernetes-xenial main" | sudo tee /etc/apt/sources.list.d/kubernetes.list

```
deb https://apt.kubernetes.io/ kubernetes-xenial main
```

student@master:~$ sudo apt update

```
Hit:1 http://pl.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://pl.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:3 http://pl.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:4 http://pl.archive.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:6 http://pl.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [1,946 kB]
Get:7 http://pl.archive.ubuntu.com/ubuntu focal-security/main amd64 c-n-f Metadata
[10.6 kB]
Get:5 https://packages.cloud.google.com/apt kubernetes-xenial InRelease [9,383 B]
Get:8 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 Packages [57.2
kB]
Fetched 2,359 kB in 1s (2,833 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
All packages are up to date.
```

Instalacja kubeadm i zależności (w tym kubectl oraz kubelet).

```
student@master:~$ sudo apt install kubeadm

Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  conntrack cri-tools ebtables kubectl kubelet kubernetes-cni socat
Suggested packages:
  nftables
The following NEW packages will be installed:
  conntrack cri-tools ebtables kubeadm kubectl kubelet kubernetes-cni socat
0 upgraded, 8 newly installed, 0 to remove and 0 not upgraded.
Need to get 75.3 MB of archives.
After this operation, 314 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 conntrack amd64 1:1.4.5-2
[30.3 kB]
Get:2 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 ebtables amd64 2.0.11-
3build1 [80.3 kB]



Get:3 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 socat amd64 1.7.3.3-2 [323
kB]
Get:4 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 cri-tools
amd64 1.24.2-00 [12.3 MB]
Get:5 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 kubernetes-cni
amd64 0.8.7-00 [25.0 MB]
Get:6 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 kubelet amd64
1.24.2-00 [19.3 MB]
Get:7 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 kubectl amd64
1.24.2-00 [9,316 kB]
Get:8 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 kubeadm amd64
1.24.2-00 [8,997 kB]
Fetched 75.3 MB in 7s (10.5 MB/s)
Selecting previously unselected package conntrack.
(Reading database ... 72397 files and directories currently installed.)
Preparing to unpack .../0-conntrack_1%3a1.4.5-2_amd64.deb ...
Unpacking conntrack (1:1.4.5-2) ...
Selecting previously unselected package cri-tools.
Preparing to unpack .../1-cri-tools_1.24.2-00_amd64.deb ...
Unpacking cri-tools (1.24.2-00) ...
Selecting previously unselected package ebtables.
Preparing to unpack .../2-ebtables_2.0.11-3build1_amd64.deb ...
Unpacking ebtables (2.0.11-3build1) ...
Selecting previously unselected package kubernetes-cni.
Preparing to unpack .../3-kubernetes-cni_0.8.7-00_amd64.deb ...
Unpacking kubernetes-cni (0.8.7-00) ...
Selecting previously unselected package socat.
Preparing to unpack .../4-socat_1.7.3.3-2_amd64.deb ...
Unpacking socat (1.7.3.3-2) ...
Selecting previously unselected package kubelet.
Preparing to unpack .../5-kubelet_1.24.2-00_amd64.deb ...
```

```
Unpacking kubelet (1.24.2-00) ...
Selecting previously unselected package kubectl.
Preparing to unpack .../6-kubectl_1.24.2-00_amd64.deb ...
Unpacking kubectl (1.24.2-00) ...
Selecting previously unselected package kubeadm.
Preparing to unpack .../7-kubeadm_1.24.2-00_amd64.deb ...
Unpacking kubeadm (1.24.2-00) ...
Setting up conntrack (1:1.4.5-2) ...
Setting up kubectl (1.24.2-00) ...
Setting up ebtables (2.0.11-3build1) ...
Setting up socat (1.7.3.3-2) ...
Setting up cri-tools (1.24.2-00) ...
Setting up kubernetes-cni (0.8.7-00) ...
Setting up kubelet (1.24.2-00) ...
Created symlink /etc/systemd/system/multi-user.target.wants/kubelet.service →
/lib/systemd/system/kubelet.service.
Setting up kubeadm (1.24.2-00) ...
Processing triggers for man-db (2.9.1-1) …
```

Dostrajanie kernela – dodanie driverów overlay i br_netfilter.

```
student@master:~$ sudo modprobe overlay

student@master:~$ sudo modprobe br_netfilter

student@master:~$ sudo vim /etc/sysctl.d/kubernetes.conf

student@master:~$ sudo cat /etc/sysctl.d/kubernetes.conf

net.bridge.bridge-nf-call-ip6tables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1

student@master:~$ sudo sysctl --system

* Applying /etc/sysctl.d/10-console-messages.conf ...
kernel.printk = 4 4 1 7
* Applying /etc/sysctl.d/10-ipv6-privacy.conf ...
net.ipv6.conf.all.use_tempaddr = 2
net.ipv6.conf.default.use_tempaddr = 2
* Applying /etc/sysctl.d/10-kernel-hardening.conf ...
kernel.kptr_restrict = 1
* Applying /etc/sysctl.d/10-link-restrictions.conf ...
fs.protected_hardlinks = 1
fs.protected_symlinks = 1
* Applying /etc/sysctl.d/10-magic-sysrq.conf ...
kernel.sysrq = 176
* Applying /etc/sysctl.d/10-network-security.conf ...
net.ipv4.conf.default.rp_filter = 2
net.ipv4.conf.all.rp_filter = 2
* Applying /etc/sysctl.d/10-ptrace.conf ...
kernel.yama.ptrace_scope = 1
* Applying /etc/sysctl.d/10-zeropage.conf ...
vm.mmap_min_addr = 65536
```

```
* Applying /usr/lib/sysctl.d/50-default.conf ...
net.ipv4.conf.default.promote_secondaries = 1
sysctl: setting key "net.ipv4.conf.all.promote_secondaries": Invalid argument
net.ipv4.ping_group_range = 0 2147483647
net.core.default_qdisc = fq_codel
fs.protected_regular = 1
fs.protected_fifos = 1
* Applying /usr/lib/sysctl.d/50-pid-max.conf ...
kernel.pid_max = 4194304
* Applying /etc/sysctl.d/99-sysctl.conf ...
* Applying /etc/sysctl.d/kubernetes.conf ...
net.bridge.bridge-nf-call-ip6tables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1
* Applying /usr/lib/sysctl.d/protect-links.conf ...
fs.protected_fifos = 1
fs.protected_hardlinks = 1
fs.protected_regular = 2
fs.protected_symlinks = 1
* Applying /etc/sysctl.conf …
```

Cgroup driver w konfiguracji Dockera musi być zmieniony na systemd.

student@master:~$ sudo systemctl status docker

```
● docker.service - Docker Application Container Engine
     Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset:
enabled)
     Active: active (running) since Mon 2022-07-04 16:42:52 UTC; 9min ago
TriggeredBy: ● docker.socket
       Docs: https://docs.docker.com
   Main PID: 929 (dockerd)
      Tasks: 8
     Memory: 103.0M
     CGroup: /system.slice/docker.service
             └─929 /usr/bin/dockerd -H fd://
--containerd=/run/containerd/containerd.sock

Jul 04 16:42:52 master dockerd[929]: time="2022-07-04T16:42:52.470798597Z"
level=warning msg="Your kernel does not support CPU realtime scheduler"
Jul 04 16:42:52 master dockerd[929]: time="2022-07-04T16:42:52.470829763Z"
level=warning msg="Your kernel does not support cgroup blkio weight"
Jul 04 16:42:52 master dockerd[929]: time="2022-07-04T16:42:52.470838591Z"
level=warning msg="Your kernel does not support cgroup blkio weight_device"
Jul 04 16:42:52 master dockerd[929]: time="2022-07-04T16:42:52.471355537Z" level=info
msg="Loading containers: start."
Jul 04 16:42:52 master dockerd[929]: time="2022-07-04T16:42:52.758403835Z" level=info
msg="Default bridge (docker0) is assigned with an IP address 172.17.0.0>
Jul 04 16:42:52 master dockerd[929]: time="2022-07-04T16:42:52.842568354Z" level=info
msg="Loading containers: done."
Jul 04 16:42:52 master dockerd[929]: time="2022-07-04T16:42:52.907534824Z" level=info
msg="Docker daemon" commit="20.10.12-0ubuntu2~20.04.1" graphdriver(s)=o>
Jul 04 16:42:52 master dockerd[929]: time="2022-07-04T16:42:52.908253132Z" level=info
msg="Daemon has completed initialization"
Jul 04 16:42:52 master systemd[1]: Started Docker Application Container Engine.
```

```
Jul 04 16:42:52 master dockerd[929]: time="2022-07-04T16:42:52.961035335Z" level=info
msg="API listen on /run/docker.sock"
```

student@master:~$ sudo vim /etc/docker/daemon.json

student@master:~$ sudo cat /etc/docker/daemon.json

```
{
  "exec-opts": ["native.cgroupdriver=systemd"],
  "log-driver": "json-file",
  "log-opts": {
    "max-size": "100m"
  },
  "storage-driver": "overlay2"
}
```

student@master:~$ sudo systemctl restart docker

Wdrażanie klastra – Control Plane. Na końcu wygenerowany zostanie plik konfiguracyjny /etc/kubernetes/admin.conf oraz token, za pomocą którego jesteśmy w stanie dołączyć kolejny Control Plane lub workery. Warto go zapisać.

student@master:~$ sudo kubeadm init

```
[init] Using Kubernetes version: v1.24.2
[preflight] Running pre-flight checks
[preflight] Pulling images required for setting up a Kubernetes cluster
[preflight] This might take a minute or two, depending on the speed of your internet
connection
[preflight] You can also perform this action in beforehand using 'kubeadm config images
pull'
[certs] Using certificateDir folder "/etc/kubernetes/pki"
[certs] Generating "ca" certificate and key
[certs] Generating "apiserver" certificate and key
[certs] apiserver serving cert is signed for DNS names [kubernetes kubernetes.default
kubernetes.default.svc kubernetes.default.svc.cluster.local master] and IPs [10.96.0.1
10.10.1.10]
[certs] Generating "apiserver-kubelet-client" certificate and key
[certs] Generating "front-proxy-ca" certificate and key
[certs] Generating "front-proxy-client" certificate and key
[certs] Generating "etcd/ca" certificate and key
[certs] Generating "etcd/server" certificate and key
[certs] etcd/server serving cert is signed for DNS names [localhost master] and IPs
[10.10.1.10 127.0.0.1 ::1]
[certs] Generating "etcd/peer" certificate and key
[certs] etcd/peer serving cert is signed for DNS names [localhost master] and IPs
[10.10.1.10 127.0.0.1 ::1]
[certs] Generating "etcd/healthcheck-client" certificate and key
[certs] Generating "apiserver-etcd-client" certificate and key
[certs] Generating "sa" key and public key
[kubeconfig] Using kubeconfig folder "/etc/kubernetes"
[kubeconfig] Writing "admin.conf" kubeconfig file
[kubeconfig] Writing "kubelet.conf" kubeconfig file
```

```
[kubeconfig] Writing "controller-manager.conf" kubeconfig file
[kubeconfig] Writing "scheduler.conf" kubeconfig file
[kubelet-start] Writing kubelet environment file with flags to file
"/var/lib/kubelet/kubeadm-flags.env"
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[kubelet-start] Starting the kubelet
[control-plane] Using manifest folder "/etc/kubernetes/manifests"
[control-plane] Creating static Pod manifest for "kube-apiserver"
[control-plane] Creating static Pod manifest for "kube-controller-manager"
[control-plane] Creating static Pod manifest for "kube-scheduler"
[etcd] Creating static Pod manifest for local etcd in "/etc/kubernetes/manifests"
[wait-control-plane] Waiting for the kubelet to boot up the control plane as static
Pods from directory "/etc/kubernetes/manifests". This can take up to 4m0s
[apiclient] All control plane components are healthy after 14.505218 seconds
[upload-config] Storing the configuration used in ConfigMap "kubeadm-config" in the
"kube-system" Namespace
[kubelet] Creating a ConfigMap "kubelet-config" in namespace kube-system with the
configuration for the kubelets in the cluster
[upload-certs] Skipping phase. Please see --upload-certs
[mark-control-plane] Marking the node master as control-plane by adding the labels:
[node-role.kubernetes.io/control-plane node.kubernetes.io/exclude-from-external-load-
balancers]
[mark-control-plane] Marking the node master as control-plane by adding the taints
[node-role.kubernetes.io/master:NoSchedule node-role.kubernetes.io/control-
plane:NoSchedule]
[bootstrap-token] Using token: dfdmx1.o7595py3o5cfj1wg
[bootstrap-token] Configuring bootstrap tokens, cluster-info ConfigMap, RBAC Roles
[bootstrap-token] Configured RBAC rules to allow Node Bootstrap tokens to get nodes
[bootstrap-token] Configured RBAC rules to allow Node Bootstrap tokens to post CSRs in
order for nodes to get long term certificate credentials
[bootstrap-token] Configured RBAC rules to allow the csrapprover controller
automatically approve CSRs from a Node Bootstrap Token
[bootstrap-token] Configured RBAC rules to allow certificate rotation for all node
client certificates in the cluster
[bootstrap-token] Creating the "cluster-info" ConfigMap in the "kube-public" namespace
[kubelet-finalize] Updating "/etc/kubernetes/kubelet.conf" to point to a rotatable
kubelet client certificate and key
[addons] Applied essential addon: CoreDNS
[addons] Applied essential addon: kube-proxy

Your Kubernetes control-plane has initialized successfully!

To start using your cluster, you need to run the following as a regular user:

  mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config

Alternatively, if you are the root user, you can run:

  export KUBECONFIG=/etc/kubernetes/admin.conf

You should now deploy a pod network to the cluster.
Run "kubectl apply -f [podnetwork].yaml" with one of the options listed at:
  https://kubernetes.io/docs/concepts/cluster-administration/addons/

Then you can join any number of worker nodes by running the following on each as root:
```

```
kubeadm join 10.10.1.10:6443 --token dfdmx1.o7595py3o5cfj1wg \
      --discovery-token-ca-cert-hash
sha256:c45e2d415f692f7ea56a5b47a145b359e261bc5509a3a04681b16a7f9c46e9b8
```

```
student@master:~$ vim token.txt
```

```
student@master:~$ cat token.txt
```

```
kubeadm join 10.10.1.10:6443 --token dfdmx1.o7595py3o5cfj1wg \
      --discovery-token-ca-cert-hash
sha256:c45e2d415f692f7ea56a5b47a145b359e261bc5509a3a04681b16a7f9c46e9b8
```

```
student@master:~$ mkdir .kube
```

```
student@master:~$ sudo cp -i /etc/kubernetes/admin.conf .kube/config
```

```
student@master:~$ sudo chown student:student .kube/config
```

```
student@master:~$ kubectl get nodes
```

```
NAME     STATUS     ROLES           AGE     VERSION
master   NotReady   control-plane   3m16s   v1.24.2
```

```
student@master:~$ kubectl apply -f "https://cloud.weave.works/k8s/net?
k8s-version=$(kubectl version | base64 | tr -d '\n')"
```

```
WARNING: This version information is deprecated and will be replaced with the output
from kubectl version --short. Use --output=yaml|json to get the full version.
serviceaccount/weave-net created
clusterrole.rbac.authorization.k8s.io/weave-net created
clusterrolebinding.rbac.authorization.k8s.io/weave-net created
role.rbac.authorization.k8s.io/weave-net created
rolebinding.rbac.authorization.k8s.io/weave-net created
daemonset.apps/weave-net created
```

```
student@master:~$ kubectl get nodes
```

```
NAME     STATUS   ROLES           AGE     VERSION
master   Ready    control-plane   6m23s   v1.24.2
```

Task 2: Instalacja klastra Kubernetes – dołączanie workerów do klastra.

Cele:
Rozbudowanie klastra poprzez dodanie nowych workerów, na których będą wdrażane aplikacje.

```
student@master:~$ ping -c 1 node1

PING node1 (10.10.1.20) 56(84) bytes of data.
64 bytes from node1 (10.10.1.20): icmp_seq=1 ttl=64 time=2.30 ms

--- node1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 2.296/2.296/2.296/0.000 ms

student@master:~$ ssh student@node1

The authenticity of host 'node1 (10.10.1.20)' can't be established.
ECDSA key fingerprint is SHA256:2bgpDKs9xj0QtqZe3AkgBXDtU6mj+fJX1vNqgY8RUMA.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'node1,10.10.1.20' (ECDSA) to the list of known hosts.
student@node1's password:
Welcome to Ubuntu 20.04.4 LTS (GNU/Linux 5.4.0-121-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Mon 04 Jul 2022 06:30:00 PM UTC

  System load:  0.0               Processes:               124
  Usage of /:   25.6% of 8.90GB   Users logged in:         1
  Memory usage: 5%                IPv4 address for enp1s0: 10.10.1.20
  Swap usage:   0%


45 updates can be applied immediately.
To see these additional updates run: apt list --upgradable


Last login: Mon Jul  4 18:11:44 2022
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

student@node1:~$ sudo vim /etc/hosts

[sudo] password for student:

student@node1:~$ sudo cat /etc/hosts

127.0.0.1 localhost
127.0.1.1 node1

# The following lines are desirable for IPv6 capable hosts
```

```
::1     ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters

10.10.1.10 master
10.10.1.20 node1
10.10.1.30 node2
```

student@node1:~$ sudo apt update && sudo apt -y upgrade

```
Hit:1 http://pl.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://pl.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://pl.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 http://pl.archive.ubuntu.com/ubuntu focal-security InRelease
Reading package lists... Done
Building dependency tree
Reading state information... Done
41 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

student@node1:~$ sudo apt install -y docker.io

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base libidn11 pigz runc ubuntu-fan
Suggested packages:
  ifupdown aufs-tools cgroupfs-mount | cgroup-lite debootstrap docker-doc rinse zfs-
fuse | zfsutils
The following NEW packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base docker.io libidn11 pigz runc
ubuntu-fan
0 upgraded, 9 newly installed, 0 to remove and 0 not upgraded.
Need to get 69.2 MB of archives.
After this operation, 334 MB of additional disk space will be used.
Get:1 http://pl.archive.ubuntu.com/ubuntu focal/universe amd64 pigz amd64 2.4-1 [57.4
kB]
Get:2 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 bridge-utils amd64 1.6-
2ubuntu1 [30.5 kB]
Get:3 http://pl.archive.ubuntu.com/ubuntu focal-updates/main amd64 runc amd64 1.1.0-
0ubuntu1~20.04.1 [3,892 kB]
Get:4 http://pl.archive.ubuntu.com/ubuntu focal-updates/main amd64 containerd amd64
1.5.9-0ubuntu1~20.04.4 [33.0 MB]
Get:5 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 dns-root-data all 2019052802
[5,300 B]
Get:6 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 libidn11 amd64 1.33-
2.2ubuntu2 [46.2 kB]
Get:7 http://pl.archive.ubuntu.com/ubuntu focal-updates/main amd64 dnsmasq-base amd64
2.80-1.1ubuntu1.5 [315 kB]
Get:8 http://pl.archive.ubuntu.com/ubuntu focal-updates/universe amd64 docker.io amd64
20.10.12-0ubuntu2~20.04.1 [31.8 MB]
```

```
Get:9 http://pl.archive.ubuntu.com/ubuntu focal-updates/main amd64 ubuntu-fan all
0.12.13ubuntu0.1 [34.4 kB]
Fetched 69.2 MB in 6s (10.9 MB/s)
Preconfiguring packages ...
Selecting previously unselected package pigz.
(Reading database ... 72037 files and directories currently installed.)
Preparing to unpack .../0-pigz_2.4-1_amd64.deb ...
Unpacking pigz (2.4-1) ...
Selecting previously unselected package bridge-utils.
Preparing to unpack .../1-bridge-utils_1.6-2ubuntu1_amd64.deb ...
Unpacking bridge-utils (1.6-2ubuntu1) ...
Selecting previously unselected package runc.
Preparing to unpack .../2-runc_1.1.0-0ubuntu1~20.04.1_amd64.deb ...
Unpacking runc (1.1.0-0ubuntu1~20.04.1) ...
Selecting previously unselected package containerd.
Preparing to unpack .../3-containerd_1.5.9-0ubuntu1~20.04.4_amd64.deb ...
Unpacking containerd (1.5.9-0ubuntu1~20.04.4) ...
Selecting previously unselected package dns-root-data.
Preparing to unpack .../4-dns-root-data_2019052802_all.deb ...
Unpacking dns-root-data (2019052802) ...
Selecting previously unselected package libidn11:amd64.
Preparing to unpack .../5-libidn11_1.33-2.2ubuntu2_amd64.deb ...
Unpacking libidn11:amd64 (1.33-2.2ubuntu2) ...
Selecting previously unselected package dnsmasq-base.
Preparing to unpack .../6-dnsmasq-base_2.80-1.1ubuntu1.5_amd64.deb ...
Unpacking dnsmasq-base (2.80-1.1ubuntu1.5) ...
Selecting previously unselected package docker.io.
Preparing to unpack .../7-docker.io_20.10.12-0ubuntu2~20.04.1_amd64.deb ...
Unpacking docker.io (20.10.12-0ubuntu2~20.04.1) ...
Selecting previously unselected package ubuntu-fan.
Preparing to unpack .../8-ubuntu-fan_0.12.13ubuntu0.1_all.deb ...
Unpacking ubuntu-fan (0.12.13ubuntu0.1) ...
Setting up runc (1.1.0-0ubuntu1~20.04.1) ...
Setting up dns-root-data (2019052802) ...
Setting up libidn11:amd64 (1.33-2.2ubuntu2) ...
Setting up bridge-utils (1.6-2ubuntu1) ...
Setting up pigz (2.4-1) ...
Setting up containerd (1.5.9-0ubuntu1~20.04.4) ...
Created symlink /etc/systemd/system/multi-user.target.wants/containerd.service →
/lib/systemd/system/containerd.service.
Setting up docker.io (20.10.12-0ubuntu2~20.04.1) ...
Adding group `docker' (GID 117) ...
Done.
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service →
/lib/systemd/system/docker.service.
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket →
/lib/systemd/system/docker.socket.
Setting up dnsmasq-base (2.80-1.1ubuntu1.5) ...
Setting up ubuntu-fan (0.12.13ubuntu0.1) ...
Created symlink /etc/systemd/system/multi-user.target.wants/ubuntu-fan.service →
/lib/systemd/system/ubuntu-fan.service.
Processing triggers for systemd (245.4-4ubuntu3.17) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for dbus (1.12.16-2ubuntu2.2) ...
Processing triggers for libc-bin (2.31-0ubuntu9.9) …
```

student@master:~$ sudo vim /etc/docker/daemon.json

student@master:~$ sudo cat /etc/docker/daemon.json

```
{
  "exec-opts": ["native.cgroupdriver=systemd"],
  "log-driver": "json-file",
  "log-opts": {
    "max-size": "100m"
  },
  "storage-driver": "overlay2"
}
```

student@master:~$ sudo systemctl restart docker

student@node1:~$ sudo systemctl status docker

```
● docker.service - Docker Application Container Engine
     Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset:
enabled)
     Active: active (running) since Mon 2022-07-04 18:37:21 UTC; 2min 8s ago
TriggeredBy: ● docker.socket
       Docs: https://docs.docker.com
   Main PID: 19649 (dockerd)
      Tasks: 8
     Memory: 28.4M
     CGroup: /system.slice/docker.service
             └─19649 /usr/bin/dockerd -H fd://
--containerd=/run/containerd/containerd.sock

Jul 04 18:37:21 node1 dockerd[19649]: time="2022-07-04T18:37:21.515324869Z"
level=warning msg="Your kernel does not support CPU realtime scheduler"
Jul 04 18:37:21 node1 dockerd[19649]: time="2022-07-04T18:37:21.515471038Z"
level=warning msg="Your kernel does not support cgroup blkio weight"
Jul 04 18:37:21 node1 dockerd[19649]: time="2022-07-04T18:37:21.515630317Z"
level=warning msg="Your kernel does not support cgroup blkio weight_device"
Jul 04 18:37:21 node1 dockerd[19649]: time="2022-07-04T18:37:21.516194751Z" level=info
msg="Loading containers: start."
Jul 04 18:37:21 node1 dockerd[19649]: time="2022-07-04T18:37:21.675725975Z" level=info
msg="Default bridge (docker0) is assigned with an IP address 172.17.0.>
Jul 04 18:37:21 node1 dockerd[19649]: time="2022-07-04T18:37:21.769250444Z" level=info
msg="Loading containers: done."
Jul 04 18:37:21 node1 dockerd[19649]: time="2022-07-04T18:37:21.801605476Z" level=info
msg="Docker daemon" commit="20.10.12-0ubuntu2~20.04.1" graphdriver(s)=>
Jul 04 18:37:21 node1 dockerd[19649]: time="2022-07-04T18:37:21.801898498Z" level=info
msg="Daemon has completed initialization"
Jul 04 18:37:21 node1 systemd[1]: Started Docker Application Container Engine.
Jul 04 18:37:21 node1 dockerd[19649]: time="2022-07-04T18:37:21.855874604Z" level=info
msg="API listen on /run/docker.sock"
```

student@node1:~$ curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key add -

OK

student@node1:~$ echo "deb https://apt.kubernetes.io/ kubernetes-xenial main" | sudo tee /etc/apt/sources.list.d/kubernetes.list

```
deb https://apt.kubernetes.io/ kubernetes-xenial main
```

student@node1:~$ sudo apt update

```
Hit:1 http://pl.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://pl.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://pl.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 http://pl.archive.ubuntu.com/ubuntu focal-security InRelease
Get:5 https://packages.cloud.google.com/apt kubernetes-xenial InRelease [9,383 B]
Get:6 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 Packages [57.2
kB]
Fetched 66.6 kB in 1s (73.4 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
All packages are up to date.
```

student@node1:~$ sudo apt install -y kubeadm

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  libfwupdplugin1
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  conntrack cri-tools ebtables kubectl kubelet kubernetes-cni socat
Suggested packages:
  nftables
The following NEW packages will be installed:
  conntrack cri-tools ebtables kubeadm kubectl kubelet kubernetes-cni socat
0 upgraded, 8 newly installed, 0 to remove and 0 not upgraded.
Need to get 75.3 MB of archives.
After this operation, 314 MB of additional disk space will be used.
Get:1 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 conntrack amd64 1:1.4.5-2
[30.3 kB]
Get:2 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 ebtables amd64 2.0.11-
3build1 [80.3 kB]
Get:3 http://pl.archive.ubuntu.com/ubuntu focal/main amd64 socat amd64 1.7.3.3-2 [323
kB]
Get:4 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 cri-tools
amd64 1.24.2-00 [12.3 MB]
Get:5 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 kubernetes-cni
amd64 0.8.7-00 [25.0 MB]
```

```
Get:6 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 kubelet amd64
1.24.2-00 [19.3 MB]
Get:7 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 kubectl amd64
1.24.2-00 [9,316 kB]
Get:8 https://packages.cloud.google.com/apt kubernetes-xenial/main amd64 kubeadm amd64
1.24.2-00 [8,997 kB]
Fetched 75.3 MB in 7s (10.5 MB/s)
Selecting previously unselected package conntrack.
(Reading database ... 72393 files and directories currently installed.)
Preparing to unpack .../0-conntrack_1%3a1.4.5-2_amd64.deb ...
Unpacking conntrack (1:1.4.5-2) ...
Selecting previously unselected package cri-tools.
Preparing to unpack .../1-cri-tools_1.24.2-00_amd64.deb ...
Unpacking cri-tools (1.24.2-00) ...
Selecting previously unselected package ebtables.
Preparing to unpack .../2-ebtables_2.0.11-3build1_amd64.deb ...
Unpacking ebtables (2.0.11-3build1) ...
Selecting previously unselected package kubernetes-cni.
Preparing to unpack .../3-kubernetes-cni_0.8.7-00_amd64.deb ...
Unpacking kubernetes-cni (0.8.7-00) ...
Selecting previously unselected package socat.
Preparing to unpack .../4-socat_1.7.3.3-2_amd64.deb ...
Unpacking socat (1.7.3.3-2) ...
Selecting previously unselected package kubelet.
Preparing to unpack .../5-kubelet_1.24.2-00_amd64.deb ...
Unpacking kubelet (1.24.2-00) ...
Selecting previously unselected package kubectl.
Preparing to unpack .../6-kubectl_1.24.2-00_amd64.deb ...
Unpacking kubectl (1.24.2-00) ...
Selecting previously unselected package kubeadm.
Preparing to unpack .../7-kubeadm_1.24.2-00_amd64.deb ...
Unpacking kubeadm (1.24.2-00) ...
Setting up conntrack (1:1.4.5-2) ...
Setting up kubectl (1.24.2-00) ...
Setting up ebtables (2.0.11-3build1) ...
Setting up socat (1.7.3.3-2) ...
Setting up cri-tools (1.24.2-00) ...
Setting up kubernetes-cni (0.8.7-00) ...
Setting up kubelet (1.24.2-00) ...
Created symlink /etc/systemd/system/multi-user.target.wants/kubelet.service →
/lib/systemd/system/kubelet.service.
Setting up kubeadm (1.24.2-00) ...
Processing triggers for man-db (2.9.1-1) …
```

W celu przyłączenia workera do Control Plane wykorzystaj token wygenerowany na masterze.

```
student@node1:~$ sudo kubeadm join 10.10.1.10:6443 --token
dfdmx1.o7595py3o5cfj1wg         --discovery-token-ca-cert-hash
sha256:c45e2d415f692f7ea56a5b47a145b359e261bc5509a3a04681b16a7f9c46e9b8
```

```
[sudo] password for student:
[preflight] Running pre-flight checks
[preflight] Reading configuration from the cluster...
[preflight] FYI: You can look at this config file with 'kubectl -n kube-system get cm
kubeadm-config -o yaml'
```

```
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[kubelet-start] Writing kubelet environment file with flags to file
"/var/lib/kubelet/kubeadm-flags.env"
[kubelet-start] Starting the kubelet
[kubelet-start] Waiting for the kubelet to perform the TLS Bootstrap...

This node has joined the cluster:
* Certificate signing request was sent to apiserver and a response was received.
* The Kubelet was informed of the new secure connection details.

Run 'kubectl get nodes' on the control-plane to see this node join the cluster.
```

student@node1:~$ exit

```
logout
Connection to node1 closed.
```

Po pewnym czasie (1 lub 2 minuty) node1 powinien być dołączony do klastra.

student@master:~$ kubectl get nodes

```
NAME     STATUS   ROLES           AGE    VERSION
master   Ready    control-plane   109m   v1.24.2
node1    Ready    <none>          54s    v1.24.2
```

Te same komendy wykonaj na hoście node2, aby przyłączyć kolejny worker.